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Staff Paper

**Profitability and Production Efficiency of the Crop and
Livestock Enterprises of Michigan Dairy Operations:
1998 Summary and Analysis**

By

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Staff Paper #01-04

January 2001



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21 pages

Abstract: This paper summarizes the 1998 results of the Dairy Profitability and Production Efficiency project. Among the major findings are that the average cost of production was almost exactly equal to the average milk herd revenue on a per hundredweight basis. All eight farms covered variable costs of producing milk. Five of the eight farms showed a profit when all costs of production were included. All six farms that raised their own replacement heifers lost money on the enterprise. With respect to crop production, corn and corn silage were not profitable enterprises. The hay enterprise was profitable for five of the farms.

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I. Introduction

The Michigan dairy industry is concerned with which segments of a diversified dairy operation that produces feed crops and raises replacement heifers are profitable and why. The Dairy Industry Advisory Committee of Michigan aired these concerns in a 1993 meeting and this issue continues to be at the top of the priority list of dairy research areas. In July 1997, Michigan State University initiated a project to study the profitability and production efficiency of the crop and livestock enterprises of Michigan dairy operations. The remainder of 1997 involved the coordination and preparation for the effort by MSU faculty, extension specialists, farmers and dairy industry members. The project began in January 1998 with nine dairy operations participating.

One of the main objectives of this project was determining the cost of producing milk on dairy farms. The cost of production is often determined by assuming that the only farm enterprise is the milking herd. This approach, which assumes that all inputs such as feed and heifers are purchased by the milking herd, ignores the complementarity and potential comparative advantage of feed crop production, heifer raising, and family labor. In contrast this project analyzes all farm enterprises using enterprise accounting methods--methods commonly utilized by manufacturing companies--to establish a more precise and true cost of production. Another general practice in cost of production estimates is to ignore the farm equity capital cost, unpaid management and unpaid labor--instead leaving these factors as residual claimants. These costs were addressed using finance literature and opportunity costs to arrive at a complete cost of production. The result is a comprehensive economic review of farm activities that allows accurate and appropriate decisions on crop and livestock production by enterprise.

The project required the use of a computerized accounting system (e.g., MicroTel, Quicken, or Quickbooks) and enterprising the transactions by farmer cooperators. Campus and extension personnel worked with the farmer to set up the relevant profit, cost and allocation accounts and to streamline the accounting system. Other requirements included a log of labor hours, feed sheets (simple rations from a feed salesman/consultant are usually sufficient), beginning and ending balance sheets (often done as a FINAN by University Extension), and feed and animal inventories. While the requirements seemed daunting at first glance, the participants did not generally find the work-load overwhelming. However, campus and field extension staff provided assistance as needed to help mitigate the work.

Objectives

1. To make MSU Extension agents aware of accounting methods used for determining the profitability of the business profit centers.
2. To utilize comprehensive cost accounting methods on selected dairy farms to evaluate the economic performance of the various profit centers.
3. To collect and merge comprehensive production and financial data as a means to monitor efficiency and profitability of the business.
4. To use the knowledge and benchmark data gained in Objectives 2 and 3 to develop simpler and less involved enterprising procedures that can be more widely used by dairy producers.

Results include a better understanding of the economic advantages and disadvantages Michigan has relative to its competitors. Using this information, the industry may be better able to adjust and remain competitive.

Farms were selected in conjunction with MSU Extension Dairy and Farm Management Specialists. The farms chosen either had or were willing to use a computerized accounting program, could provide beginning and ending year balance sheets, and were willing to work on labor and machinery use records. The eight farms that ultimately completed 1998 records were geographically dispersed across the lower peninsula of Michigan¹. These farms were also dispersed across a wide range of farm size and production technologies.

This paper summarizes the results from the first year of the Dairy Profitability and Production Efficiency project, 1998. Because 1999 values and analysis follow in a subsequent research report, this paper concentrates on presenting summary statistics of profit and efficiency measures. Further results and discussion of 1999 including a discussion of the implications for cost of production methods will be available in the final report.

II. Methods and Procedures

While most basic cost of production methods utilize income tax information and arbitrarily assign costs based on some measure of enterprise size such as revenues, this project focused on collecting and analyzing the necessary records to accurately and completely allocate all costs to the appropriate enterprise. By doing so, the intention was to provide an accurate picture of the relative strengths and weaknesses of enterprises on Michigan dairy farms and, also, to assess the appropriateness of simpler procedures to estimate cost of production. A complete summary of the accounting procedures and adjustments is included in the final research report. Here we briefly outline the required information and basic procedures.

¹ One farm dropped out of the project during 1998.

Enterprise accounting involves setting up profit, cost, and service centers on the farm as well as allocation or holding accounts. Profit centers are enterprises that have both explicit revenue generation and costs. The milking herd, replacement heifers, and crops such as corn and hay are common profit centers for Michigan dairy farms. Cost, or service, centers are enterprises that exist to contribute to the profit centers. Often, the revenues or income for the cost centers is not explicitly paid but, rather, a transfer within the same farm. Machinery, equipment, and buildings are examples of cost centers on dairy farms.

Allocation, or holding, accounts are set up to keep track of costs and revenues that apply across multiple profit or cost centers. If the cost or revenue can be readily assigned to a cost or profit center, then that may be done during the standard accounting. However, there are many costs and revenues that apply across profit and cost centers and whose exact allocation is not known until later. An example of an allocation account is feed that is purchased for use by both the milking herd and replacement heifer enterprises. In the case of feed, the costs are allocated using the ration records. Other costs that require allocation include management, utilities, and fuel among others.

A. Data Recording and Collecting

The records needed to participate in this project were, for the most part, similar to what the farm cooperators were keeping with a few notable additions. Required information included:

1. **Financial Transactions** -- The participants of the project utilized a computerized accounting program such as Microtel from MSU, Quicken, or Quick Books.

Entering financial transactions into the accounting system included assigning each

transaction an enterprise code. This allowed tracking expenditures and income by “Profit Centers” or “Service Centers.”

2. **Beginning and Ending Inventories** -- The FINAN analysis and the depreciation record had the market values used in valuing equipment, facilities, livestock, crops in storage and other similar inventory items.
3. **Supplemental Physical Data Record** -- This record was new to the participants. Its main purpose was to show how the inputs supplied by the “Service Centers,” of the business are employed in the “Profit Centers.” For example, the cooperators recorded hours of labor as it was used by the corn or milking herd enterprises. Information was recorded for the utilization of major machinery items in a similar way. This information was subsequently used to allocate the costs related to these service centers to the profit centers.
4. **Feed Utilization Sheet** -- This record tracked the rations and the length of time they were fed to the various livestock groups. Often the only extra effort involved was making a copy of rations being fed, noting the number of animals being fed the ration, and the time period the rations were fed. From this information we allocated costs of both purchased and grown feeds to the livestock profit centers.
5. **Crop Production Record** -- Most producers keep a log of crops harvested. This information was transferred to a summary sheet.
6. **Monthly Animal Inventories** – If the participant was on DHIA, this information was already recorded. If not, a barn sheet was supplied to record animal numbers

by group (e.g., cow in milk, dry cows, heifer less than a year in age) on a monthly basis.

These records were checked for accuracy at MSU and later verified in summary form by the farm cooperators. Additional information such as the relevant market places for replacements, land rental, and opportunity cost of unpaid management and family labor was collected as needed.

B. Data Analysis

All information was collected at Michigan State University. Costs were allocated from the holding accounts such as feed to the appropriate enterprise. The crops that were harvested by a given farm were sold from that crop enterprise into a "storage and marketing" account. The milking herd and replacement heifer enterprises then purchased the feed from the storage and marketing account throughout the year at the going market rate. In this way, the storage and marketing account would gain any increase in market price since harvest, but also be responsible for any loss and the cost of maintaining the storage facilities.

Labor and management supplied labor were allocated across enterprises based on the supplemental physical data forms. The value of labor was the going market rate for that quality of labor. A management fee was charged to each of the profit centers at four percent of the value added by the profit center.

Owner capital was valued based on industry risk premium values estimated using MSU dairy farm industry data. The individual farm charge for capital was estimated using the

leverage position for the farm. The lowest cost of capital charge was 8.16 percent while the highest cost of capital was 10.37 percent.

The total cost, which might also be referred to as the total "economic" cost of production for the enterprise in question includes all factors of production such as unpaid labor, management and a competitive return to capital. This value does not represent a cash flow notion of costs that many producers are aware of but rather a complete accounting of all costs without any "free" use of unpaid resources such as operator labor and capital.

III. Enterprise Costs and Returns

The enterprise cost and returns summaries can be split into dairy, including the milking herd and heifer enterprises, and crops, including corn, corn silage, and hay. While there were other livestock and crop enterprises present on some farms, this paper focuses on the common enterprises. To protect farm anonymity, all values are presented only in summary form including average, minimum, and maximum. For each table, the minimum and maximum represent the extreme value for that production, revenue or cost component across the farms. For example, the average total (economic) cost of producing milk across the eight farms was \$16.47/cwt while the lowest total cost was \$14.15/cwt. However, note that neither the high or low total costs are the sum of the individual costs by category.

The most important enterprise on virtually all dairy farms is the milking herd. This enterprise usually supplies the overwhelming majority of the farm revenue and is the cause of most farm costs. Tables 1 and 2 present a summary of the milk cow enterprise.

The average herd size was 193 cows with a wide range of herd sizes represented—from 44 to 462 cows (Table 1). The eight farms analyzed had an average milk production sold per cow of almost 23,000 pounds per year. Average total hours of labor per hundredweight of milk used by the milking herd—for all activities such as feeding, milking, bedding—was 0.23 hours or about 14 minutes. A wide range of labor efficiency was present across farms which is reflected in the range in labor costs.

The milk price in 1998 was relatively high and the farms received an average gross milk price, which includes all premiums, of \$15.33 per hundredweight (Table 1). Milk revenue represented an average of 93 percent of the total milking herd revenue. Cull cow revenues were the second largest source of revenue with an average of 3.2 percent of the milking herd revenue. Calf sales, usually a paper sale on the same operation from the milking herd to the replacement heifer enterprise, was the third largest source of revenue but only contributed an average of 2.3 percent. Manure value was credited to the milking herd only if the farm changed commercial fertilizer purchases to reflect the nutrients added to the soil from manure. Manure contributed less than one percent on average to the milking herd revenues.

The largest cost of production on these farms was feed, which included both purchased and home-grown, followed by labor and replacement cost (Table 1). Feed accounted for an average of 37.6 percent of total cost of producing milk. The range of feed costs varied from \$5.13 to \$7.42 per hundredweight reflecting timing of purchases, quality, and efficiency of utilization. Labor averaged \$2.60 per hundredweight with a rather large range of \$1.92 to \$4.78 per hundredweight. Recall that these labor costs include unpaid family labor. Replacement heifer cost also varied widely across farms from \$1.32 to \$3.39 per hundredweight. Labor and

Table 1. Milking Herd Enterprise Costs and Returns (8 farms, \$ per hundredweight)

| | Average | Minimum | Maximum | |
|-------------------------------|----------------|-----------------|----------------|--------------------|
| Production Factors | | | | |
| Production per cow, lbs | 22,957 | 17,594 | 26,556 | |
| Cows | 193 | 44 | 462 | |
| Hours Labor per cwt | 0.23 | 0.13 | 0.39 | |
| Income | | | | %Total Rev. |
| Milk Sales | \$15.33 | \$15.00 | \$15.82 | 93.0 |
| Calf Sales | \$0.38 | \$0.19 | \$0.53 | 2.3 |
| Manure Value | \$0.16 | \$0.04 | \$0.37 | 0.9 |
| Culls | \$0.53 | \$0.41 | \$0.72 | 3.2 |
| Other Misc. | \$0.09 | \$0.00 | \$0.24 | 0.5 |
| TOTAL INCOME | \$16.48 | \$16.03 | \$17.15 | 100.0 |
| Variable Costs | | | | %Total Cost |
| Labor | \$2.60 | \$1.92 | \$4.78 | 15.8 |
| Feed | \$6.19 | \$5.13 | \$7.42 | 37.6 |
| Supplies & Bedding | \$0.54 | \$0.29 | \$0.84 | 3.3 |
| Marketing | \$0.63 | \$0.54 | \$0.73 | 3.8 |
| Misc. Dairy | \$0.13 | \$0.05 | \$0.24 | 0.8 |
| Breeding | \$0.14 | \$0.05 | \$0.32 | 0.8 |
| Vet and Med | \$0.52 | \$0.32 | \$0.79 | 3.1 |
| BST | \$0.25 | \$0.03 | \$0.60 | 1.5 |
| Replacement Cost | \$2.05 | \$1.32 | \$3.39 | 12.5 |
| Equipment | \$0.50 | \$0.29 | \$0.80 | 3.1 |
| Building & Improvements | \$0.24 | \$0.09 | \$0.45 | 1.4 |
| Utilities | \$0.25 | \$0.13 | \$0.39 | 1.5 |
| Other | \$0.09 | \$0.01 | \$0.19 | 0.5 |
| TOTAL VARIABLE COST | \$14.12 | \$11.87 | \$17.69 | 85.7 |
| Net over variable cost | \$2.36 | (\$0.54) | \$4.62 | |
| Fixed Costs | | | | %Total Cost |
| Equip | \$0.61 | \$0.34 | \$1.04 | 3.7 |
| Interest & Insurance | \$0.56 | \$0.35 | \$0.76 | 3.4 |
| Building & Improvements | \$0.42 | \$0.11 | \$0.85 | 2.6 |
| Management Fee | \$0.33 | \$0.24 | \$0.40 | 2.0 |
| General Overhead | \$0.43 | \$0.16 | \$0.82 | 2.6 |
| TOTAL FIXED COST | \$2.35 | \$2.03 | \$2.57 | 14.3 |
| TOTAL COST | \$16.47 | \$14.15 | \$19.73 | 100.0 |
| NET RETURN | \$0.01 | (\$2.58) | \$2.35 | |

replacement costs were the largest explainers of the difference in total cost of production. On the whole, variable cost of producing milk accounted for 85.7 percent of the total cost of production.

Fixed costs accounted for the remaining 14.3 percent of milk production cost on average (Table 1). The largest element of fixed cost was equipment which reflected milking herd specific equipment costs as well as the allocated cost of shared farm equipment. Adding interest, insurance, buildings, management and general overhead resulted in the total fixed cost of \$2.35 per hundredweight on average. Fixed costs were much more uniform across farms—although there was significant variation in the individual categories of cost such as facilities and overhead.

The total cost of producing milk averaged \$16.47—exactly a penny less than the average total milk herd income (Table 1). Five farms had profitable milk herds in 1998 with the most profitable making \$2.35 per hundredweight. The remaining three farms lost money when all costs were accounted for with the largest loss being \$2.58 per hundredweight. Both the most profitable and the least profitable farm were in the middle of the farm size range indicating that size alone cannot explain cost of production. Instead, management and efficiency have important roles to play at all sizes.

On a per cow basis the costs and returns look remarkably similar to the hundredweight basis (Table 2). The average total income for 1998 across the eight farms was \$3,773 per cow with a range from \$3,017 to \$4,258. Total costs averaged \$3,729 for an average profit of \$44 per cow. The most profitable farm made \$591 per cow and the least profitable lost \$454 per cow.

Table 2. Milking Herd Enterprise Costs and Returns (8 farms, \$ per cow)

| | Average | Minimum | Maximum | |
|-------------------------------|----------------|----------------|----------------|------------------------|
| Production Factors | | | | |
| Production per cow, lbs | 22,957 | 17,594 | 26,556 | |
| Cows | 193 | 44 | 462 | |
| Hours Labor per cwt | 51.9 | 29.7 | 69.5 | |
| Income | | | | |
| | | | | %Total Rev. |
| Milk Sales | \$3,514 | \$2,784 | \$3,983 | 93.15 |
| Calf Sales | \$87 | \$41 | \$126 | 2.30 |
| Manure Value | \$35 | \$11 | \$84 | 0.92 |
| Culls | \$120 | \$72 | \$166 | 3.18 |
| Other Misc. | \$17 | \$0 | \$53 | 0.44 |
| TOTAL INCOME | \$3,773 | \$3,017 | \$4,258 | 100.00 |
| Variable Costs | | | | |
| | | | | % of Total Cost |
| Labor | \$579 | \$450 | \$842 | 15.52 |
| Feed | \$1,398 | \$1,291 | \$1,641 | 37.49 |
| Supplies & Bedding | \$125 | \$55 | \$213 | 3.37 |
| Marketing | \$144 | \$115 | \$183 | 3.85 |
| Misc. Dairy | \$30 | \$11 | \$60 | 0.79 |
| Breeding | \$30 | \$14 | \$55 | 0.81 |
| Vet and Med | \$118 | \$61 | \$200 | 3.18 |
| BST | \$59 | \$5 | \$130 | 1.58 |
| Replacement Cost | \$461 | \$263 | \$645 | 12.37 |
| Equipment | \$113 | \$63 | \$203 | 3.03 |
| Building & Improvements | \$53 | \$23 | \$79 | 1.41 |
| Utilities | \$59 | \$26 | \$105 | 1.58 |
| Other | \$20 | \$4 | \$36 | |
| TOTAL VARIABLE COST | \$3,189 | \$2,988 | \$3,491 | 85.51 |
| Net over variable cost | \$584 | (\$96) | \$1,164 | |
| Fixed Costs | | | | |
| Equip | \$121 | \$29 | \$240 | 3.24 |
| Interest & Insurance | \$99 | \$29 | \$216 | 2.65 |
| Building & Improvements | \$91 | \$29 | \$216 | 2.44 |
| Management Fee | \$239 | \$35 | \$656 | 6.41 |
| General Overhead | \$101 | \$35 | \$209 | 2.71 |
| TOTAL FIXED COST | \$540 | \$358 | \$656 | 14.49 |
| TOTAL COST | \$3,729 | \$3,471 | \$4,035 | 100.00 |
| NET RETURN | \$44 | (\$454) | \$591 | |

The replacement heifer enterprise was present in some form on all farms. However, two of the eight farms utilized a custom heifer raiser in some form and were not included in the summary statistics as it was impossible to separate out the costs and returns on those operations (Table 3). The milk cow enterprise sold each heifer calf to the heifer enterprise as a newborn. The heifer enterprise raised the heifers and sold late pregnant (springing) heifers back into the milking herd. Each transaction was done at the current market price and validated by the producers. Because the heifers were of all different ages and the farms were followed for a single year, an inventory adjustment was made, and all expenses are expressed as average cost per heifer month. That is, the costs and revenues were adjusted for the fact that older heifers were worth more than younger heifers at the end of the year. In order to put the comparisons on equal footing, we chose 24 months as the age to first calving to standardize the values.

The range of heifer prices was \$1,100 to \$1,500 at the actual age of first calving (which was greater than 24 months). This price reflected what the farm operators determined heifers were worth as they entered the milking herd. The standardized, 24 month old, average heifer was valued at \$1,048. The costs of production are divided into variable and fixed costs. The largest costs of raising heifers are the same as for the milking herd—feed and labor (Table 3). The feed costs averaged \$24.27 per heifer month (remember, these are across all ages of heifers) while labor averaged \$10.40 per heifer month. "Calf purchases" includes purchasing the heifer calves from that farm's milk cow herd while "outside heifer purchases" are heifers purchased from other operations. The "other" category includes various expenses such as repairs and utilities. The remaining expense categories are straightforward with total average variable cost equal to \$51.12 per heifer month. Fixed costs include depreciation on facilities, equipment,

interest, insurance, taxes, and a charge for management. The fixed expenses averaged \$12.49/heifer month for a total average cost of \$63.61 per heifer month. Assuming a 24-month age to first calving, the average cost to raise a heifer for these farms is about \$1,526. Note that this age assumption is perhaps a bold one because the age varied both within and across farms but was necessary for comparison across farms.

The minimum and maximum columns in Table 3 are across all six farms for that cost category. That is, the lowest average total cost to raise a heifer was \$57.50 per heifer month while the maximum cost was \$72.57 per heifer month (these totals are not equal to the sum of each cost category which are themselves minimums or maximums). Those farms that had lower costs in some categories (e.g., labor) often were higher in other cost categories (e.g., equipment). Even with the range in farm size and location, the farms examined were remarkably consistent in almost every cost category. The net average loss per heifer across these farms was \$19.96 per heifer month or about \$480 per heifer. This reflects the difference between what the producers felt the heifer was worth as a springing heifer and what it cost to raise the heifer to 24 months.

Table 3. Replacement Heifer Enterprise Costs (6 farms, \$ per heifer month)

| | Average | Minimum | Maximum | |
|--------------------------------|------------------|------------------|-----------------|-----------------------------|
| Production Factors | | | | |
| Heifer months | 1,545.5 | 449 | 2,400 | |
| Number Heifer Equivalent | 64.40 | 18.71 | 100.00 | |
| Hours Labor/Heifer Month | 1.03 | 0.55 | 1.56 | |
| Income | | | | |
| Heifer sales | \$42.96 | \$32.65 | \$50.72 | %Total Rev. 98.42 |
| Manure | \$0.69 | \$0.24 | \$0.86 | 1.58 |
| TOTAL INCOME | \$43.65 | \$33.19 | \$50.96 | 100.00 |
| Variable Costs | | | | |
| | | | | % of Total Cost |
| Labor | \$10.40 | \$6.03 | \$15.02 | 16.35 |
| Feed | \$24.27 | \$20.19 | \$30.44 | 38.15 |
| Calf Cost | \$6.90 | \$3.34 | \$10.15 | 10.84 |
| Supplies & Bedding | \$1.90 | \$0.97 | \$2.56 | 2.99 |
| Misc. Dairy | \$0.21 | \$0.00 | \$0.70 | 0.32 |
| Breeding | \$0.81 | \$0.40 | \$2.08 | 1.27 |
| Vet and Med | \$1.08 | \$0.51 | \$1.86 | 1.70 |
| Equipment | \$2.16 | \$1.19 | \$3.13 | 3.40 |
| Building & Improvements | \$1.62 | \$0.17 | \$3.84 | 2.54 |
| Utilities | \$1.64 | \$0.79 | \$2.99 | 2.57 |
| Other | \$0.14 | \$0.00 | \$0.31 | 0.22 |
| TOTAL VARIABLE COST | \$51.12 | \$41.91 | \$56.52 | 80.37 |
| Net Over Variable Costs | (\$7.47) | (\$23.33) | \$9.02 | -11.75 |
| Fixed Costs | | | | |
| Equip | \$2.20 | \$0.71 | \$4.14 | 3.46 |
| Interest & Insurance | \$4.66 | \$3.18 | \$5.51 | 7.33 |
| Building & Improvements | \$3.29 | \$0.28 | \$7.69 | 5.17 |
| Management Fee | \$0.88 | \$0.66 | \$1.08 | 1.39 |
| General Overhead | \$1.46 | \$0.60 | \$2.40 | 2.30 |
| TOTAL FIXED COST | \$12.49 | \$7.60 | \$16.36 | 19.63 |
| TOTAL COST | \$63.61 | \$57.50 | \$72.57 | 100.00 |
| NET RETURN | (\$19.96) | (\$39.39) | (\$7.34) | |

The crop enterprises were also examined. Corn was an enterprise on all eight farms that were examined in 1998. However, one farm had a large, weather-related crop failure. Because the costs were extra-ordinarily high for the small harvest from this farm, the records reflecting the crop loss were omitted from both the corn and corn silage cost of production estimated.

The average price of corn at harvest in 1998 was \$1.72 per bushel (Table 4). While it was possible to store corn and receive a higher price, less storage and marketing costs, the corn enterprise was paid the harvest price and sold immediately to the storage and marketing account which, in turn, sold it to the cows or to the outside market. Government payments were not reflected in the corn enterprise. The average harvest was 125 bushels per acre. The average amount of labor used on the corn crop was 2.29 hours per hundred bushel (a little less than an acre).

The single largest cost of producing corn was the land cost (18.3 percent) followed by fertilizer cost (17.2 percent). Variable costs totaled \$2.32 per bushel on average. Not a single farm covered variable cost of corn production (without government payments considered). The average loss was \$0.60 per bushel above variable costs.

Total cost of corn production averaged \$2.90 per bushel, with \$0.58 per bushel from fixed costs (Table 4). The average loss was \$1.18 per bushel with the smallest loss \$0.74 and the largest \$2.20 on a per bushel basis. Some farms had a large amount of costs from the machinery variable cost and equipment fixed cost (including depreciation). In these cases, the farms seemed to be over-capitalized in the corn enterprise.

Table 4. Corn Grain Enterprise Costs and Returns (7 farms, \$ per bushel)

| | Average | Minimum | Maximum | |
|-------------------------------|-----------------|-----------------|-----------------|---------------------|
| Production Factors | | | | |
| Acres | 210 | 32 | 566 | |
| Bushels per Acre | 125 | 109 | 139 | |
| Labor Hours (per 100 bu) | 2.29 | 1.11 | 4.42 | |
| Income | \$1.72 | \$1.69 | \$1.77 | |
| Variable Costs | | | | |
| | | | | % Total Cost |
| Labor | \$0.26 | \$0.15 | \$0.46 | 9.0 |
| Seeds | \$0.17 | \$0.10 | \$0.26 | 5.9 |
| Fertilizer | \$0.50 | \$0.29 | \$0.83 | 17.2 |
| Chemicals | \$0.25 | \$0.11 | \$0.37 | 8.6 |
| Machinery | \$0.29 | \$0.15 | \$0.44 | 9.8 |
| Custom Hire | \$0.09 | \$0.00 | \$0.24 | 3.0 |
| Land Cost | \$0.53 | \$0.32 | \$0.83 | 18.3 |
| Utilities | \$0.13 | \$0.01 | \$0.35 | 4.3 |
| Interest | \$0.10 | \$0.08 | \$0.14 | 3.6 |
| Other | \$0.00 | \$0.00 | \$0.03 | 0.2 |
| TOTAL VARIABLE COST | \$2.32 | \$1.89 | \$2.98 | 80.0 |
| Net Over Variable Cost | (\$0.60) | (\$1.28) | (\$0.12) | |
| Fixed Costs | | | | |
| Equipment | \$0.42 | \$0.14 | \$0.80 | 14.4 |
| Management Fee | \$0.07 | \$0.07 | \$0.07 | 2.4 |
| Overhead | \$0.10 | \$0.03 | \$0.16 | 3.3 |
| TOTAL FIXED COST | \$0.58 | \$0.36 | \$0.93 | 20.0 |
| TOTAL COST | \$2.90 | \$2.46 | \$3.89 | 100.0 |
| NET RETURN | (\$1.18) | (\$2.20) | (\$0.74) | |

Corn silage was also examined (Table 5). The average corn silage yield was 15.7 tons per acre. Because a transparent market is not readily available for corn silage, a price was engineered using the prices of energy (corn), protein (soybean meal) and fiber (straw)—the three main nutrients supplied by corn silage. The result was an average of \$24.93 per ton and a range from \$20.81 to \$26.23. These values are in line with anecdotal evidence which suggested a price in the \$25 range.

The relative size of the costs was, not surprisingly, in line with the corn enterprise. The total variable costs averaged \$21.81 per ton for an average return above variable costs of \$3.12 per ton (Table 5). When fixed costs were included, the total cost averaged \$30.66 per ton for an average loss of \$5.73 per ton. However, in contrast to the corn enterprise, there was a farm that returned a positive value for silage; although the most profitable from was only \$0.86 per ton in the black. The largest loss was \$12.05 per ton.

The hay enterprise included both dry hay and haylage and the summary values are expressed for dry hay equivalents (Table 6). The average hay price for 1998 was \$97.52 per ton of dry hay. Variable costs averaged \$62.55 per ton. All seven farms examined had a positive return over variable costs while one farm could not cover variable costs. The average return above variable cost was \$35.02 per ton. With all costs totaled, the average cost was \$93.68 per dry ton for an average return of \$3.89 per ton. Five of the seven farms had profitable hay enterprises (with the most profitable clearing \$20.51 per ton). On the whole, the hay enterprise was much more profitable than corn for these Michigan dairy farms in 1998.

Table 5. Corn Silage Enterprise Costs and Returns (7 farms, \$ per ton)

| | Average | Minimum | Maximum | |
|-------------------------------|-----------------|------------------|----------------|---------------------|
| Production Factors | | | | |
| Acres | 145 | 36 | 328 | |
| Tons per Acre | 15.7 | 11.1 | 18.2 | |
| Labor Hours per Ton | 0.26 | 0.07 | 0.49 | |
| Income | \$24.93 | \$20.81 | \$26.23 | |
| Variable Costs | | | | |
| | | | | % Total Cost |
| Labor | \$2.93 | \$0.89 | \$5.15 | 9.6 |
| Seeds | \$1.36 | \$0.95 | \$1.93 | 4.4 |
| Fertilizer | \$4.10 | \$2.85 | \$6.59 | 13.4 |
| Chemicals | \$1.96 | \$1.03 | \$2.77 | 6.4 |
| Machinery | \$4.20 | \$2.24 | \$7.12 | 13.7 |
| Custom Hire | \$1.75 | \$0.00 | \$3.69 | 5.7 |
| Land Cost | \$4.25 | \$1.95 | \$5.71 | 13.9 |
| Utilities | \$0.25 | \$0.10 | \$0.51 | 0.8 |
| Interest | \$0.97 | \$0.79 | \$1.24 | 3.2 |
| Other | \$0.04 | \$0.00 | \$0.24 | 0.1 |
| TOTAL VARIABLE COST | \$21.81 | \$19.39 | \$29.43 | 71.1 |
| Net Over Variable Cost | \$3.12 | (\$4.07) | \$6.65 | |
| Fixed Costs | | | | |
| Equipment | \$6.44 | \$2.37 | \$8.79 | 21.0 |
| Management Fee | \$1.00 | \$0.83 | \$1.05 | 3.3 |
| Overhead | \$1.41 | \$0.47 | \$2.22 | 4.6 |
| TOTAL FIXED COST | \$8.85 | \$4.92 | \$11.49 | 28.9 |
| TOTAL COST | \$30.66 | \$25.37 | \$37.41 | 100.0 |
| NET RETURN | (\$5.73) | (\$12.05) | \$0.86 | |

Table 6. Hay Enterprise Costs and Returns (7 farms, \$ per ton)

| | Average | Minimum | Maximum | |
|--------------------------------|----------------|------------------|-----------------|---------------------|
| Production Factors | | | | |
| Acres | 189 | 48 | 251 | |
| Tons / Acre (Dry Equiv) | 3.9 | 2.6 | 5.0 | |
| Labor Hours per Ton | 1.2 | 0.5 | 2.3 | |
| Income | \$97.57 | \$87.12 | \$106.27 | |
| Variable Costs | | | | |
| | | | | % Total Cost |
| Labor | \$14.25 | \$6.22 | \$22.54 | 15.2 |
| Seeds | \$4.06 | \$0.24 | \$6.66 | 4.3 |
| Fertilizer | \$6.79 | \$3.56 | \$10.06 | 7.2 |
| Chemicals | \$1.23 | \$0.00 | \$3.92 | 1.3 |
| Supplies | \$1.07 | \$0.00 | \$6.88 | 1.1 |
| Machinery | \$11.95 | \$4.02 | \$15.46 | 12.8 |
| Custom Hire | \$3.19 | \$0.00 | \$13.91 | 3.4 |
| Land Cost | \$16.27 | \$11.21 | \$20.00 | 17.4 |
| Utilities | \$0.91 | \$0.38 | \$2.88 | 1.0 |
| Interest | \$2.76 | \$2.45 | \$3.37 | 2.9 |
| Other | \$0.07 | \$0.00 | \$0.46 | 0.1 |
| TOTAL VARIABLE COSTS | \$62.55 | \$55.80 | \$68.81 | 66.8 |
| Net Over Variable Costs | \$35.02 | \$26.94 | \$48.15 | |
| Fixed Costs | | | | |
| Equipment | \$20.77 | \$10.62 | \$32.93 | 22.2 |
| Interest | \$1.33 | \$0.63 | \$1.95 | 1.4 |
| Management Fee | \$3.90 | \$3.48 | \$4.25 | 4.2 |
| Overhead | \$5.13 | \$1.74 | \$8.79 | 5.5 |
| TOTAL FIXED COST | \$31.13 | \$25.17 | \$45.48 | 33.2 |
| TOTAL COST | \$93.68 | \$81.52 | \$106.79 | 100.0 |
| NET RETURN | \$3.89 | (\$18.55) | \$20.51 | |

One final efficiency measure examined was allocation of managerial time across enterprises. These farms could have more than one manager which included partners and spouses. The number of managers ranged from one to four with the participants determining who was a part of the managerial team. On average the managers spent about half of their time on tasks related to the milking herd (Table 7). This average included a low of 28 percent and a high of almost 85 percent. Overhead, which might be called general farm tasks, and the residual "other" (e.g., machinery repair) category are the next largest average uses of managerial time. Heifers took up an average of 8.3 percent of the managerial time. Crops took up smaller amounts of time for most managers.

Table 7. Allocation of Managerial Time (percent)

| | Average | Minimum | Maximum |
|--------------|----------------|----------------|----------------|
| Milking herd | 49.6 | 28.3 | 84.6 |
| Heifers | 8.3 | 3.1 | 11.0 |
| Corn | 4.1 | 0 | 9.2 |
| Corn Silage | 5.2 | 1.2 | 10.2 |
| Hay | 8.2 | 2.6 | 12.9 |
| Other Crops | 2.0 | 0 | 6.2 |
| Overhead | 10.2 | 0 | 22.9 |
| Other | 12.5 | 0.1 | 23.3 |
| TOTAL | 100.0 | | |

IV. Conclusions

The Dairy Profitability and Production Efficiency Project at Michigan State University completed the first year of data collection for calendar year 1998. This paper presents the results and analysis of the eight farms that completed 1998. Among the major findings were that the average cost of production was almost exactly equal to the average milk herd revenue on a per hundredweight basis. All eight farms covered variable costs of producing milk. Five of the eight farms showed a profit when all costs of production were included.

All six farms that raised their own replacement heifers lost money on the enterprise. The fact that the farms lost money may reflect a general under-valuing of their own heifers. It may also reflect the opportunity to utilize a custom heifer raiser and improve profitability. The remaining two farms used a custom heifer raiser for at least some heifers.

With respect to crop production, corn and corn silage were not profitable enterprises. None of the farms examined could cover variable expenses of growing corn for grain. The hay enterprise was profitable for five of the farms.