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MAINE AGRICULTURAL AND FOREST EXPERIMENT STATION
THE UNIVERSITY OF MAINE

Organic Milk Production in Maine: Attributes, Costs, and Returns

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FOREWORD

This report summarizes attributes, costs, and returns for organic dairy farms in Maine that responded to the 2008 dairy cost of production survey. This survey and analysis was conducted by the University of Maine in cooperation with the Maine Milk Commission. This publication reports on data collected over the 2007 production year. Funding for this report was provided by the Maine Milk Commission, the Maine Agricultural and Forest Experiment Station, the USDA, and the University of Maine. The researchers wish to thank the many farmers who took the time to complete the surveys that made this research possible.

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INTRODUCTION

Two hundred and seventy-two managers of dairy farm operations in Maine were asked to participate in a survey on the cost of production and to provide information regarding their 2007 production year. Of the 123 operators who completed the survey, 30 managed farms that produced organic milk in 2007. These 30 organic farms, which represent approximately 40% of all organic dairy farms in Maine, are used in this publication to describe the organic farm industry in Maine in 2007.

In this report, analysis and discussion of the data revolve around four categories. The first category averages all 30 organic farms to create a statewide group. We then broke these 30 farms into three size groups (small, medium, and large) based on the number of cows on each farm. The number of farms within each group is comparable. There were nine small farms with an average of 30 cows on each farm, 10 medium farms with an average of 55 cows each, and 11 large farms with about an average of 100 cows each.

Having split the farms into these three size groups, we then studied other key characteristics of organic dairy farms to ensure consistency among the groups. Our analysis of factors such as the amount of milk shipped annually, annual milk and livestock sales, amount of milk produced per cow, and number of full-time equivalent workers demonstrated that there are indeed similarities among farms within each size group. The analysis presented here discusses characteristics of the three size groups, along with the statewide group.

SECTION I: A DESCRIPTIVE STUDY OF THE MAINE ORGANIC DAIRY INDUSTRY

Demographics

Of the Maine organic dairy farmers who responded to the survey, 87% grew up on a farm. Fifty-four percent of them currently operate the same farm on which they grew up. On average, these multi-generational farms were established in 1951, although a single farm pulls this average down. If this farm is not included, the average year of establishment for these farms is 1963.

Examining the farms by size groups illustrates that 78% and 80% of organic dairy farmers on small and medium farms, respectively, grew up on a farm, and 57% and 75%, respectively, currently operate the farm on which they grew up. Small farms, on average, were established in 1969; medium farms, on average, were established in 1919. One individual farm affects the average year of establishment among medium farms dramatically. If this farm is excluded, the average year of establishment for medium farms is 1950. One hundred percent of the managers of large farms grew up on a farm, and 36% currently manage these same farms, which were established, on average, in 1970.

Tenure, age, and education

Managers of Maine organic farms have held their position for an average of 18 years although tenures range from one to 44 years. Average tenure for managers of small, medium, and large farms is 21, 11, and 23 years, respectively. The range of tenure is largest for the large farm group, which spans from five to 44 years, while ranges for the small and medium farms are from 10 to 36 years and one to 23 years, respectively. Only 13% of managers of small farms had farmed elsewhere before becoming manager of their current farm. Forty percent of managers of medium farms and 27% of managers of large farms, on the other hand, had farmed elsewhere. The state average is 28%. The statewide average age of organic dairy farm operators is 48 years old, with the distribution shown in Figure 1. Among managers of small and large farms, the average is roughly 51 years old, whereas the average age of managers of medium farms is only 40 years old. For the state as a whole and within each group, farm managers have an average of 13 years of formal schooling.

Legal structure

Sixty percent of Maine organic farms listed sole proprietorship as their business structure. No non-family partnerships exist among the sample. The remaining farms are split between corporation (17%) and family partnerships (23%). Sole proprietorships and family partnerships each account for 44% of the business structures of small farms. Seventy percent of medium farms use

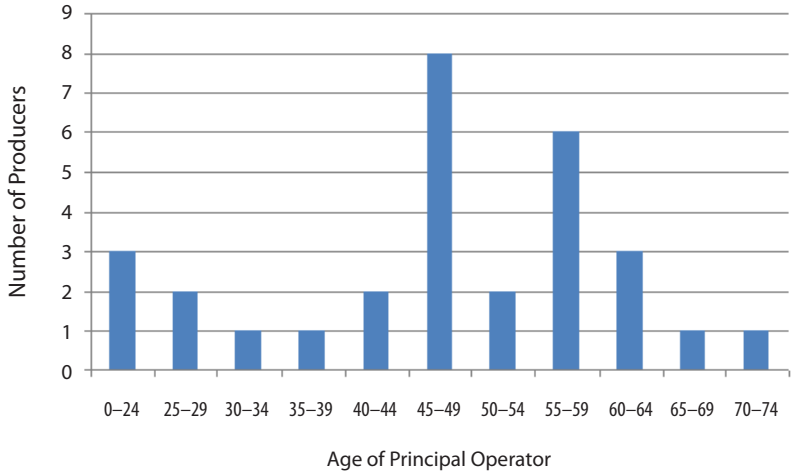

Figure 1: Statewide distribution of average age of farm operator in years. Source: 2008 Cost of Production Survey.

a sole proprietorship business structure. Legal structures on large farms are a combination of sole proprietorship, corporation, and family partnership, although sole proprietorship is the most prominent.

On-farm management and production practices

The use of various on-farm management and production practices within each size cluster and statewide is depicted in Table 1. Most organic farms dip teats either before or after milking. Fifty-three percent of farm managers regularly schedule veterinary services for their animals.

Thirty-seven percent of producers across the state use total mixed ration (TMR), and 63% balance feed rations quarterly. Large farms make use of these techniques much more frequently than small or medium farms; 11% of small and 20% of medium farms use TMR, and 56% of small and 50% of medium farms use balanced feed rations.

Forty-seven percent of organic producers maintain a Dairy Herd Improvement Association (DHIA) record, but only 7% use computerized herd-management software such as Dairy Comp 305®, Scout®, or BouMatic®. A larger proportion of the managers of medium and large farms use a DHIA record and computerized herd-management software relative to managers of small farms. Only one responding farm placed its herd in a seasonal milking program in which cows are dry for a two- to three-month period.

Table 1. Management and production practices employed on organic dairy farms (percentage of respondents).

	Farm Size			
Management/Production Practice	Small	Medium	Large	State Average
Pre-dip all teats before milking	89	70	73	77
Post-dip all teats after milking	100	100	100	100
Scheduled veterinary services	56	60	45	53
Balance feed rations quarterly	56	50	82	63
TMR machinery	11	20	73	37
Seasonal milking program	11	0	0	3
DHIA dairy record program	11	60	64	47
Computerized herd management	0	10	9	7
Analyze financial performance on farm	89	90	45	73
Hire a management service to analyze financial performance	0	0	9	3

Source: 2008 Cost of Production Survey.

Number of head

Figure 2 shows statewide livestock holdings on a per farm basis. The total number of dairy animals, or total head, is calculated by summing the number of dairy cows, dairy heifers, dairy calves, beef cows, feeder cattle, beef calves, and feeder cattle less than 500 lbs, and mature bulls on the farm. Small farms average 51 head, medium farms average 92 head, and large farms average 176 head. As Figure 2 demonstrates, there are more small and medium organic farms in the state than large farms. Although farms with at least 150 head represent only 30% of the sample, they represent 51% of total livestock holdings. On the other hand, farms with fewer than 76 head represent 33% of the sample, but account for only 15% of total livestock holdings.

Figure 3 shows the distribution of organic herd size for Maine. Herd size is a sub-set of total head and is defined as the number of cows, both lactating and dry, that have calved. Consistent with Maine's conventional dairy industry, there are more smaller organic farms.

Production Systems

Milking technology

The survey collected information on milking technologies used on dairy farms and as expected, found that the larger the farm, the more likely it is to adopt labor-saving milking technologies. Forty-five percent of Maine organic dairy farmers milk their herd in a stanchion or tie-stall barn, and 93% of

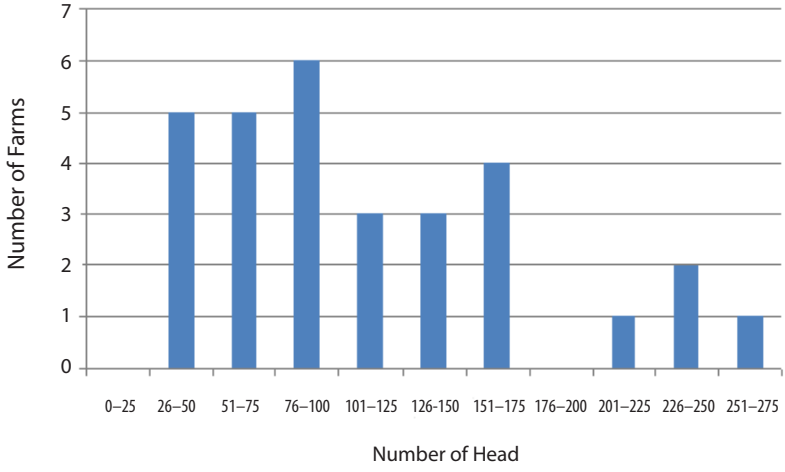

Figure 2. Distribution of number of head by farm. Source: 2008 Cost of Production Survey.

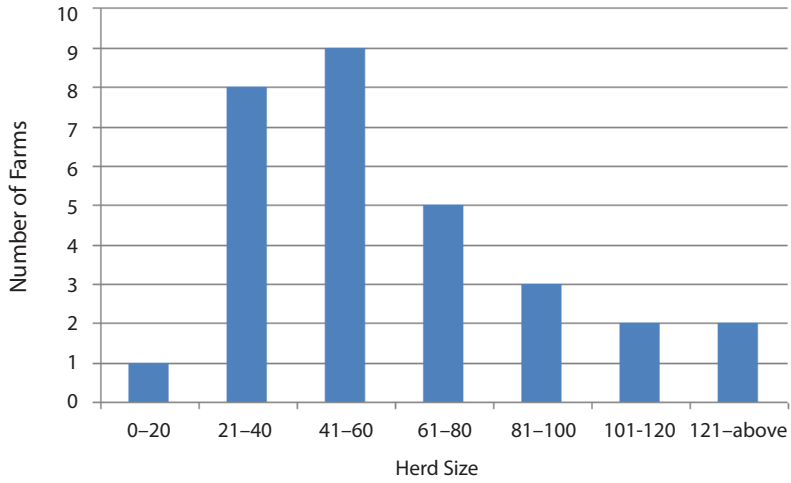

Figure 3. Maine organic dairy herd size. Source: 2008 Cost of Production Survey.

stanchion or tie-stall barns have a pipeline system, while the remaining 7% transfer milk via a dumping station. The herringbone parlor is the second most common milking system, used by 39% of organic farms across the state. No farm in the sample employed a side-opening stall or rotary parlor, and only 12% used a flat, parallel, or raised parlor.

Small farms use the greatest variety of milking technologies. Forty-four percent of small farms have a stanchion or tie-stall barn with a pipeline system to transfer milk, while the remaining farms use either a herringbone (22%), flat (22%), or raised (11%) parlor. Among medium farms, 50% use a stanchion or tie-stall barn with a pipeline system, and 40% use a herringbone parlor. Almost all large farms use either a stanchion or tie-stall barn with a pipeline system (36%) or a herringbone parlor (55%).

Organic farms in Maine have an average of seven milking units. Of these seven units, 10% are equipped with automatic takeoffs. Small farms average five milking units, none of which have automatic takeoffs. Medium farms averaged six milking units of which 10% are equipped with automatic takeoffs. Large farms have an average of nine milking units, 30% of which are equipped with automatic takeoffs.

All organic farmers who responded to the survey, regardless of farm size, report milking twice a day. Farms average between one and two milkers during any one milking session. The statewide average for total time per milking is 3.5 hours. Among small farms, total time spent milking is just 2.5 hours, whereas for medium and large farms it is 4 hours.

Herd housing

The most common types of herd housing across the state are a stanchion, tie, or comfort stall (42%) and a cold free stall (39%). These two types each account for 44% of housing found on small farms. Sixty-six percent of medium farms use stanchion, tie, or comfort stall housing, whereas cold free stalls and warm free stalls account for the remaining 34%. Cold free stalls are the predominant housing type on large farms (54%), while stanchion, tie, or comfort stalls account for most of the remaining housing types used.

Ninety-seven percent of organic dairy barns across Maine have concrete flooring. The remaining 3% of farms use materials such as soil, gravel, or stone. Sawdust, used by 90% of all organic farms, is the most common form of bedding. Thirty-seven percent of farms complement sawdust with another form of bedding material such as sand, straw, rubber, or a mattress. Farms not using sawdust use sand and/or straw for bedding.

Assets

This section reviews the capital assets of farms, which have been split by group into four categories. These categories are (1) land value, (2) farm residence value, (3) farm buildings value, which includes all of the remaining fixed structures on the farm, and (4) equipment assets value. The total values for each asset category provided in Table 2 are the averages of the values reported by farmers within each group and across the state as a whole.

As one might expect, land, farm building, and equipment values increase with farm size. Farm residence values do not follow this pattern, and in fact small farms report the highest home residence values, although an individual high value in the small farm homes affects the average of this group. When

Table 2. Reported value of capital assets by farm size ($).

Asset Type	Farm Size			State Average
	Small	Medium	Large	
Land value	203,008	285,924	563,389	356,457
Farm residence value	173,571	104,000	122,200	130,760
Farm buildings value	78,571	123,563	277,662	168,228
Total value of farmland and buildings	455,150	513,487	963,251	655,445
Equipment assets value	98,338	146,667	339,950	198,702
Total value of all capital assets	553,488	660,154	1,303,201	854,147

Source: 2008 Cost of Production Survey.

this farm is removed, the values of the residences for small farms are similar to those for medium and large farms. Equipment values increase by 50% from small to medium farms, and by 230% between medium and large farms. The increase in equipment and land values as farm size increases is expected, as larger herds require more equipment and land relative to smaller herds, and there is generally a substitution of capital for labor.

Table 3 shows average land holdings (owned or operated) in acres by farm size and statewide across five categories. The five land-type categories are tillable crop land, permanent hay field, pasture, woodland, and other land. Owned acres are those held by the farm, and leased acres are those owned by someone else and rented or used at no cost by the farmer. The survey also asked if respondents rented land to another farm, but no farm in the sample reported doing so. Table 3 also reports average acreage per cow for each farm size group, which is the sum of the average crop, hay, and pasture acreage divided by the average number of cows in each group. Dairy farms typically require a minimum of three acres of crop, hay, and pasture land per cow for nutrient management purposes (G. Anderson personal communication 2010).

The average Maine organic dairy farm owns more woodland than any other type of land. The owned acres of tillable cropland and hay fields combined trail owned woodland acres for most farm sizes. Pasture accounts for

Table 3. Reported land holdings by farm size (# of acres).

Land Type	Own/Lease	Farm Size			State Average
		Small	Medium	Large	
Tillable crop land	Own	15	81	132	80
	Lease	8	24	116	55
Permanent hay field	Own	41	70	106	75
	Lease	39	103	88	77
Pasture	Own	28	49	87	56
	Lease	22	6	21	16
Wood	Own	65	224	257	189
	Lease	0	0	5	2
Other land	Own	1	4	12	6
	Lease	0	0	0	0
Total land holdings	Own	145	427	592	403
	Lease	69	137	229	150
Acres/cow (crop, hay, & pasture)	(Owned & Leased)	5.10	6.05	5.50	5.61

Source: 2008 Cost of Production Survey.

an average of 14% owned land across the state, but it is a greater percentage of land holdings on small farms than on medium and large farms. Small, medium, and large farms supplement owned land by leasing 32%, 24%, and 27% of their total acreage, respectively. Small farms lease mostly additional hay fields and pasture, whereas medium and large farms lease mostly crop and hay fields.

Given reported land values from Table 2 and the total land holdings by acre reported in Table 3, an average value of land was estimated at $885/acre. This value is calculated by dividing the reported total average value of land by the total average of land holdings in acres. Differences in land values due to topography and location are unavoidable, but it is assumed here that these differences are captured by the reported values.

Tables 4 and 5 provide information on the prevalence of various types of capital complements for each farm size and for the state as a whole. The tables present percentages of owners in each category who own a given farm building or piece of equipment. All organic dairy farms across the state own a dairy barn, and most have a separate heifer barn, an equipment shed, and a machine shop. Although 82% of large farms have a silo, only 22% of medium farms have a silo of any type, and none of the small farms have one. Similarly, a relatively smaller proportion of small (22%) and medium (10%) farms have "other" storage for silage in comparison to large farms (64%). Forty percent of

Table 4. Capital asset complement by farm size (percentage of respondents).

Farm Buildings	Farm Size			State Average
	Small	Medium	Large	
	%			
Dairy barn	100	100	100	100
Separate heifer barn	67	80	91	80
Equipment shed/barn	78	90	82	83
Machine/repair shop	56	40	82	60
Silos	0	22	82	58
Other silage/haylage storage	22	10	64	45
Separate milking parlor	44	40	36	40
Housing for hired help	0	10	64	27
Separate maternity barn	11	10	9	10
Hutches or super-hutches	0	0	36	14
Separate hospital barn	0	10	0	3

Source: 2008 Cost of Production Survey.

Table 5. Capital equipment complement by farm size (percentage of respondents).

Equipment	Farm Size			State Average
	Small	Medium	Large	
	%			
Mower/conditioner	100	100	100	100
Manure spreader	100	100	100	100
Farm trucks and cars	89	100	100	97
Baler(s)	100	100	100	100
Tillage equipment	44	70	82	67
Fertilizer/chemical application implement	56	50	73	60
Generator	89	80	100	90
Skid steer/loaders	89	100	82	90
Seeder	11	35	57	34
Computerized feed mixer or feeder	11	10	70	31
Forage harvester	0	0	55	20

Source: 2008 Cost of Production Survey.

farms also have a separate milking parlor, whereas only 10% have a separate maternity barn. Small farms do not have any housing for hired helped, but 10% of medium farms and 64% of large farms do. Few farms have a separate hospital barn.

Typically, field equipment accounts for the largest segment of equipment assets. The majority of organic farms in each group maintain similar holdings. The exceptions are for computerized feed mixers, forage harvesters, and seeders, which are predominantly found on larger farms. The number of equipment pieces held and the age of the equipment cause much of the variation in total reported values of equipment assets.

Figure 4 highlights the relative importance of different assets among each farm size group. The four columns represent the total reported value of asset holdings for each farm size. Within each column, four differently shaded areas denote the proportion of the four asset categories.

Land, building, and equipment assets account for relatively similar ratios of total assets across the farm sizes. However, home residence values account for a much larger percentage of small farm assets given that these farms have less dairy equipment and less land but still have a home. The relative value of home residence in comparison to total assets decreases for medium and large farms, accounting for 32% of small farm total assets and only 9% of large farm total assets.

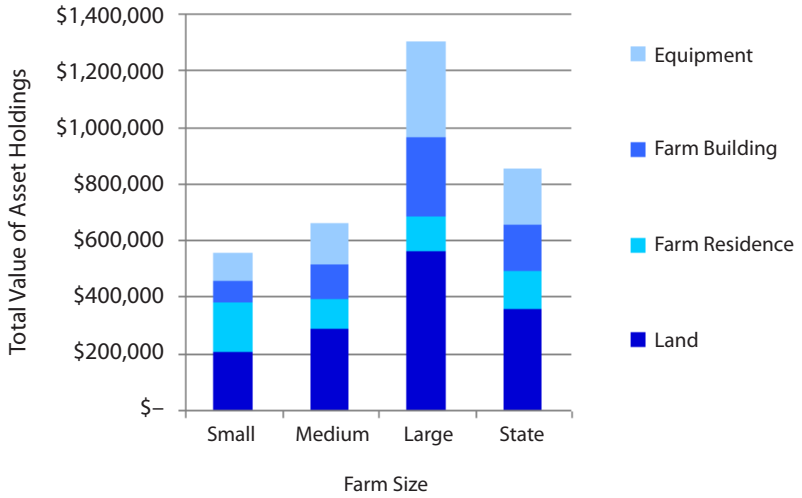

Figure 4. Contribution of farm land, buildings, residences, and equipment to total asset holdings by farm. Source: 2008 Cost of Production Survey.

Livestock Holdings and Crop Production

Livestock

In comparison to conventional farms, far fewer organic dairy farms maintain dairy herds comprised solely of the Holstein breed. Thirteen percent of organic farms in Maine had a herd comprised solely of Holstein cows. Another 50% of organic farms, however, maintain herds made up mainly of Holsteins. Twenty-three percent of herds are comprised primarily of Jersey cows. The other herds are comprised of Guernsey, Brown Swiss, Ayrshire, Milking Shorthorn, and crossbred cattle. Small and medium farms tend to have more diverse herds than large farms.

Table 6 depicts the annual milk shipped in pounds, along with the average milk shipped per cow, for each group. Average milk shipped per cow is a calculation of the annual pounds of milk shipped divided by the average number of dairy cows in each group. Many factors, including the milking-system technology, feeding strategies, and herd health, affect the average milk shipped per cow. The diversity of herd holdings is another important impact factor. It is interesting to note that while the average milk shipped per cow increases from small to medium farms, it decreases slightly from medium to large farms.

Table 6. Organic milk production by farm size.

	Farm Size			State Average
	Small	Medium	Large	
Total milk shipped (lbs)	288,315	753,429	1,340,021	828,978
Milk shipped per cow (lbs/cow)	9,610	13,698	13,420	12,952

Source: 2008 Cost of Production Survey.

Those familiar with milk production per cow on conventional farms will note the numbers reported here are lower. Organic farms typically ship less milk per cow than conventional farms (McBride and Greene 2007). One reason is that in 2007 there were no organic milk replacers available, so organic farms had to feed whole milk to their calves, which affects the amount of milk shipped (R. Kersbergen personal communication 2010). These findings are in line with results from other studies on organic-milk production. For example, in a national study of 352 organic dairy farms, McBride and Greene (2009) found an average of 13,601 lbs of milk shipped per cow on organic farms, compared to 18,983 lbs shipped per cow on conventional farms. Parson et al. (2006) found an average milk shipped of 14,060 lbs per cow on thirty organic farms in Vermont and Maine.

Table 7 presents the average number of dairy cows, heifers, and calves held on each type of farm. Dairy cows, heifers, and calves account for 97% of the livestock population on small and medium farms, and 98% on large farms. Table 7 also presents the average of reported values for each cow type, from which a total value is calculated.

Crop production inputs

On conventional farms, the four most commonly used crop inputs are lime, fertilizer, chemicals, and seed. On average, however, organic dairy farmers do not use as many crop inputs as conventional dairy farmers because they rely more on pasture than on stored feed and because organic fertilizers are limited and expensive. Of the most commonly used crop inputs, small organic farms report purchasing only seed although they also report using manure as an input. Medium and large farms purchased an average of 11 and 28 tons of lime, respectively, while the state average for organic farms is 14 tons. The average quantity of fertilizer purchased is 0.6 and 14 tons for the medium and large farms, respectively, while the organic farms across the state average 5.3 tons.

Table 7. Total livestock holdings and their reported value by farm size.

Livestock	Farm Size	Livestock Holdings (#)	Value per Animal ($)	Total Value ($)
Dairy cows	Small	30	$1,657	$ 49,710
	Medium	55	$1,906	$104,830
	Large	100	$2,144	$214,400
	State average	64	$1,923	$123,072
Dairy heifers	Small	9	$1,233	$11,097
	Medium	21	$1,675	$35,175
	Large	50	$1,444	$72,200
	State average	28	$1,470	$41,160
Dairy calves	Small	11	$714	$7,854
	Medium	22	$881	$19,382
	Large	31	$594	$18,414
	State average	22	$730	$16,060
Total	Small	50	-	$68,661
	Medium	98	-	$159,387
	Large	181	-	$305,014
	State average	115	-	$180,292

Source: 2008 Cost of Production Survey.

The return-to-family-labor and ownership budgets presented below offer average expenditure across farm sizes for each type of input on per cow and per hundredweight (cwt) bases. Due to variations in units of measurement, it is difficult to compare the usage of crop inputs other than lime and fertilizer across farms. Thus, comparisons are made on a total-cost-per-input basis.

Table 8 presents total average annual expenditure for each type of input. As expected, total expenditure on inputs increases with farm size. Larger herds require more land and feed, which require more crop inputs. Medium and large farms allocate the greatest percentage of crop-input expenditures to lime and seed, while fertilizer assumes a smaller portion of total expenditures. Small farm operators reported only seed costs as their explicit crop expense.

Table 8. Total expenditure on crop input per farm ($).

Crop Input	Farm Size			State Average
	Small	Medium	Large	
Lime	0	604	1,473	741
Fertilizer	0	155	1,009	422
Chemicals*	–	–	–	–
Seed	355	564	2,765	1,243
Total	355	1,323	5,247	2,406

Source: 2008 Cost of Production Survey.
*Only one producer reported purchasing chemicals, so this value is omitted.

Livestock Production

Forage

Organic producers grow roughly 95% of the forage used as feed on their farms.[1] They supplement this with purchased forage by 8%, 5%, and 2% for small, medium, and large farms, respectively. For farms that purchase forage, the average annual expenditure is $2,213, $2,716, and $818 for small, medium, and large farms, respectively.

Small farm operators produce an average of 912 tons of forage, or 30 tons per cow, annually. Omitting two outlier responses, the average tons of forage produced on small farms falls to 358, and the per cow average falls to 12 tons. According to survey responses, small farms spend slightly more than 1.5 labor hours each day to feed their animals. All small farm managers use pasture to feed their herds in addition to harvested forage. For 89% of these operators, pasture is the most important feed source for milking cows during the grazing months. Thirty-four percent of managers move their pasturing herds at least every day, while the remaining 66% leave their herds on a pasture for up to two to three days.

Medium farm operators produce a total of 514 tons of forage, or 9 tons per cow, annually and spend an average of two labor hours for each feeding. Again, all medium farm operators used pasture as a feed source, and 100% indicated that it was the most important feed source for their herds during

[1]In this study, forage included both wet (silage) and dry (hay) materials. Future surveys of this nature should consider breaking these materials into separate categories

the grazing months. Sixty percent of medium farms move their herds at least once a day, while the remaining farms move their herds between every two and seven days.

Large farm operators produce a total of 1,522 tons of forage, or 15 tons per cow, annually and spend three labor hours for each feeding. All large farm managers use pasture during the grazing months, and 64% report it as the most important source of feed. There was quite a range of responses to the question about how often cows are moved on large farms, from as frequently as twice a day to more than one week.

Concentrate feed

A majority of farms purchase their concentrate feed through a Maine-based feed dealer, but some buy it from an out-of-state dealer or directly from another farmer, at an average price of $551 per ton. Table 9 details the total quantity of concentrate purchased in 2007. Small farm operators purchased an average of 52 tons of concentrate; whereas medium farms purchased an average of 158 tons and large farms an average of 217 tons of concentrate. The statewide average was 146 tons. It is interesting to note that as farm size increases, so does the likelihood that a greater portion of feed will be purchased from an out-of-state supplier.

Livestock health and breeding

Roughly half of all farms in the state manage herd health with regularly scheduled veterinary visits. Small farms average three vet visits per year at a cost of roughly $575 annually, or $192 per visit. Medium farms spend approximately $1,877 annually on seven vet visits per year, or $268 per visit. Large farms average 10 vet visits per year at a total cost of $2,835 annually, or $284 per visit. As a group, Maine organic dairy farms average seven veterinary visits per year at a total cost of $1,837 annually, or $262 per visit.

Table 9. Use of purchased feed concentrate by farm size.

	Farm Size			State Average
	Small	Medium	Large	
Total quantity purchased (ton)	52	158	217	146
Price per ton	$563	$459	$600	$551
Concentrate cost per cow	$976	$1,317	$1,302	$1,257
Quantity per cow (ton)	1.73	2.87	2.17	2.28

Source: 2008 Cost of Production Survey

Fifty-seven percent of producers purchase additional medication or treatments from sources other than veterinary-administered care. For most farms, these medications or treatments came from a route truck, a farm store, or a mail-order catalog. Annually, small, medium, and large farms spent $689, $896, and $2000, respectively, on additional medication or treatments. Statewide, farms spent an average of $1,120 annually, or $17.50 per cow.

Sixty-three percent of Maine organic dairy producers use artificial insemination (AI) services, with average annual costs of $285, $2,424, and $2,195 for small, medium, and large farms, respectively, and a statewide average of $1,663. Ninety percent of all farms raise all their own replacement heifers; the remaining 10% contract with another farm to raise replacement heifers and spend an average of $1.80 per day per head.

Off-farm Employment and Labor Use

In this section we discuss the importance of off-farm income and the use of farm labor. Survey respondents selected from among four categories that reflect the relative importance of off-farm income sources. These categories are

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

Table 10 reports the percentage of farms within each size category for each response category. Seventy-nine percent of all organic farms depend upon farm income as either the sole or predominant source of income. Almost three-quarters of large farms rely solely on on-farm income, and none of them reported that off-farm income was as important as, or more important than, farm income. Both small and medium farm families rely, to varying degrees, on off-farm income.

Farm labor consists of two types: family labor and hired non-family labor. The information provided by labor data allows for inspection of labor efficiencies between different size farms. Table 11 reports the total annual hours of on-farm labor, both family and non-family, and the number of full-time equivalents (FTE). We calculated annual hours worked by multiplying hours worked per week by weeks worked per year, for each worker, then by summing for each farm and averaging across all farms in a given size group. Dividing total annual labor hours by 3,000 provides the number of FTEs. Three thousand hours translates into 60 hours per week for 50 weeks or roughly 57 hours per week for 52 weeks.

Table 10. Importance of off-farm income relative to farm income by farm size (percentage of respondents).

Ranking Options	Farm Size			State Average
	Small	Medium	Large	
1. More important	25	10	0	10
2. As important	38	0	0	10
3. Less important	12	10	27	17
4. No off-farm income	25	80	73	62

Source: 2008 Cost of Production Survey.

Table 11 provides information on total farm labor along with full-time equivalents (FTEs) and family vs non-family labor. The state average of total annual labor hours per farm is roughly 8,000, which equals 2.7 FTEs. Small farms meet their labor requirements with the equivalent of 1.5 FTEs, most of which is family labor, with only 11% being non-family labor. Medium and large farms, on the other hand, supplement family labor with a much larger amount of hired non-family labor. Medium farms average 3.0 FTEs with 71% of total labor coming from the family, and large farms average 3.2 FTEs with 55% of total labor coming from the family.

Two useful measures of labor efficiency are the number of cows per FTE and pounds of milk sold per FTE. Efficiency standards for conventional dairies are sorted based on milking system. Workers operating a tie-stall or stanchion system should be able to handle 30 to 35 cows per FTE, whereas

Table 11. Annual labor usage by farm size.

Labor Usage	Farm Size			State Average
	Small	Medium	Large	
Labor used (hours)				
Family	4,014	6,350	5,310	5,270
Non-family	480	2,561	4,400	2,804
Number of full time equivalents (FTE)	1.5	3.0	3.2	2.7
Family labor (%)	89.3	71.3	54.7	65.3

Source: 2008 Cost of Production Survey.

workers operating a free-stall-parlor system should be able to handle 40 to 50 cows per FTE (OSU 2008). Maine's small and medium organic farm operators most commonly use a stanchion or tie-stall system, while large farms primarily use a free-stall system.

To date, there has been limited research published regarding organic dairy labor efficiencies. A study using data from seven organic dairy farms in Vermont shows that, among the sample, organic farms had on average 23 cows per FTE (McCrory 2001). This aligns well with the statewide average of 24 cows per FTE found among the sample of organic dairy farms in Maine (Table 12).

Pounds of milk sold per FTE, another measure of labor efficiency, depend upon both the breed type (large or small) and the milking-system technology. For conventional farms milking mostly Holsteins, each worker should average between 600,000 and 1 million lbs for a stanchion or free-stall-parlor system (OSU 2008). For conventional farms milking mainly small-breed cows, each worker should average roughly 450,000 lbs for stanchion systems and 750,000 lbs for free-stall-parlor systems (OSU 2008). Herd holdings on small organic farms are typically a mix of both large-breed Holsteins and smaller breeds such as Jersey, Guernsey, Ayrshire, Milking Shorthorn, or crossbred cattle. Medium farms maintain herds comprised of both large- and small-breed animals, while large breeds dominate on large farms.

It is generally accepted that organic farms require more labor than comparable conventional farms because organic farms rely more heavily on pasture. Thus, it is expected that organic farms will not meet the labor-efficiency standards of conventional farms. Whereas conventional farms may produce more than 450,000 lbs of milk per FTE for small-herd farms, we found that Maine organic farms produce an average of 307,000 lbs of milk per FTE, with a range from 192,210 to 418,756, depending on farm size. These results are comparable to McCrory's study of Vermont's organic farms, which found that on average Vermont organic dairy farms produced 305,000 lbs of milk per FTE (McCrory 2001).

Table 12. Labor efficiency measures by farm.

	Farm Size			State Average
	Small	Medium	Large	
Number of dairy cows per FTE	20	18	31	24
Pounds of milk sold per FTE	192,210	251,143	418,756	307,028

Source: 2008 Cost of Production Survey.

Future Outlook

The survey requested that respondents specify the number of years they intended to continue operating. Figure 5 shows farmers' responses to this question.

No respondents indicated that they would stop milking in 2008. All of the farms that expect to exit organic dairy farming within the next five years are small farms. However, 75% of small farms intend to farm beyond five years, and 38% expect to operate beyond 10 years. An equivalent percentage of large and small organic farms expect to exit the industry in five to 10 years. Interestingly, only 29% of these farms indicate that they have a transfer strategy in place. Ninety percent of medium organic farms and 64% of large organic farms anticipate that they will continue dairy farming for more than 10 years.

The survey contained a series of questions in which farmers were asked to specify anticipated growth or change to the farm in the future. Table 13 details the results. Two-thirds of farms across the state claim that that are unlikely to reduce the number of cows on their farms, whereas an average of 28% believe they will increase the number of cows. Small and medium farms are more likely to add cows than large farms, and they are also more likely, albeit in smaller percentages, to reduce the number of cows they own. Thus, large farms anticipate maintaining the most herd-size stability. Interestingly,

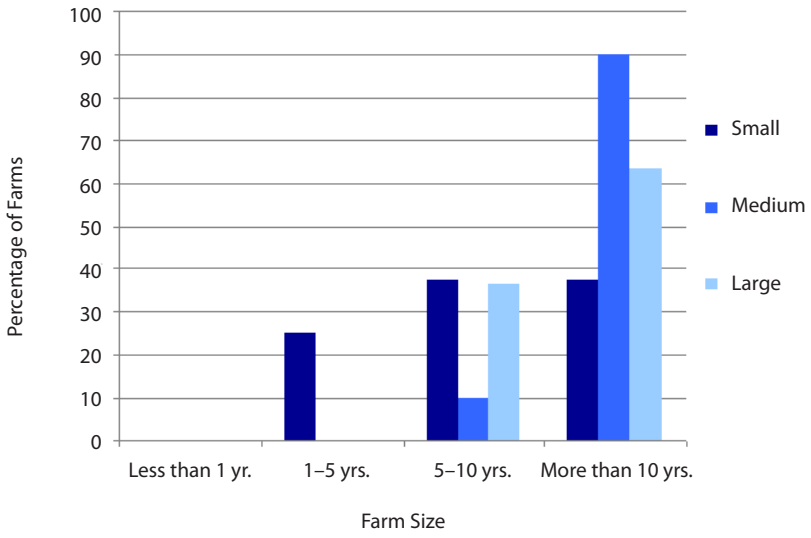

Figure 5. Future outlook: years until expected exit from the industry (percentage of respondents). Source: 2008 Cost of Production Survey.

Table 13. Anticipated growth or change over the next three years by farm (percentage of respondents).

	Farm Size			State Average
	Small	Medium	Large	
	%			
Transfer management				
Yes	12	11	36	21
No	50	33	45	43
N/A b/c not retiring soon	38	56	18	36
Add more cows				
Unlikely/very unlikely	25	30	55	38
Equally likely/unlikely	38	20	18	24
Likely/very likely	25	40	18	28
In progress	13	10	9	10
Reduce number of cows				
Unlikely/very unlikely	63	70	64	66
Equally likely/unlikely	25	10	27	21
Likely/very likely	13	20	9	14
In progress	0	0	0	0
Try another type of farming				
Unlikely/very unlikely	62	100	82	86
Equally likely/unlikely	38	0	18	14
Likely/very likely	0	0	0	0
In progress	0	0	0	0

Source: 2008 Cost of Production Survey.

the handful of farms that claim it is either likely or very likely they will reduce cow numbers in the future also indicate that they plan to continue to operate for more than 10 years.

Operators were also asked questions about whether they would diversify into other on-farm activities, such as bottling fresh milk, cheese making, or crop or livestock activities. Table 14 shows that small farms are more likely than medium or large farms to diversify. In fact, many small farms report that the introduction of such activities is already in progress. Fifty percent of small farms are already bottling fresh milk, 25% are making cheese, and 38% are diversifying into crop or livestock activities. On the whole, however, a significant proportion of organic farms do not plan to diversify. Eighty-two percent

Table 14. Anticipated transition or diversification of activities by farm (percentage of respondents).

	Farm Size			State Average
	Small	Medium	Large	
Bottle fresh milk				
Unlikely/very unlikely	25	60	82	59
Equally likely/unlikely	13	10	9	10
Likely/very likely	13	0	9	7
In progress	50	30	0	24
Make other dairy products (i.e., cheese-making)				
Unlikely/very unlikely	25	67	82	61
Equally likely/unlikely	25	0	9	11
Likely/very likely	25	22	9	18
In progress	25	11	0	11
Diversify into other crop or livestock activities				
Unlikely/very unlikely	13	50	55	41
Equally likely/unlikely	38	25	9	22
Likely/very likely	13	0	27	15
In progress	38	25	9	22

Source: 2008 Cost of Production Survey.

of large farms claim it is either unlikely or very unlikely that they will bottle fresh milk or make cheese. These percentages are 60% and 67%, respectively, for the medium farms. Small farms are slightly more likely than medium or large farms to diversify into crop or livestock activities.

SECTION II: RETURN TO FAMILY LABOR AND OWNERSHIP—A PROFIT ANALYSIS

This section analyzes six different groupings of organic dairy farms with respect to costs and returns. The groupings include the small, medium, large, and statewide groups already used in this report, plus the addition of two new groups representing the five most profitable farms and the five least profitable farms in the sample, based on return to family labor and ownership.

In this analysis, we use net return to family labor and ownership as a proxy for profit. It is an indicator of what is available to the principal farm operator and to unpaid family labor after annual operating and overhead expenses are

subtracted from the total annual revenue. Essentially, it is what the principal owner/operator has available for living expenses and for all capital costs. To maintain a viable dairy industry in the state of Maine in the long run, producers must be profitable. In this section, we examine the return to operators, along with some factors that may be useful as management benchmarks.

Total annual revenue was calculated using six sources of income: milk sales, crop sales, livestock sales, Maine tier payments, federal Milk Income Loss Contract (MILC) payments, and other federal payments. Figures for milk, crop, and livestock sales came from the survey responses. The Maine Department of Agriculture provided the Maine tier payments for 2007 for the farms that responded to the survey. The Farm Service Agency provided federal MILC payments to these farms. Other federal payments consisted solely of direct federal corn payments and were found on the Environmental Working Group website. Table 15 summarizes these revenue streams.

Annual operating expenses include hired labor, purchased feed, livestock, crop and pasture, and maintenance expenditures. These expenses came directly from the survey responses. Deduction charges and the milk-marketing costs, which were $0.31/cwt for all farms, were calculated using the formula from the conventional cost-of-production model (Dalton and Bragg 2006). Hauling fees were attributed to each farm based on their buyer. For example, farms shipping milk to H.P. Hood and Horizon were not charged a separate hauling fee, but farms that shipped to CROPP and Organic Valley were charged $75 a

Table 15. Average per farm annual on-farm revenue ($).

Revenue Source	Farm Size			State Average
	Small	Medium	Large	
Milk receipts	77,494	217,869	408,616	245,697
Milk receipts ($/cwt)	26.88	28.92	30.49	29.64
Crop and hay revenue	644	1,983	12,568	5,463
Livestock revenue	3,750	8,926	21,242	11,889
Milk equivalents of crop & livestock revenue ($/cwt)	1.52	1.44	2.53	2.09
Maine tier payments	1,994	5,530	12,309	6,955
Federal MILC payments	137	358	355	290
Other federal payments	0	121	1,385	548
Total revenue ($/cwt)	29.14	31.16	34.07	32.67

Source: 2008 Cost of Production Survey, the Maine Milk Commission, the Farm Service Agency, and the Environmental Working Group.

month. These charges were factored into the calculation of an average hauling fee for each size group. Using the Dalton and Bragg method from previous conventional cost-of-production studies, interest charges were calculated as one-half of the total operating expenses multiplied by 4.35%, and property tax was the total reported land value multiplied by 1.4% (Dalton and Bragg 2006).

Annual overhead expenses consist of property taxes, farm insurance, dues and fees, utilities, and miscellaneous expenses. With the exception of property taxes, all of the overhead expenses were gathered from the 2008 survey responses.

Annual Operating Expenses

Labor

Hired labor was calculated by taking the number of reported annual non-family labor hours and multiplying by a labor rate of $11.17 hour. Based on this calculation, organic dairy farms spent $3.78/cwt on labor. Small farms spent the least ($1.69/cwt), which was expected due to the reliance on family labor. Medium farms spent $3.80/cwt, and large farms spent $3.67/cwt. On average, the five most profitable farms spent $3.77/cwt, whereas the five least profitable had the highest labor costs at $4.98/cwt.

Purchased feed

Purchased feed, including both concentrate and forage, includes feed that was bought from off-farm sources as reported in the survey responses. Purchased feed accounted for the largest proportion of expenses on Maine's organic dairy farms, constituting 37.2% of total expenses, or $9.92/cwt. On small farms, feed averaged $10.84/cwt, or 37.4% of total costs. Medium and large farms devoted 38.4% and 37.3% of their respective total costs to feed at a cost of $9.89/cwt and $9.78/cwt, respectively. Reflecting their high efficiency, the five most profitable farms reported feed costs of $8.76/cwt, whereas the five least profitable reported costs of $10.81/cwt. On a percentage basis, purchased feed was 34.4% of the total expenses for the five most profitable farms and 32.7% for the five least profitable farms.

Livestock

Livestock expenses included in this section are costs associated with AI, veterinary visits, medicine, bedding, DHIA services, and livestock insurance. Small and medium organic dairies spent $1.39/cwt and $1.36/cwt on livestock expenses, respectively, and the large farms spent $1.16/cwt. The overall average for organic farms was $1.24/cwt. The five most profitable farms spent $1.40/cwt, and the five least profitable spent $1.57/cwt.

Crop and pasture

Crop and pasture expenses consist of the costs of seeds, chemicals, fertilizer, lime, custom cropping, pasture-ground lease, crop-ground lease, and other expenses associated with maintaining crop and pasture. Crop and pasture expenses were nearly identical on the small and medium farms, at $0.21/cwt and $0.22/cwt, respectively. On large farms, at $1.11/cwt, these expenses were a great deal higher most likely because large farms use corn silage on a greater scale than the small and medium farms. Overall, organic farms reported crop and pasture expenses of $0.75/cwt, while the five most profitable farms spent $1.02/cwt and the five least profitable farms spent $0.14/cwt. Future research should investigate the role of crop and pasture in the profitability of organic farming. It could be that more profitable farms invest more heavily in crop and pasture than less profitable farms, but also see a higher return from this investment.

Maintenance and equipment

Small organic farms spent on average $1.77/cwt on fuel and oil and $3.30/cwt for machinery repairs. The medium farms had lower fuel/oil and repair costs, at $1.26/cwt and $2.41/cwt, respectively. Large farms spent $1.66/cwt on fuel and oil and $1.49/cwt on machinery repairs. The large variation in machinery-repair costs may be the result of large farms having newer equipment, which requires fewer repairs, than small and medium farms. The average cost for fuel and oil across Maine's organic dairy farms was $1.55/cwt and $1.95/cwt for machinery repairs. The five most profitable farms spent $1.86/cwt and $1.37/cwt for fuel and oil and machinery repairs, respectively, while the five least profitable spent $1.49/cwt and $2.95/cwt, respectively.

Total operating expense

Total operating expense is the sum of hired labor, purchased feed expenses, livestock expenses, crop and pasture expenses, maintenance and equipment expenses, deduction charges, and interest on one-half of the total operating expense. These are the out-of-pocket costs that keep the operation running on a day-to-day basis and are a major factor in determining profitability. As unpaid family labor and ownership costs are not out-of-pocket costs, they are excluded from total operating expenses. The small organic farms had a total operating expense of $1,963.45/cow, or $20.43/cwt. The medium farm total operating expense was $2,756.88/cow, or $20.13/cwt. Large farms reported operating expenses of $2,681.79/cow, or $20.01/cwt. For organic farms across the state, operating expenses averaged $2,639.83/cow, or $20.38/cwt. The five most profitable farms had an operating expense of $2,485.29/cow, or $19.31/cwt, while the five least profitable reported expenses of $2,597.07/cow, or $23.21/cwt.

Annual Overhead Expenses

Annual overhead expenses consist of property taxes, farm insurance, dues and fees, utilities, and related expenses, which are paid annually to operate the dairy. Small, medium, and large organic farms reported total overhead expenses of $8.58/cwt, $5.61/cwt, and $6.19/cwt, respectively. Property tax on the small farms was nearly the same as on the medium farms on a per farm basis ($5,916.49 for small and $6,301.11 for medium). On a cwt basis, however, it was $2.05/cwt for small farms compared to $0.84/cwt for medium farms. Large farms paid taxes of more than twice these amounts, but when examined on a cwt basis, large farms, at $1.07/cwt, had much lower property taxes than small farms but higher than medium farms. The statewide average for total overhead expenses on organic dairy farms was $6.27/cwt, and property taxes averaged $1.10/cwt. The five most profitable farms had a total annual overhead of $6.15/cwt and property taxes of $1.41/cwt, while the five least profitable farms had total overhead costs of $9.87/cwt and property taxes of $2.53/cwt.

Utility costs were similar for large and medium farms, at $0.99/cwt and $0.97/cwt, respectively, compared to utility costs of $2.23/cwt for small farms. The statewide average for utility costs was $1.11/cwt. The five most profitable farms had utility costs of $1.44/cwt, whereas the five least profitable farms had utility costs of $1.73/cwt.

Return to Family Labor and Ownership

The overall return to family labor and ownership for all organic farms was $49,958, which comes out to $781/cow, or $6.03/cwt. Small farms had a return to family labor and ownership of $375, or $13/cow and $0.13/cwt. Medium farms showed a return of $40,860, or $743/cow and $5.42/cwt. Large organic farms had the highest return to family labor and ownership among the size group, $105,353, which comes out to $1,054/cow, or $7.86/cwt. The five most profitable farms, however, reported even higher returns, at $115,091 annually, or $1,495/cow and $11.61/cwt. The five least profitable farms had negative returns to family labor and ownership of -$24,920, or -$639/cow and -$5.71/cwt.

Summary and Discussion

Return to family labor and ownership is what is available to the farm owner/operator(s) to pay for living expenses and capital costs. The fixed ownership costs include depreciation and interest on investments for land, buildings, equipment, and livestock. In section II, we looked at the net returns associated with the different groups from the organic study. Within these groups net returns vary considerably, from just a few hundred dollars (among small farms) to more than $100,000 (among large farms).

There is research that addresses the question of how much a farm family requires for living expenses. In Illinois in 2007, 1,232 farm families, with an average of 3.0 persons per farm, enrolled in the Illinois Farm Business Farm Management Association program (UIUC 2008). This group of farms exhibited an average annual-farm-family-living expense of $60,294. The Kansas Farm Management Association's 2007 Analysis of Family Living Expenses (KFMA 2008) offered pertinent data for 364 respondents, with an average of 3.1 persons per farm. The total living expense for farm families from this analysis was $50,556 annually. To adjust these values for Maine, we used the 2007 Cost of Living Index (CLI) (U.S. = 1.0) (SCCD 2009). Maine's CLI for 2007 was 1.04, whereas in Illinois it was 0.97 and in Kansas it was 0.86. Based on the two living-expenses reports from Illinois and Kansas, Maine's estimated base living expense for farm families in 2007 would be $62,891, assuming approximately three persons per farm.

The state average return to family labor and ownership for 2007 was $49,958. Using $62,891 as a benchmark, there is a difference of nearly $13,000, which implies that Maine organic dairy producers are getting by with less and have little to put back into their operations. It should be noted that some of the farm family expenses, such as gasoline and utilities, may have been covered by the dairy operation itself.

On large organic farms, the return to family labor and ownership was $105,353, which would appear to be more than adequate to provide the family with sufficient living expenses and to allow for investment back into the business, assuming the average three-person family. The medium organic farms exhibited a return to family labor and ownership of $40,860, which is below the base estimated farm family living expenses for Maine. The small organic farms, with a return to family labor and ownership of $375, register well below the $62,891 needed to cover farm-family living expenses. Not surprising given their lower returns, 63% of the small organic farms reported that off-farm income is as important as or more important than on-farm income. Also, these farms are more likely to diversify their income stream. For example, 53% of small organic farms report bottling fresh milk, while another 13% say they are likely to do so in the future.

With a return to family labor and ownership of $115,091, the five most profitable farms have returns that are roughly $50,000 above the average level calculated for Maine. This is also more than double the state average return to family labor and ownership of $49,958. On the other hand, the five least profitable farms show a negative return to family labor and ownership that is approximately $87,000 below our estimated base farm-family living expenses.

Conclusion and Further Study

This research summarized attributes and costs and returns for Maine's organic dairy farms. Analysis reveals that economies of size exist, with larger farms on average earning higher returns than smaller farms. As expected, an analysis of the most profitable farms showed higher efficiencies in several areas including milk per cow and labor costs per cwt. Small farms rely more heavily on off-farm income and sell more milk directly from the farm. As some researchers have noted, many farmers survive by either growing larger, capturing economies of size, or diversifying to gain a broader income stream. Organic dairy farmers in Maine appear to be following this trend.

The recent (February 12, 2010) USDA announcement changing the National Organic Program regulations could have a significant impact on organic dairy practices, potentially benefiting Maine producers. It was beyond the scope of this study to carryout a pinpointed analysis of nutrient management and pasture of specific farms as related to profitability. A research agenda being developed now will likely explore these factors.

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APPENDIX

Table A1. Average cost of production for all organic farms.

Return to Family Labor and Ownership	All Organic Farms			
Number of farms	30			
Number of cows	64			
Annual Milk Shipped (cwt)	8,290			
Annual Milk Shipped (lbs/cow)	12,953			
	Total	**Per Cow**	**Per cwt**	**%**
Annual Revenue				
Milk receipts	$245,697.30	$3,839.02	$29.64	90.7
Crop and hay revenue	$5,462.96	$85.36	$0.66	2.0
Livestock revenue	$11,889.46	$185.77	$1.43	4.4
Other revenue	$7,793.94	$121.78	$0.94	2.9
Total Revenue	**$270,843.66**	**$4,231.93**	**$32.67**	
Annual Operating Expenses				
Labor				
Hired	$31,315.10	$489.30	$3.78	
Subtotal	$31,315.10	$489.30	$3.78	14.2
Purchased Feed				
Dairy concentrate	$80,462.94	$1,257.23	$9.71	36.4
Dairy forage	$1,795.46	$28.05	$0.22	0.8
Subtotal	$82,258.40	$1,285.29	$9.92	37.2
Livestock Expenses				
AI costs	$1,645.38	$25.71	$0.20	0.7
Veterinary	$1,975.74	$30.87	$0.24	0.9
Medicine	$1,605.39	$25.08	$0.19	0.7
Bedding	$3,411.33	$53.30	$0.41	1.5
DHIA	$1,264.49	$19.76	$0.15	0.6
Livestock insurance	$391.67	$6.12	$0.05	0.2
Subtotal	$10,294.00	$160.84	$1.24	4.7

	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$1,201.80	$18.78	$0.14	0.5
Chemicals	$58.33	$0.91	$0.01	0.0
Fertilizer	$421.60	$6.59	$0.05	0.2
Lime	$741.27	$11.58	$0.09	0.3
Custom cropping	$2,274.97	$35.55	$0.27	1.0
Pasture ground lease	$200.00	$3.13	$0.02	0.1
Crop ground lease	$769.50	$12.02	$0.09	0.3
Other	$526.67	$8.23	$0.06	0.2
Subtotal	$6,194.14	$96.78	$0.75	2.8
Maintenance and Equipment expenses				
Fuel and oil	$12,861.08	$200.95	$1.55	5.8
Machinery repairs	$16,203.94	$253.19	$1.95	7.3
Subtotal	$29,065.02	$454.14	$3.51	13.2
Deduction Charges				
Milk Marketing	$2,569.83	$40.15	$0.31	1.2
Hauling and Trucking	$210.00	$3.28	$0.03	0.1
Subtotal	$2,779.83	$43.43	$0.34	1.3
Interest (on ½ of total operating expense)	$7,042.93	$110.05	$0.85	3.2
Total Operating Expense	**$168,949.42**	**$2, 639.83**	**$20.38**	**76.5**
Annual Overhead Expenses				
Property tax	$9,131.93	$142.69	$1.10	4.1
Farm insurance	$4,895.16	$76.49	$0.59	2.2
Dues and fees	$3,622.72	$56.61	$0.44	1.6
Utility	$9,240.86	$144.39	$1.11	4.2
Miscellaneous	$25,045.08	$391.33	$3.02	11.3
Total Overhead Expense	**$51,935.75**	**$811.50**	**$6.27**	**23.5**
Return to Family Labor and Ownership	**$49,958.49**	**$780.60**	**$6.03**	

Table A2. Average cost of production for small organic farm.

Return to Family Labor and Ownership	Small Organic			
Number of farms	9			
Number of cows	30			
Annual Milk Shipped (cwt)	2,883			
Annual Milk Shipped (lbs/cow)	9,610			
	Total	**Per Cow**	**Per cwt**	**%**
Annual Revenue				
Milk receipts	$77,494.00	$2,583.13	$26.88	92.2
Crop and hay revenue	$644.44	$21.48	$0.22	0.8
Livestock revenue	$3,750.70	$125.02	$1.30	4.5
Other revenue	$2,130.92	$71.03	$0.74	2.5
Total Revenue	$84,020.06	$2,800.67	$29.14	
Annual Operating Expenses				
Labor				
Hired	$4,858.95	$161.97	$1.69	
Subtotal	$4,858.95	$161.97	$1.69	5.8
Purchased Feed				
Dairy concentrate	$29,275.44	$975.85	$10.15	35.0
Dairy forage	$1,966.75	$65.56	$0.68	2.4
Subtotal	$31,242.19	$1,041.41	$10.84	37.4
Livestock Expenses				
AI costs	$285.28	$9.51	$0.10	0.3
Veterinary	$775.11	$25.84	$0.27	0.9
Medicine	$689.25	$22.98	$0.24	0.8
Bedding	$1,476.79	$49.23	$0.51	1.8
DHIA	$626.58	$20.89	$0.22	0.7
Livestock insurance	$161.11	$5.37	$0.06	0.2
Subtotal	$4,014.12	$133.80	$1.39	4.8

	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$ -	$ -	$ -	0.0
Chemicals	$ -	$ -	$ -	0.0
Fertilizer	$ -	$ -	$ -	0.0
Lime	$ -	$ -	$ -	0.0
Custom cropping	$222.22	$7.41	$0.08	0.3
Pasture ground lease	$277.78	$9.26	$0.10	0.3
Crop ground lease	$116.67	$3.89	$0.04	0.1
Other	$ -	$ -	$ -	0.0
Subtotal	$616.67	$20.56	$0.21	0.7
Maintenance and Equipment expenses				
Fuel and oil	$5,116.25	$170.54	$1.77	6.1
Machinery repairs	$9,506.00	$316.87	$3.30	11.4
Subtotal	$14,622.25	$487.41	$5.07	17.5
Deduction Charges				
Milk Marketing	$893.78	$29.79	$0.31	1.1
Hauling and Trucking	$200.00	$6.67	$0.07	0.2
Subtotal	$1,093.78	$36.46	$0.38	1.3
Interest (on ½ of total operating expense)	$2,445.49	$81.85	$0.85	2.9
Total Operating Expense	**$58,903.45**	**$1,963.45**	**$20.43**	**70.4**
Annual Overhead Expenses				
Property tax	$5,916.49	$197.22	$2.05	7.1
Farm insurance	$2,294.22	$76.47	$0.80	2.7
Dues and fees	$1,712.21	$57.07	$0.59	2.0
Utility	$6,441.01	$214.70	$2.23	7.7
Miscellaneous	$8,377.29	$279.24	$2.91	10.0
Total Overhead Expense	**$24,741.22**	**$824.71**	**$8.58**	**29.6**
Return to Family Labor and Ownership	**$375.39**	**$12.51**	**$0.13**	

Table A3. Average cost of production for medium organic farm.

Return to Family Labor and Ownership	Medium Organic			
Number of farms	10			
Number of cows	55			
Annual Milk Shipped (cwt)	7,534			
Annual Milk Shipped (lbs/cow)	13,698			
	Total	**Per Cow**	**Per cwt**	**%**
Annual Revenue				
Milk receipts	$217,869.15	$3,961.26	$28.92	92.8
Crop and hay revenue	$1,983.43	$36.06	$0.26	0.8
Livestock revenue	$8,926.32	$162.30	$1.18	3.8
Other revenue	$6,009.06	$109.26	$0.80	2.6
Total Revenue	**$234,787.96**	**$4,268.87**	**$31.16**	
Annual Operating Expenses				
Labor				
Hired	$28,603.18	$520.06	$3.80	
Subtotal	$28,603.18	$520.06	$3.80	14.7
Purchased Feed				
Dairy concentrate	$71,802.52	$1,305.50	$9.53	37.0
Dairy forage	$2,716.39	$49.39	$0.36	1.4
Subtotal	$74,518.91	$1,354.89	$9.89	38.4
Livestock Expenses				
AI costs	$2,524.00	$45.89	$0.34	1.3
Veterinary	$1,876.50	$34.12	$0.25	0.9
Medicine	$884.85	$16.09	$0.12	0.5
Bedding	$2,913.03	$52.96	$0.39	1.5
DHIA	$1,198.65	$21.79	$0.16	0.6
Livestock insurance	$840.00	$15.27	$0.11	0.4
Subtotal	$10,237.03	$186.13	$1.36	5.3

	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$563.80	$10.25	$0.07	0.3
Chemicals	$ -	$ -	$ -	0.0
Fertilizer	$154.80	$2.81	$0.02	0.1
Lime	$603.81	$10.98	$0.08	0.3
Custom cropping	$ -	$ -	$ -	0.0
Pasture ground lease	$68.75	$1.25	$0.01	0.0
Crop ground lease	$291.00	$5.29	$0.04	0.2
Other	$ -	$ -	$ -	0.0
Subtotal	$1,682.16	$30.58	$0.22	0.9
Maintenance and Equipment expenses				
Fuel and oil	$9,530.01	$173.27	$1.26	4.9
Machinery repairs	$18,130.42	$329.64	$2.41	9.3
Subtotal	$27,660.43	$502.92	$3.67	14.3
Deduction Charges				
Milk Marketing	$2,335.63	$42.47	$0.31	1.2
Hauling and Trucking	$270.00	$4.91	$0.04	0.1
Subtotal	$2,605.63	$47.38	$0.35	1.3
Interest (on ½ of total operating expense)	$6,320.87	$114.92	$0.84	3.3
Total Operating Expense	**$151,628.21**	**$2,756.88**	**$20.13**	**78.2**
Annual Overhead Expenses				
Property tax	$6,301.11	$114.57	$0.84	3.2
Farm insurance	$3,512.50	$63.86	$0.47	1.8
Dues and fees	$4,627.10	$84.13	$0.61	2.4
Utility	$7,273.01	$132.24	$0.97	3.8
Miscellaneous	$20,586.22	$374.29	$2.73	10.6
Total Overhead Expense	**$42,299.94**	**$769.09**	**$5.61**	**21.8**
Return to Family Labor and Ownership	**$40,859.81**	**$742.91**	**$5.42**	

Table A4. Average cost of production for large organic farm.

Return to Family Labor and Ownership	Large Organic			
Number of farms	11			
Number of cows	100			
Annual Milk Shipped (cwt)	13,400			
Annual Milk Shipped (lbs/cow)	13,400			
	Total	Per Cow	Per cwt	%
Annual Revenue				
Milk receipts	$408,616.49	$4,086.16	$30.49	89.5
Crop and hay revenue	$12,568.59	$125.69	$0.94	2.8
Livestock revenue	$21,242.20	$212.42	$1.59	4.7
Other revenue	$14,049.94	$140.50	$1.05	3.1
Total Revenue	$456,477.22	$4,564.77	$34.07	
Annual Operating Expenses				
Labor				
Hired	$49,144.81	$491.45	$3.67	
Subtotal	$49,144.81	$491.45	$3.67	14.0
Purchased Feed				
Dairy concentrate	$130,216.73	$1,302.17	$9.72	37.1
Dairy forage	$818.18	$8.18	$0.06	0.2
Subtotal	$131,034.91	$1,310.35	$9.78	37.3
Livestock Expenses				
AI costs	$1,959.45	$19.59	$0.15	0.6
Veterinary	$3,048.30	$30.48	$0.23	0.9
Medicine	$3,010.00	$30.10	$0.22	0.9
Bedding	$5,447.12	$54.47	$0.41	1.6
DHIA	$1,846.26	$18.46	$0.14	0.5
Livestock insurance	$172.73	$1.73	$0.01	0.0
Subtotal	$15,483.86	$154.84	$1.16	4.3

	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$2,765.09	$27.65	$0.21	0.8
Chemicals	$159.09	$1.59	$0.01	0.0
Fertilizer	$1,009.09	$10.09	$0.08	0.3
Lime	$1,472.73	$14.73	$0.11	0.4
Custom cropping	$6,022.64	$60.23	$0.45	1.7
Pasture ground lease	$255.68	$2.56	$0.02	0.1
Crop ground lease	$1,738.64	$17.39	$0.13	0.5
Other	$1,436.36	$14.36	$0.11	0.4
Subtotal	$14,859.32	$148.59	$1.11	4.2
Maintenance and Equipment Expenses				
Fuel and oil	$22,226.00	$222.26	$1.66	6.3
Machinery repairs	$19,932.72	$199.33	$1.49	5.7
Subtotal	$42,158.72	$421.59	$3.15	12.0
Deduction Charges				
Milk Marketing	$4,154.06	$41.54	$0.31	1.2
Hauling and Trucking	$163.64	$1.64	$0.01	0.0
Subtotal	$4,317.70	$43.18	$0.32	1.2
Interest (on ½ of total operating expense)	$11,179.47	$111.79	$0.83	3.2
Total Operating Expense	$268,178.79	$2,681.79	$20.01	76.41
Annual Overhead Expenses				
Property tax	$14,336.23	$143.36	$1.07	4.1
Farm insurance	$8,280.16	$82.80	$0.62	2.4
Dues and fees	$4,272.80	$42.73	$0.32	1.2
Utility	$13,320.60	$133.21	$0.99	3.8
Miscellaneous	$42,735.87	$427.36	$3.19	12.2
Total Overhead Expense	**$82,945.66**	**$829.46**	**$6.19**	**23.6**
Return to Family Labor and Ownership	**$105,352.77**	**$1,053.53**	**$7.86**	

Table A5. Average cost of production for top 5 (profit) organic farms.

Return to Family Labor and Ownership	Top 5 Farms			
Number of farms	5			
Number of cows	77			
Annual Milk Shipped (cwt)	9,910			
Annual Milk Shipped (lbs/cow)	12,870			
	Total	**Per Cow**	**Per cwt**	**%**
Annual Revenue				
Milk receipts	$308,640.77	$4,008.32	$31.14	84.0
Crop and hay revenue	$23,180.00	$301.04	$2.34	6.3
Livestock revenue	$24,822.20	$322.37	$2.50	6.8
Other revenue	$10,756.10	$139.69	$1.09	2.9
Total Revenue	**$367,399.07**	**$4,771.42**	**$37.07**	
Annual Operating Expenses				
Labor				
Hired	$37,403.86	$485.76	$3.77	
Subtotal	$37,403.86	$485.76	$3.77	14.8
Purchased Feed				
Dairy concentrate	$85,054.60	$1,104.61	$8.58	33.7
Dairy forage	$1,800.00	$23.38	$0.18	0.7
Subtotal	$86,854.60	$1,127.98	$8.76	34.4
Livestock Expenses				
AI costs	$1,800.00	$23.38	$0.18	0.7
Veterinary	$3,893.47	$50.56	$0.39	1.5
Medicine	$2,340.00	$30.39	$0.24	0.9
Bedding	$4,171.66	$54.18	$0.42	1.7
DHIA	$1,503.20	$19.52	$0.15	0.6
Livestock insurance	$200.00	$2.60	$0.02	0.1
Subtotal	$13,908.33	$180.63	$1.40	5.5

	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$1,127.60	$14.64	$0.11	0.4
Chemicals	$350.00	$4.55	$0.04	0.1
Fertilizer	$519.60	$6.75	$0.05	0.2
Lime	$3,745.62	$48.64	$0.38	1.5
Custom cropping	$2,000.00	$25.97	$0.20	0.8
Pasture ground lease	$150.00	$1.95	$0.02	0.1
Crop ground lease	$240.00	$3.12	$0.02	0.1
Other	$1,960.00	$25.45	$0.20	0.8
Subtotal	$10,092.82	$131.08	$1.02	4.0
Maintenance and Equipment expenses				
Fuel and oil	$18,435.00	$239.42	$1.86	7.3
Machinery repairs	$13,623.00	$176.92	$1.37	5.4
Subtotal	$32,058.00	$416.34	$3.23	12.7
Deduction Charges				
Milk Marketing	$3,071.97	$39.90	$0.31	1.2
Hauling and Trucking	$-	$ -	$ -	0.0
Subtotal	$3.071.97	$39.90	$0.31	1.2
Interest (on 1/2 of total operating expense)	$7,977.45	$103.60	$0.84	3.2
Total Operating Expense	**$191,367.03**	**$2,486.29**	**$19.31**	**75.8**
Annual Overhead Expenses				
Property tax	$13,993.20	$181.73	$1.41	5.4
Farm insurance	$5,573.00	$72.38	$0.56	2.1
Dues and fees	$2,280.00	$29.61	$0.23	0.9
Utility	$14,254.56	$185.12	$1.44	5.5
Miscellaneous	$24,840.00	$322.60	$2.51	9.5
Total Overhead Expense	**$60,940.76**	**$791.44**	**$6.15**	**24.2**
Return to Family Labor and Ownership	**$115,091.28**	**$1,494.69**	**$11.61**	

Table A6. Average cost of production for five least profitable organic farms.

Return to Family Labor and Ownership	Bottom 5 Farms			
Number of farms	5			
Number of cows	39			
Annual milk shipped (cwt)	4,364			
Annual milk shipped (lbs/cow)	10,911			
	Total	**Per Cow**	**Per cwt**	**%**
Annual Revenue				
Milk receipts	$110,394.00	$2,830.62	$25.29	92.4%
Crop and hay revenue	$560.00	$14.36	$0.13	0.5%
Livestock revenue	$6,230.00	$159.74	$1.43	5.2%
Other revenue	$2,274.74	$58.33	$0.52	1.9%
Total Revenue	**$119,458.74**	**$3,063.04**	**$27.37**	
Annual Operating Expenses				
Labor				
Hired	$21,725.65	$557.07	$4.98	
Subtotal	$21,725.65	$557.07	$4.98	15.0%
Purchased Feed				
Dairy concentrate	$45,425.57	$1,164.76	$10.41	31.5%
Dairy forage	$1,740.00	$44.62	$0.40	1.2%
Subtotal	$47,165.57	$1,209.37	$10.81	32.7%
Livestock Expenses				
AI costs	$1,566.50	$40.17	$0.36	1.1%
Veterinary	$1,010.11	$25.90	$0.23	0.7%
Medicine	$633.80	$16.25	$0.15	0.4%
Bedding	$2,013.61	$51.63	$0.46	1.4%
DHIA	$840.20	$21.54	$0.19	0.6%
Livestock insurance	$780.00	$20.00	$0.18	0.5%
Subtotal	$6,844.22	$175.49	$1.57	4.7%

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	Total	Per Cow	Per cwt	%
Crop and Pasture Expenses				
Seeds	$-	$-	$-	0.0%
Chemicals	$-	$-	$-	0.0%
Fertilizer	$-	$-	$-	0.0%
Lime	$-	$-	$-	0.0%
Custom cropping	$400.00	$10.26	$0.09	0.3%
Pasture ground lease	$125.00	$3.21	$0.03	0.1%
Crop ground lease	$90.00	$2.31	$0.02	0.1%
Other	$-	$-	$-	0.0%
Subtotal	$615.00	$15.77	$0.14	0.4%
Maintenance and Equipment Expenses				
Fuel and oil	$6,482.64	$166.22	$1.49	4.5%
Machinery repairs	$12,877.28	$330.19	$2.95	8.9%
Subtotal	$19,359.92	$496.41	$4.44	13.4%
Deduction Charges				
Milk Marketing	$1,352.94	$34.69	$0.31	0.9%
Hauling and Trucking	$-	$ -	$ -	0.0%
Subtotal	$1,352.94	$34.69	$0.31	0.9%
Interest (on ½ of total operating expense)	$4,222.25	$108.26	$0.97	2.9%
Total Operating Expense	**$101,285.55**	**$2,597.07**	**$23.21**	**70.2%**
Annual Overhead Expenses				
Property tax	$11,040.03	$283.08	$2.53	7.4%
Farm insurance	$3,180.00	$81.54	$0.73	2.1%
Dues and fees	$6,578.50	$168.68	$1.51	4.4%
Utility	$7,553.82	$193.69	$1.73	5.1%
Miscellaneous	$14,741.29	$377.98	$3.38	9.9%
Total Overhead Expense	**$43,093.64**	**$1,104.97**	**$9.87**	**29.0%**
Return to Family Labor and Ownership	**$(24,920.45)**	**$(638.99)**	**$(5.71)**	