

## **A Ten Year Economic Look at Wisconsin Dairy Systems**

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### **Introduction**

For more than a decade, concern has been expressed about the shrinking of the Wisconsin milk production capacity on three fronts: cow numbers, farm numbers and total milk production. This trend is especially troubling because the U.S. demand for milk and milk products has been increasing. Therefore Wisconsin is supplying a decreasing share of a growing market.

The exact cause of this decrease is unknown but it may be related to our relatively old facilities and high cost of production (low net income). In addition, the attitudes and wants of some farm managers and their families have changed. Today they want a family income closer to those of their urban cousins and they want time away from the farm to spend with their families. To achieve this, some farm managers have greatly expanded their herds and completely changed the way their cows are milked and cared for while others have started grazing their herds.

Will these “new” systems reduce the cost of production and/or help farm managers meet some of their other goals compared to our traditional system? This paper will use ten years of data to look at these questions.

### **Dairy Farm System Definitions**

The following is a brief description of the three dairy systems studied.

- 1) Management Intensive Rotational Grazing (**MIRG**) operations in which an attempt is made to harvest up to half of the herds' forage needs via grazing.
- 2) The traditional confinement (**TC**) family sized farm (50 – 75 cows) with a stanchion barn, stored feed and mainly family labor.
- 3) The large modern confinement (**LMC**) dairy farm that uses a parlor for milking and free stalls to house cattle. Most LMC operations have recently expanded to 250 or more cows and rely heavily on hired labor and stored feed.

### **Data Source**

Lakeshore Farm Management Association, Fox Valley Management Association, Wisconsin Farm and Business Management Association, Wisconsin County Agents, Wisconsin Technical College System Instructors, and Center for Dairy profitability staff originally collected this data. They helped individual farm managers reconcile their financial data. Individual farm managers used a number of different manual and computerized record keeping systems to enter the initial financial records, including the Agricultural Accounting and Information Management System (AAIMS©) The computer program called Agricultural Financial Advisor (AgFA©) was used to analyze the data for this report.

### **Cost Calculation Method**

Dairy farms have numerous sources of income: milk, cull cows, calves, MILC payment, cooperative dividends, property tax credit on income taxes, crop-related government payments, etc. This large number of income sources makes using an equivalent income unit essential. In addition, on most dairy farms the cost of producing crops sold for cash cannot be separated from the cost of producing crops fed to the dairy herd. The farm's total income (including cash sales of crops and changes in the value of feed and cattle inventories) must be included when calculating equivalent units.

For this analysis, the equivalent unit used was **Hundredweight of Milk Sales Equivalent** (CWT EQ). The formula is:

$$\frac{\text{Total Farm Income from all Sources}}{\text{U.S. All Milk Price per Hundredweight (for the year in question)}}$$

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## Background

A better understanding of the results presented in this paper may require some additional background definitions and information. Tables 1, 2 and 3 and the intervening paragraphs attempt to provide that.

**Total income** includes all sources of income including non-cash. Typical sources of non-cash income are changes in stored raised crops inventory, changes in raised breeding livestock numbers and changes in raised market livestock. These changes can be either positive or negative.

**Total cost** includes all possible costs including the opportunity cost of unpaid labor, management and capital supplied by the owner(s). It is difficult to be fair in estimating opportunity costs when comparing different systems. Therefore total costs won't be shown here.

**Allocated cost** equals total cost minus the opportunity cost of unpaid labor, management and capital supplied by the owner(s).

**Net Farm Income from Operations (NFIFO)** is total income minus allocated costs. NFIFO can be smaller, larger or equal to the combined opportunity cost of unpaid labor, management and capital supplied by the owning family. Since everyone does not consciously calculate opportunity cost, non-economists often use allocated cost as a default proxy for total cost.

**Basic costs** are all the cash and non-cash costs except the opportunity costs, interest, depreciation, paid labor, and paid management. Livestock depreciation is included as a basic cost to reflect the depreciation costs associated with differing cull rates between systems. It is included with basic costs, because like all other basic cost items, it is greatly influenced by daily management decisions.

**Basic cost** is a useful measure for comparing one farm to another that differs by:

- the amount of paid versus unpaid labor
- the amount of paid versus unpaid management
- the amount of debt
- the investment level
- the capital consumption claimed (depreciation)

Basic cost is very similar to the cost of goods concept that is commonly used by many non-farm businesses. Since basic cost primarily includes variable expenses (those most affected by short run decisions), it comes close to determining the minimum amount of income needed per unit of production to continue producing in the short run.

Table 1 shows that in 2004, the MIRG group had a \$-1.36 (8.54-9.90) advantage in basic cost/CWT EQ over the LMC group and a \$-0.65 (8.54-9.19) advantage over the TC group. In 1997, the MIRG group had a \$-1.16 (7.28-8.44) advantage in basic cost/CWT EQ over the LMC group and a \$-0.54 (7.28-7.82) advantage over the TC group. The only exception to this pattern occurred in 2003 when the TC group had a lower basic cost per CWT EQ than graziers.

Table 1  
Dollars of Basic Cost (including Livestock Depreciation)/CWT EQ

Year	MIRG	TC	LMC
2004	8.54	9.19	9.90
2003	7.50	7.27	8.08
2002	7.48	7.69	8.18
2001	7.68	8.66	9.36
2000	6.60	7.31	8.13
1999	7.13	7.66	8.50
1998	7.83	7.84	8.43
1997	7.28	7.82	8.44
1996	7.86	***	***
1995	6.49	***	***

\*\*\* Data for confinement farms was not fully sorted into the groups listed above until 1996 and by labor compensation type until 1997. The basic cost per CWT EQ for the average Wisconsin confinement farm in 1995 and 1996 was \$7.41 and \$8.55 respectively.

**Non-basic costs** are interest, (non-livestock) depreciation, paid labor and paid management. Basic cost plus non-basic costs equal allocated costs.

Table 2 shows that in 2004, the MIRG group had a \$-0.59 (3.12-3.81) advantage over the LMC group and a \$-1.16 (2.39-3.55) advantage over the TC group. In 1997, the MIRG group had a \$-1.70 (2.70-4.40) advantage over the LMC group and a \$-1.09 (2.70-3.79) advantage over the TC group. The only exception to this pattern occurred in 1999 and 2002 when the LMC group had a slightly lower non-basic cost/CWT EQ than the TC group.

Table 2  
Non-Basic Cost/CWT EQ  
(Interest Non-livestock Depreciation, Paid Labor and Management)

Year	MIRG	TC	LMC
2004	3.12	3.32	3.81
2003	2.62	2.88	3.48
2002	2.39	3.55	3.50
2001	2.78	3.67	3.73
2000	2.59	3.34	3.69
1999	2.68	3.74	3.71
1998	2.35	4.06	4.62
1997	2.70	3.79	4.40
1996	2.98	***	***
1995	2.50	***	***

\*\*\* Data for confinement farms was not fully sorted into the two size groups listed above until 1996 and by labor compensation type until 1997. The non-basic cost/CWT EQ average for Wisconsin confinement farms in 1996 and 1995 was \$4.21 and \$3.55 respectively.

Table 3 shows the lbs of milk sold per average cow in each system each year. Table 3 shows the following ranking of lbs of milk sold per average cow from highest to lowest; LMC, TC, and MIRG. Production per cow appears to be increasing slightly over time for the groups. Milk sold per cow bounced up and down in a narrow range for the MIRG group.

Table 3  
Pounds of Milk Sold per Cow per Year

Year	MIRG	TC	LMC
2004	16,526	19,962	22,699
2003	15,726	19,881	23,268
2002	15,644*	19,490	22,403
2001	15,644*	19,383	22,335
2000	16,306	19,773	21,796
1999	15,481	19,590	21,693
1998	16,231	19,243	22,038
1997	16,200	18,549	20,377
1996	15,769	***	***
1995	17,043	***	***

\*\*\* Data for confinement farms was not fully sorted into the two size groups listed above until 1996 and by labor compensation type until 1997. The lbs of milk sold per cow for the average Wisconsin confinement farm in 1995 and 1996 were 18,463 and 18,493 respectively.

\* By coincidence MIRG lbs of milk sold per cow was the same in 2001 and 2002.

## Results

The cost per hundredweight of milk equivalent sold (CWT EQ) method was used to compare the economic competitiveness of the three milk production systems. Of course, other measures of economic performance plus non-economic concerns and objectives are valid and useful too.

Note: When the Cost of Production (COP) is calculated using the CWT EQ method, the group that has the lowest total allocated COP per CWT EQ also has the highest Net Farm Income from Operations (NFIFO) per CWT EQ. NFIFO, as defined by the Farm Financial Standards Council (FFSC), is the return to the unpaid labor and management plus a return to the owner's equity capital. Total allocated costs include all costs except opportunity costs.

Table 4 shows the NFIFO per CWT EQ for the MIRG, TC, and LMC Wisconsin dairy farm systems from 1995 through 2004. In 2004, the MIRG group had a \$2.05 (4.44 – 2.39) NFIFO per CWT EQ advantage

over the LMC group and a \$0.85 (4.44 – 3.59) advantage over the TC group. In 1997, the advantage for the MIRG group was \$2.60 (3.55 – 0.95) over the LMC group and \$1.56 (3.55 – 1.99) over the TC group.

Table 4 also shows the multi-year simple average NFIFO per CWT EQ. Using simple averages during the multiple year comparison periods, the advantage for the MIRG group was \$2.31 (3.85 – 1.54) over the LMC group and \$1.31 (3.85 – 2.54) over the TC group.

This advantage has to be examined carefully because some costs are excluded using the FFSC method of calculating NFIFO. This method excludes the opportunity cost of owner and family labor and management and includes paid labor and management. Since many LMC operations are farm corporations, they not only hire a majority of their labor but also pay a wage to most of the family members that work in the farm business. Tables 5 and 6 address this issue.

In addition, Table 4 shows the range in the number of farms observed in each system and the range in average herd size for each system during the eight-year period. The average herd size in the LMC group ranged from 443 to 519 over the ten-year period. The average herd size in the MIRG group ranged from 50 to 71 over the ten-year period. The number of observations in the MIRG group (19 to 43) is less than the number of observations in the TC group (180 to 216) and the LMC group (34 to 80). However these results are consistent with grazing data from other states in the northeast quarter of the country.<sup>2</sup>

Table 4  
Net Farm Income from Operations (NFIFO) per Hundredweight Equivalent of Milk Sold (CWT EQ)  
Under Different Wisconsin Dairy Systems  
(US Dollars)

Year	MIRG	TC	LMC
2004	4.44	3.59	2.39
2003	2.38	2.35	0.94
2002	2.53	0.91	0.47
2001	4.48	2.61	1.85
2000	3.20	1.68	.51
1999	4.56	2.97	2.16
1998	5.45	3.51	2.36
1997	3.55	1.99	.95
1996	4.13	3.07	2.20
1995	3.81	***	***
Multiple Year Simple Average NFIFO/CWT EQ	3.85	2.54	1.54
Range in Numbers of Observations <sup>2</sup>	19-43	180-216	34-80
Range in Average # of Cows/Herd/Year	50-71	62-63	443-519

\*\*\* Data for confinement farms was not fully sorted into the groups listed above until 1996. The NFIFO per CWT EQ for the average Wisconsin confinement farm in 1995 was \$1.90.

There are three types of labor and management on the farms in this study. They are: unpaid or opportunity cost of labor and management (those costs were excluded when NFIFO was calculated for Table 4), wages for labor and management paid to dependents (these costs as well as the unpaid labor and management costs were excluded when NFIFO was calculated for Table 5) and non-dependent paid labor and management. Table 6 excludes all three types of labor and management.

On some smaller TC and MIRG farms none of the labor or management is paid. On some LMC farms all the labor and management is paid. Therefore using the Farm Financial Standards Council method of calculating NFIFO provides an advantage to the smaller TC and MIRG farms in the calculation of NFIFO. One way to reduce that advantage is to calculate a “NFIFO plus all paid labor and management” value. In other words,

<sup>2</sup> Knoblauch, Wayne A., Linda D. Putnam, Jason Karszes. 2004. “Dairy Farm Management: Business Summary, New York State, 2003.” Cornell University, College of Agriculture and Life Sciences. December.

make a calculation of NFIFO assuming ALL labor and management is unpaid. Table 6 makes such a calculation by excluding all three types of labor and management for costs.

Table 5 shows the average NFIFO per CWT EQ for each system for each year if wages and benefits paid to dependents of the owner(s) were not included as a cost. This table was constructed because dependents (spouse and children) are not paid a competitive wage in all farm businesses. Consequently the calculations in Table 4 favor the farm businesses that pay the least competitive wage or no wage at all to dependents. Therefore, not including wages and benefits paid to dependents starts to make the comparison of NFIFO per CWT EQ more impartial.

Table 5 shows that in 2004, the MIRG group had a \$1.98 (4.49 – 2.51) NFIFO per CWT EQ advantage over the LMC group and a \$0.10 (4.49 – 4.39) advantage over the TC group. In 1997, the advantage for the MIRG group was \$2.36 (3.55 – 1.19) over the LMC group and \$0.84 (3.55 – 2.71) over the TC group.

This narrows the MIRG group's advantage over the LMC group somewhat (from \$2.31 to \$1.98 in 2004 and from \$2.60 to \$2.36 in 1997) but not substantially. It narrowed the MIRG advantage over the TC group from \$0.85 to \$0.10 in 2004 and from \$1.56 to \$0.84 in 1997

Table 5  
NFIFO per CWT EQ If Dependent Labor Compensation Were Unpaid  
(Otherwise Same Data as Table 4)

Year	MIRG	TC	LMC
2004	4.49	4.39	2.51
2003	2.42	3.04	0.99
2002	2.63	1.73	0.56
2001	4.63	3.95	2.05
2000	3.24	2.49	0.69
1999	4.56	3.77	2.42
1998	5.45	4.25	2.56
1997	3.55	2.71	1.19
1996	4.13	***	***
1995	3.81	***	***

\*\*\* Data for confinement farms was not fully sorted into the two size groups listed above until 1996 and by labor compensation type until 1997.

Table 6 shows that in 2004, the MIRG group had a \$0.40 (4.95 – 4.55) NFIFO per CWT EQ advantage over the LMC group and a \$0.02 (4.95 – 4.93) advantage over the TC group. In 1997, the advantage for the MIRG group was \$1.58 (4.34 – 2.76) over the LMC group and \$1.26 (4.34 – 3.08) over the TC group.

Moving from table 4 to table 6, the MIRG group's advantage over the LMC group narrowed from \$2.31 to \$0.40 in 2004 and from \$2.60 to \$1.58 in 1997. The gap between the groups remains, but this comparison shows that the decision on which labor costs to exclude accounts for some of the differences between the groups. Note: We did not try to calculate net income if the unpaid or opportunity cost labor and management were included as a cost because selecting a method for determining the value of unpaid labor and management is controversial.

In nine of ten years the MIRG group still had the highest NFIFO/CWT EQ if all labor was unpaid. In 2003, the MIRG and TC groups traded positions. The LMC group remained on the bottom all ten years.

Table 6 also shows the MIRG group had a \$0.79(4.45-3.66) advantage over the TC group and a \$1.12(4.45-3.33) advantage over the LMC group in comparing the multiple year simple average NFIFO/CWT EQ for the dairy systems.

Table 6  
 NFIFO per CWT EQ If All Labor Compensation Were Unpaid  
 (Otherwise Same Data as Table 4)

Year	MIRG	TC	LMC
2004	4.95	4.93	4.55
2003	2.78	3.47	2.77
2002	3.14	2.12	2.34
2001	5.02	3.97	3.69
2000	3.49	2.89	2.27
1999	5.07	4.17	4.00
1998	6.03	4.61	4.28
1997	4.34	3.08	2.76
1996	5.04	***	***
1995	4.60	***	***
Multiple Year Simple Average NFIFO/CWT EQ	4.45	3.66	3.33

\*\*\* Data for confinement farms was not fully sorted into the two size groups listed above until 1996 and by labor compensation type until 1997. The NFIFO per CWT EQ for the average Wisconsin confinement farm was \$3.34 in 1996 and \$2.97 in 1995.

Based on Tables 4, 5 and 6 it may seem like LMC expansion will not solve any problems facing the Wisconsin industry. While expansion does not appear to solve the cost of production problems facing the Wisconsin dairy industry, it can, however, solve some of the problems facing individual farm managers. Many farm managers say they expand to address the two major problems commonly associated with operating a dairy farm. One of these problems is very little time away from the dairy. The second problem is limited money for family living.

In smaller dairies, most of the labor and management is embodied in the operator and the operator's family. Therefore, family vacations are nearly impossible and time to attend the children's school activities are at a premium. Larger farms (like the farms in the LMC group, but regardless of system) have a large pool of labor and management allowing the owner(s) to have time away from the dairy.

The second issue, additional money for family living, also appears to be addressed by LMC system. Table 7 shows the average total NFIFO for each system for each year. Table 7 is based on the values from Table 4 and shows that the LMC system provides 2 to 4 times the NFIFO per farm. **Readers need to understand that most of the farms in the MIRG and TC groups are owned and operated by one owner/operator family. Many of the LMC farms are owned and operated by more than one owner/operator family. At this point the data doesn't indicate the exact number of owner/operator families per LMC farm.**

Table 7 also shows that the MIRG farms provide more NFIFO per farm than the TC group of farms. This is somewhat misleading because TC farm managers pay more to their dependents than MIRG farm managers (see the discussion of Table 5 above). When we do not include wage payments to dependents in the NFIFO calculation, it becomes "the dollars available to the owner and owner's family for family living or savings." After doing this, the LMC system still has a clear advantage in NFIFO per farm, but the MIRG and TC systems are now nearly equal, with the MIRG having the advantage some years and the TC systems having the advantage in other years.

Table 7  
 Comparing the Net Farm Income from Operations between Different Dairy Systems

Year	MIRG	TC	LMC
2004	63,091	56,562	336,660
2003	30,655	41,774	133,200
2002	31,928	15,564	59,616
2001	52,446	36,921	209,361
2000	39,340	26,320	61,272
1999	62,110	45,698	261,651
1998	67,045	49,849	285,865
1997	41,780	28,297	109,831
1996	42,786	29,147	104,440
1995	41,104	***	***

\*\*\* Data for confinement farms was not fully sorted into the two size groups listed above until 1996 and by labor compensation type until 1997. The NFIFO for the average Wisconsin confinement farm in 1995 was \$32,496.

### **Conclusions**

It is not the intent of this paper to anoint one dairy system as the system of the future in the Wisconsin dairy industry. The intent is to highlight some key measures revealed by economic analysis, and to provide better decision-making information to farm families.

Tables 4, 5 and 6 show the following ranking of NFIFO per CWT EQ; (from highest to lowest) MIRG, TC, and LMC. In all years shown in the tables, the MIRG group was a lower cost producer than either confinement group. Also, the LMC group always had the lowest NFIFO per CWT EQ and was the high cost producer. Once in ten years (2003), the TC group would have had the highest NFIFO/CWT EQ if all labor were unpaid.

Table 7 shows NFIFO per farm in the LMC group is 2 to 5 times the NFIFO per farm in the MIRG and TC groups. However, it is likely that most of the farms in the MIRG and TC groups are owned and operated by one owner/operator family. Whereas, many of the LMC farms are owned and operated by more than one owner/operator family. In the past, we have not collected the number of owner/operator families per farm because of the difficulty of defining an "owner/operator family". We are attempting to agree on a definition and collect that data in the future.

### **References**

- Vanderlin, Jenny, Gary Frank. "Milk Production Costs in 2004 on Selected Wisconsin Dairy Farms." University of Wisconsin-Madison, Center for Dairy Profitability, August 2004 and others at [cdp.wisc.edu](http://cdp.wisc.edu).
- Knoblauch, Wayne A., Linda D. Putnam, Jason Karszes. 2004. "Dairy Farm Management: Business Summary, New York State, 2003." Cornell University, College of Agriculture and Life Sciences. October.
- Kriegel, Tom, Jim Endress, Larry Tranel, Robert Tigner, Ed Heckman, Bill Bivens, Phil Taylor, Chris Wolf Margot Rudstrom, Tony Rickard, Jim Grace, Thomas Noyes, Clif Little, Jack Kyle, John Molenhuis, J. Craig Williams, and Gary Frank. 2005. "Dairy Grazing Farms Financial Summary: Regional/Multi-State Interpretation of Small Farm Data, Fourth Year Report, 2005." Great Lakes Grazing Network. April.