# Managing the Milking Parlor on Economic Consideration of Profitability

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As today's dairy industry consolidates, cows are being milked more rapidly through larger milking parlors on larger dairies than ever before. Because milk is the primary commodity and source of income for producers, the harvesting of milk is the single most important job on any dairy. Producing high-quality milk to maximize yields and economic value requires effective parlor management, an enormous challenge for producers. Managing large parlors includes managing labor, milking equipment, as well as monitoring and evaluating parlor performance. Decisions concerning the milking center are some of the most complicated decisions a dairy producer has to make. Milking procedures, herd size, milking interval, the milk market, and the equity position of a producer influence these decisions. Producers will have to make the following decisions before they can select or develop management protocols for a milking parlor:

1. How many cows will be milked through the parlor?
2. What milking procedure will be used (minimal or full)?
3. If a full milking routine; how much contact time do you want (strips per teat)?
4. Which milking routine will be used (sequential, grouping, or territorial)?
5. Are you willing to train teams of milkers to operate large parlors?

This paper will discuss the factors to consider when developing, selecting, and implementing a milking procedure and/or routine. An economic analysis has been performed to evaluate the impact of pre-milking hygiene.

## Options for Milking Procedures and Routines in Parallel and Herringbone Parlors

Typical milking parlor terms:

Prep time–time taken to manually clean and dry the teat surface.

Contact time–time spent manipulating/touching teats and is the source of stimulation for oxytocin release.

Prep-lag time-time between the beginning of teat preparation to the application of the milking machine.

Milking procedures–the individual events (i.e., strip, pre-dip, wipe, attach) required to milk a single cow.

Milking routines–define how an individual milker or a group of milkers carry out a given milking procedure (minimal or full) over multiple cows. In parallel and herringbone parlors, there are three predominant milking routines (grouping, sequential, and territorial).

Grouping Milking Routine–In a grouping routine, the operator performs all the individual tasks of the milking procedure on 4-5 cows. Once a group of cows has been completed the operator moves to the next group of available cows.

Sequential Milking Routine–Operators using a sequential routine split up the individual tasks of the milking procedure between operators and work as a team. Operators work as a team following each other performing their individual tasks.

Territorial Milking Routine–Milkers are assigned units on both sides of the parlor and only operate the units assigned to them. When a territorial routine is used milkers are not dependent on other milkers to perform specific tasks.

The two predominant milking procedures are minimal (strip or wipe and attach) and full (pre-dip, strip, wipe and attach). However, some producers choose to use a full routine without stripping cows. Milking procedures impact the number of cows per stall per hour in parallel, herringbone and rotary parlors. In large parallel and herringbone parlors, cows per stall per hour were 5.2 when minimal milking procedures were used and 4.4 when full milking procedures were used. Cows per stall per hour declined from 5.8 to 5.3 when a minimal routine was used compared to a full routine in rotary parlors (Armstrong et al. 2001). In large parlors, milking procedures have a dramatic impact on the number of units one operator can handle in parallel and herringbone parlors. In 1997, Smith et al. published guidelines for the number of units that one operator could handle using a minimal and a full milking procedure. When a full milking procedure was used, a milker could operate 10 units per side compared to 17 units per side when using minimal milking procedures. These recommendations were based on allowing 4-6 seconds to strip a cow and attaching all the units on one side of the parlor within 4 minutes.

In recent years, several milking management specialists have been recommending 2-3 squirts per teat (8-10 seconds) when stripping cows to increase stimulation and promote better milk letdown. Some of these management specialists believe that increasing the amount of stimulation reduces unit on times. At this time, data supporting this theory does not exist. An AABP research update reported by Rapnicki, Stewart, and Johnson (2002) indicated that milk flow rate decreased when cows that had

been previously stripped were no longer stripped. If this is implemented, producers will have to reduce the number of units one operator can manage per side (Table 1). The sequencing of the individual events of the milking procedure is critical. A study published in the Journal of Dairy Science by Wagner and Ruegg (2002) indicated there were no significant differences in milk yield, milk unit attachment time, or milk flow for cows that were forestripped as compared to cows that were not forestripped. There does not appear to be published data that concludes that when forestripping is included in the pre-milking hygiene that milking performance will be improved. Rasmussen et al. (1992) reported an ideal prep-lag time of one minute and 18 seconds. Prep-lag times of 1-1.5 minutes are generally accepted as optimal for all stages of lactation. Some of the advantages and disadvantages of minimal and full milking procedures are listed in Tables 2 and 3.

Table 1. Time (seconds) required for individual events of the milking procedure.

| | Procedure | | |
|---|---|---|---|
| Event | Minimal* | Full | Full with 10 sec Contact Times |
| Strip | 4-6 | 4-6 | 10 |
| Pre-dip | | 6-8 | 6-8 |
| Wipe | 6-8 | 6-8 | 6-8 |
| Attach | 8-10 | 8-10 | 8-10 |
| Total | 12-18 seconds | 24-32 seconds | 30-36 seconds |

*Strip or wipe and attach

Table 2. Advantages and disadvantages of a minimal milking routine.

| |
|---|
| Compromises teat skin sanitation |
| Successful when cows enter the milking parlor clean and dry |
| “Machine on-time” may be prolonged |
| Steady state throughput is increased. |
| Time required to milk the herd may be decreased (total milking time). |
| May require milkers to decide when extra cleaning of dirty teats is required |
| Can cause lower milk quality and higher mastitis when compared to “full hygiene” |

Table 3. Advantages and disadvantages of a full milking procedure.

| |
|---|
| Maximizes teat sanitation and milk letdown |
| Use four separate procedures or can combine into two or three procedures |
| Use when maximum milk quality results are the goal |
| Minimizes “machine on-time” |
| Results in lower cow throughput or higher labor cost compared to “minimal” or “none” |
| Requires milker training to maximize results |

Three predominant milking routines are used in parallel and herringbone parlors (sequential, grouping, and territorial). These milking routines are presented in Figure 1. The use of territorial routines will reduce throughput 20-30% when compared to sequential routines (Smith et al. 1997).

## Rotary Parlors

Entry time (seconds/stall), number of empty stalls, number of cows which go around a second time, entry and exit stops and the size of the parlor (number of stalls) influence the performance of rotary parlors. The entry time will determine the maximum number of cows that can be milked per hour. For example, if the entry time is 10 seconds, the maximum throughput will be 360 cows per hour (3600 seconds per hour + 10 seconds per stall = 360 cows per hour). This is referred to as theoretical throughput. Theoretical throughput assumes that the parlor never stops, cows are milked out in one rotation and a new cow occupies every stall at entry. In reality, there are empty stalls, cows that go around a second time and times when the rotary table is stopped. Table 4 shows rotary parlor performance at different percentages of theoretical throughput. As the number of empty stalls, cows making a second trip around, and number of stops increases, the percent of theoretical throughput is decreased.

Table 4. Rotary parlor performance (cows per hour).

| | % of theoretical cows/hr | | | | |
|---|---|---|---|---|---|
| Time (sec/stall) | 100% | 90% | 80% | 70% | 60% |
| 8 | 450 | 405 | 360 | 315 | 270 |
| 9 | 400 | 360 | 320 | 280 | 240 |
| 10 | 360 | 324 | 288 | 252 | 216 |
| 11 | 327 | 295 | 262 | 229 | 196 |
| 12 | 300 | 270 | 240 | 210 | 180 |
| 13 | 277 | 249 | 222 | 194 | 166 |
| 14 | 257 | 231 | 206 | 180 | 154 |
| 15 | 240 | 216 | 192 | 168 | 144 |
| 16 | 225 | 203 | 180 | 158 | 135 |

The number of stalls or size of the rotary parlor affects the available unit on time. Table 6 lists available unit on time for different sizes of rotary parlors at different rotation times. A rotary parlor must be large enough to allow approximately 90 percent of the cows to be milked out in one trip around the parlor.

## Impact of Automatic Take-offs

A study published by Stewart et al. (2002) would indicate that when automatic cluster remover settings were increased, average milking duration was reduced 10.2 to 15.6 seconds per cow. Higher automatic cluster remover settings did not have a negative impact on milk production per cow. Average milk flow per minute increased 0.11 to 0.42 lb/minute. Increasing automatic cluster remover settings represents an opportunity to increase parlor performance.

## Detecting Clinical Mastitis

Although often a challenge for large dairies, it is necessary to forestrip milk from teats to detect clinical mastitis. Some dairies have chosen to strip cows intermittently (once a week or as needed) with a herdsperson or lead milker. Others have chosen to forestrip two groups of cows per day, thus on a dairy with 10 pens, all cows would be forestripped at least once every five

days. If 0.5% of a herd has clinical mastitis, and each case last 5 days, then only 0.1% of the herd will be diagnosed each day. Which means, in a herd with 1,000 cows milked 3 times per day it would be necessary to forestrip 12,000 teats to detect one new case of mastitis (W. Nelson Philpot, Ph.D., professor emeritus Louisiana State University, and President of Philpot and Associates International, Inc.).

## Economic Analysis

Dairy producers wishing to expand or build new facilities will have to consider the pre-milking hygiene and the amount of time it takes when sizing the milking parlor. Table 5 demonstrates milking parlor performance when the time required for pre-milking hygiene is changed. Dairy budgets were generated for a dairy with a double-40 parallel with pre-milking hygiene times of 20, 30 and 40 seconds.

Table 5. Impact of the time required for pre-milking hygiene on milking parlor performance (double-40 parallel).

| Total number of stalls | 80 | 80 | 80 | 80 | 80 | 80 |
|---|---|---|---|---|---|---|
| Pre-milking hygiene, sec/cow | 15 | 20 | 25 | 30 | 35 | 40 |
| Number of operators | 4 | 4 | 4 | 4 | 4 | 4 |
| Milking Interval | 3X | 3X | 3X | 3X | 3X | 3X |
| Stalls/side | 40 | 40 | 40 | 40 | 40 | 40 |
| Hours of steady state throughput | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Unit on time (seconds) | 360 | 360 | 360 | 360 | 360 | 360 |
| Turn around time per side (seconds)[1] | 120 | 120 | 120 | 120 | 120 | 120 |
| Time to attach units/side (seconds) | 150 | 200 | 250 | 300 | 350 | 400 |
| Cows per stall hour | 5.7 | 5.3 | 4.9 | 4.6 | 4.3 | 4.1 |
| Cows per labor hour | 114 | 106 | 99 | 92 | 87 | 82 |
| Steady state throughput (cows/hour) | 457 | 424 | 395 | 369 | 347 | 327 |
| Total milking cows | 2971 | 2753 | 2564 | 2400 | 2255 | 2127 |

[1]Time required to post dip, and exit cows after milking.

## Assumptions Used in the Budget

Listed below are the assumptions used in these financial projections. It is important for individual dairy producers to study these assumptions and compare them to the respective values for their own operations.

Milk sales: based on the annual production per cow times milk price.
Milk Price: gross price of $13.00.
Milk hauling: $0.40/cwt.
Coop fees and promotion: $0.25/cwt.
Calves sold: based on a 92 percent calf crop and selling all calves (heifers and bulls) at birth.
Cull cows sold: assumes cull income is realized on 28 percent of the herd even though 34 percent of the herd is replaced annually. The 6 percent with no income represents cow death loss and cows with zero salvage value.
Feed: includes total feed for the dairy cow on an annual basis.

Labor: based on 100 cows per employee for 20 seconds, 95 cows per employee for 30 seconds and 90 cows per employee at 40 seconds at an average of $27,755 (salary + benefits) per person divided by the number of cows in the herd.
Veterinary, drugs and supplies: costs for prevention and treatment of disease and general dairy supplies.
Utilities and water: telephone, electricity, fuel and water costs allocated to the dairy enterprise.
Fuel, oil and auto expense: share of the farm car and trucks plus gasoline, diesel and oil for scraping and hauling manure and for hauling feed to the dairy herd.
Building and equipment repairs: annual building and equipment repairs allocated to dairy enterprise calculated as 2.5 percent of the total investment.
Replacements and breeding:
Capital replacement: price of a heifer replacement times the replacement rate.
Semen, A.I. services, and supplies: includes semen, artificial insemination services and supplies.
Interest: interest is charged on the value of the breeding herd, which is based on the cost of replacement heifers entering the herd.
Professional fees (legal accounting, etc.): business costs allocated to the dairy enterprise.
Miscellaneous: miscellaneous costs (subscriptions, education, etc.) allocated to the dairy enterprise.
Depreciation on buildings and equipment: depreciation is based on the total original cost less the salvage value of buildings and equipment on a per cow basis divided by the estimated life. The useful life is assumed to be 25 years for buildings and improvements and 10 years for equipment. A salvage value of 0 percent is assumed on buildings and improvements and 10 percent on equipment.
Interest on land, buildings and equipment: interest is charged on the land investment at a rate of 5.75 percent and one-half the average investment [(initial cost + salvage value) ÷ 2] for buildings and improvements and equipment at a rate of 7 percent.
Insurance and taxes on land, buildings and equipment: insurance on buildings and equipment is based on the original cost times 0.25 percent, taxes are based on 1.5 percent of the original cost for buildings and improvements and 0.50 percent for land.
Interest on operating costs: calculated on one-half of operating costs at a rate of 7 percent.

## Calculated Values

Breakeven milk price to cover total costs: represents the price needed for milk per cwt. to cover total costs of production. Assumes government payment, calf and cull income and all costs remain constant.
Asset turnover: (returns per cow divided by total assets) asset turnover is the percentage of total investment recovered by total returns. Inverting this measure allows different enterprises to be compared on the basis of capital required to generate a dollar of gross income.
Net return on assets: [(returns over total costs + interest on breeding herd + interest on operating costs + interest on land, buildings and equipment) + assets] net return on assets is the percentage return on investment capital (both borrowed and equity). This measure enables comparisons to be made between enterprises as well as other investment alternatives.

## Production Level

Costs per unit and net returns in a dairy enterprise are highly dependent on the level of milk production. Production levels vary for a number of reasons such as livestock genetics, weather, input levels, and management. Budgeting at multiple production levels can help producers examine the financial risk of a livestock enterprise that is directly related to production risk. Milk production levels of 21,000 and 24,000 pounds of milk sold per cow per year were used in these budgets. Projected budgets at the two production levels are presented on a cow and hundredweight (cwt) basis.

## Capital Requirements

Capital invested in dairy facilities varies greatly depending on herd size and degree of mechanization. The capital needed to establish new dairies designed for premilking hygiene times of 20, 30 and 40 seconds with modern equipment is estimated to be $8,291,964 for 20 seconds, $7,709,514 for 30 seconds and $7,259,064 for 40 seconds. An additional $5,285,760 for 20 seconds, $4,608,000 for 30 seconds and $4,083,840 for 40 seconds is invested in the cows. A partial breakdown of the investment assumptions used for the cost return projections is shown in

Table 6. Investment amounts are given as total for farm and per cow in the herd. Land, building and equipment investment.

| | Total for Dairy | | | Total per Cow | | |
|---|---|---|---|---|---|---|
| Premilking hygiene | 20 sec/cow | 30 sec/cow | 40 sec/cow | 20 sec/cow | 30 sec/cow | 40 sec/cow |
| Number of lactating cows | 2,753 | 2,400 | 2,127 | 0.83 | 0.83 | 0.83 |
| Land | $120,000 | $120,000 | $120,000 | $36 | $42 | $47 |
| Water rights | $60,000 | $60,000 | $60,000 | $18 | $21 | $24 |
| SUBTOTAL | $180,000 | $180,000 | $180,000 | $54 | $63 | $71 |
| | | | | | | |
| Buildings and Corrals | | | | | | |
| Milking parlor | $1,200,000 | $1,200,000 | $1,200,000 | $363 | $417 | $470 |
| Freestall barn | $3,303,600 | $2,880,000 | $2,552,400 | $1,000 | $1,000 | $1,000 |
| Corrals (dry cows) | $137,650 | $120,000 | $106,350 | $42 | $42 | $42 |
| Other | $0 | $0 | $0 | $0 | $0 | $0 |
| SUBTOTAL | $4,641,250 | $4,200,000 | $3,858,750 | $1,405 | $1,458 | $1,512 |
| | | | | | | |
| Other buildings[1] | $115,000 | $115,000 | $115,000 | $35 | $40 | $45 |
| Other facilities[2] | $1,624,514 | $1,624,514 | $1,624,514 | $492 | $564 | $636 |
| Site improvements[5] | $1,156,200 | $1,015,000 | $905,800 | $350 | $352 | $355 |
| SUBTOTAL | $2,895,714 | $2,754,514 | $2,645,314 | $877 | $956 | $1,036 |
| | | | | | | |
| Equipment and other | | | | | | |
| Cooling system | $115,000 | $115,000 | $115,000 | $35 | $40 | $45 |
| Rolling equipment | $460,000 | $460,000 | $460,000 | $139 | $160 | $180 |
| SUBTOTAL | $575,000 | $575,000 | $575,000 | $174 | $200 | $225 |
| TOTAL | $8,291,964 | $7,709,514 | $7,259,064 | $2,510 | $2,677 | $2,844 |

[1] Office/scale house and shop
[2] Commodity shed and bunkers
[5] Site leveling, excavation, manure storage system

## Feed Costs

Dairy cows require high quality forage and grain. Concentrates and grain requirements increase as milk production increases. Feed costs are based on market prices, thus, for dairy operations that produce some, or all, of their grain and forage requirements this allocates the cost of producing the feed to the dairy enterprise.

## Returns

Producers receive income primarily from the sale of milk. Additional income is received from the sale of calves and culled breeding stock. In this budget it is assumed that replacement heifers are purchased and thus all calves are sold. It is further assumed that roughly one-third (34 percent) of the cows are replaced each year due to culling and death loss. Cull income is assigned to 28 percent of the herd annually. The other 6 percent represents death loss and cows with no salvage value. Table 7 shows cost-return projections for alternative facility types on a per cow basis and Table 8 shows cost-return projections on a per cwt basis. Because milk sales make up the majority of income, returns are very sensitive to milk prices. Sensitivity analyses for milk production, milk price, and premilking hygiene are presented in Tables 9 and 10 and Figures 2, 3 and 4.

Table 7. Cost-return projection – Per cow basis (replacements purchased[1]).

| Premilking hygiene protocol =======> | 20 sec/cow | | 30 sec/cow | | 40 sec/cow | |
|---|---|---|---|---|---|---|
| Lactating cows ================> | 2,753 | | 2,400 | | 2,127 | |
| | Production level (lbs milk sold per cow per year) | | | | | |
| | 21,000 | 24,000 | 21,000 | 24,000 | 21,000 | 24,000 |
| RETURNS PER COW | | | | | | |
| 1. Milk sales @ $13.00/cwt. | $2,730.72 | $3,120.83 | $2,730.72 | $3,120.83 | $2,730.72 | $3,120.83 |
| 2. Credit for crop land | 1.17 | 1.17 | 1.34 | 1.34 | 1.52 | 1.52 |
| 3. Calves sold: 92% x $150/head | 138.00 | 138.00 | 138.00 | 138.00 | 138.00 | 138.00 |
| 4. Cull cows sold: 1,400 lbs x 28% x $45.00/cwt. | 176.40 | 176.40 | 176.40 | 176.40 | 176.40 | 176.40 |
| A. GROSS RETURNS | $3,046.30 | $3,436.40 | $3,046.47 | $3,436.57 | $3,046.64 | $3,436.74 |
| VARIABLE COSTS PER COW: | | | | | | |
| 5. Feed (from Table 3) | $1,167.15 | $1,319.27 | $1,167.15 | $1,319.27 | $1,167.15 | $1,319.27 |
| 6. Labor | 277.55 | 277.55 | 292.16 | 292.16 | 308.39 | 308.39 |
| 7. Veterinary and drugs | 20.00 | 25.00 | 20.00 | 25.00 | 20.00 | 25.00 |
| 8. Supplies | 120.00 | 130.00 | 120.00 | 130.00 | 120.00 | 130.00 |
| 9. Utilities and water | 109.41 | 120.08 | 109.41 | 120.08 | 109.41 | 120.08 |
| 10. Fuel, oil, and auto expense | 52.50 | 52.50 | 52.50 | 52.50 | 52.50 | 52.50 |
| 11. Milk hauling, coop, and promotion costs | 136.50 | 156.00 | 136.50 | 156.00 | 136.50 | 156.00 |
| 12. Building and equipment repairs | 50.20 | 50.20 | 53.54 | 53.54 | 56.88 | 56.88 |
| 13. Replacements and breeding charge: | | | | | | |
| a. Capital replacement: | 544.00 | 544.00 | 544.00 | 544.00 | 544.00 | 544.00 |
| b. Semen, A.I. services, and supplies | 40.00 | 45.00 | 40.00 | 45.00 | 40.00 | 45.00 |
| c. Interest | 112.00 | 112.00 | 112.00 | 112.00 | 112.00 | 112.00 |
| d. Insurance | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14. Professional fees (legal, accounting, etc.) | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 | 22.00 |
| 15. Miscellaneous | 20.00 | 25.00 | 20.00 | 25.00 | 20.00 | 25.00 |
| 16. Depreciation on buildings and equipment | 116.76 | 116.76 | 125.84 | 125.84 | 134.93 | 134.93 |
| 17. Interest on land, buildings, and equipment | 91.41 | 91.41 | 97.31 | 97.31 | 103.22 | 103.22 |
| 18. Insurance and taxes on land, buildings, and equip. | 40.63 | 40.63 | 43.03 | 43.03 | 45.43 | 45.43 |
| B. SUB TOTAL | $2,920.10 | $3,127.40 | $2,955.44 | $3,162.73 | $2,992.41 | $3,199.71 |
| 19. Interest on 1/2 operating costs @ 7.0% | 65.76 | 72.33 | 66.39 | 72.96 | 67.07 | 73.64 |
| C. TOTAL COSTS PER COW | $2,985.86 | $3,199.73 | $3,021.82 | $3,235.69 | $3,059.48 | $3,273.35 |
| D. RETURNS OVER TOTAL COSTS(A - C) | $60.43 | $236.67 | $24.65 | $200.88 | -$12.84 | $163.40 |
| E. BREAKEVEN MILK PRICE, $/cwt: | $12.72 | $12.02 | $12.89 | $12.17 | $13.06 | $12.32 |
| 20. Lactating cow feed cost, $/head/day | $3.51 | $3.96 | $3.51 | $3.96 | $3.51 | $3.96 |
| 21. Dry cow feed cost, $/head/day | $1.26 | $1.46 | $1.26 | $1.46 | $1.26 | $1.46 |
| F. ASSET TURNOVER (A/Assets) [2] | 74.1% | 83.6% | 71.2% | 80.4% | 68.6% | 77.3% |
| G. NET RETURN ON ASSETS ((D + 13c + 17 + 19)/Assets) [2] | 8.02% | 12.47% | 7.02% | 11.30% | 6.06% | 10.18% |

[1]For cost of raising replacement heifers see MF-399.

[2]Assets equal total value of breeding herd and land, buildings, and equipment.

Table 8. Cost-return projection – Per CWT basis (replacements purchased[1]).

| Premilking hygiene protocol =========> | 20 sec/cow | | 30 sec/cow | | 40 sec/cow | |
|---|---|---|---|---|---|---|
| Lactating cows ==========> | 2,753 | | 2,400 | | 2,127 | |
| | Production level (lbs milk sold per cow per year) | | | | | |
| | 21,000 | 24,000 | 21,000 | 24,000 | 21,000 | 24,000 |
| RETURNS PER CWT | | | | | | |
| 1. Milk sales @ $13.00/cwt. | $13.00 | $13.00 | $13.00 | $13.00 | $13.00 | $13.00 |
| 2. Credit for crop land | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| 3. Calves sold: 92% x $150/head | 0.66 | 0.58 | 0.66 | 0.58 | 0.66 | 0.58 |
| 4. Cull cows sold: 1,400 lbs x 28% x $45.00/cwt. | 0.84 | 0.74 | 0.84 | 0.74 | 0.84 | 0.74 |
| A. GROSS RETURNS | $14.51 | $14.32 | $14.51 | $14.32 | $14.51 | $14.32 |
| VARIABLE COSTS PER CWT: | | | | | | |
| 5. Feed (from Table 3) | $5.56 | $5.50 | $5.56 | $5.50 | $5.56 | $5.50 |
| 6. Labor | 1.32 | 1.16 | 1.39 | 1.22 | 1.47 | 1.28 |
| 7. Veterinary and drugs | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 8. Supplies | 0.57 | 0.54 | 0.57 | 0.54 | 0.57 | 0.54 |
| 9. Utilities and water | 0.52 | 0.50 | 0.52 | 0.50 | 0.52 | 0.50 |
| 10. Fuel, oil, and auto expense | 0.25 | 0.22 | 0.25 | 0.22 | 0.25 | 0.22 |
| 11. Milk hauling, coop, and promotion costs | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| 12. Building and equipment repairs | 0.24 | 0.21 | 0.25 | 0.22 | 0.27 | 0.24 |
| 13. Replacements and breeding charge: | | | | | | |
| a. Capital replacement: | 2.59 | 2.27 | 2.59 | 2.27 | 2.59 | 2.27 |
| b. Semen, A.I. services, and supplies | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| c. Interest | 0.53 | 0.47 | 0.53 | 0.47 | 0.53 | 0.47 |
| d. Insurance | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 14. Professional fees (legal, accounting, etc.) | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 |
| 15. Miscellaneous | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 16. Depreciation on buildings and equipment | 0.56 | 0.49 | 0.60 | 0.52 | 0.64 | 0.56 |
| 17. Interest on land, buildings, and equipment | 0.44 | 0.38 | 0.46 | 0.41 | 0.49 | 0.43 |
| 18. Insurance and taxes on land, buildings, and equip. | 0.19 | 0.17 | 0.20 | 0.18 | 0.22 | 0.19 |
| B. SUB TOTAL | $13.91 | $13.03 | $14.07 | $13.18 | $14.25 | $13.33 |
| 19. Interest on 1/2 operating costs @ 7.0% | 0.31 | 0.30 | 0.32 | 0.30 | 0.32 | 0.31 |
| C. TOTAL COSTS PER CWT | $14.22 | $13.33 | $14.39 | $13.48 | $14.57 | $13.64 |
| D. RETURNS OVER TOTAL COSTS (A - C) | $0.29 | $0.99 | $0.12 | $0.84 | -$0.06 | $0.68 |
| E. BREAKEVEN MILK PRICE, $/cwt: | $12.72 | $12.02 | $12.89 | $12.17 | $13.06 | $12.32 |
| 20. Lactating cow feed cost, $/head/day | $3.51 | $3.96 | $3.51 | $3.96 | $3.51 | $3.96 |
| 21. Dry cow feed cost, $/head/day | $1.26 | $1.46 | $1.26 | $1.46 | $1.26 | $1.46 |
| F. ASSET TURNOVER (A/Assets) [2] | 74.1% | 83.6% | 71.2% | 80.4% | 68.6% | 77.3% |
| G. NET RETURN ON ASSETS ((D + 13c + 17 + 19)/Assets) [2] | 8.02% | 12.47% | 7.02% | 11.30% | 6.06% | 10.18% |

[1] For cost of raising replacement heifers see MF-399.

[2]Assets equal total value of breeding herd and land, buildings, and equipment.

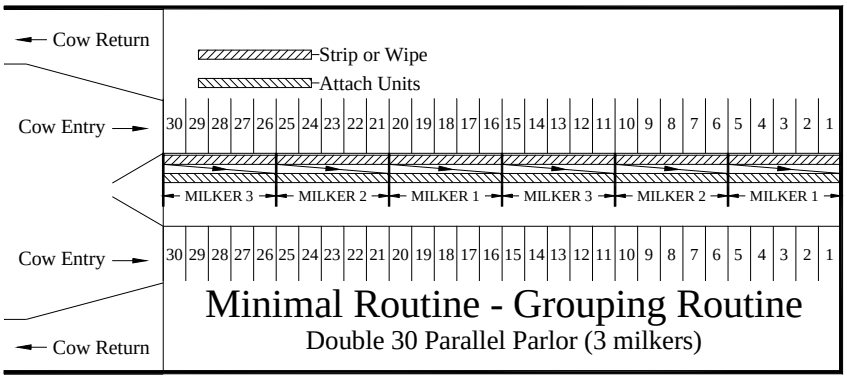
Table 9. Sensitivity Analysis of Return on Investment (Line G) to Milk Production

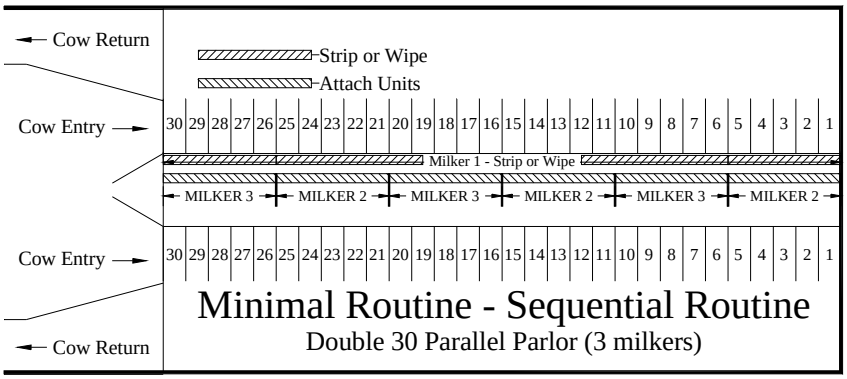
| | Premilking hygiene protocol | | | | | |
|---|---|---|---|---|---|---|
| | 20 sec/cow | | 30 sec/cow | | 40 sec/cow | |
| | Average Milk Price, $/cwt | | | | | |
| Milk production | $13.00 | $12.00 | $13.00 | $12.00 | $13.00 | $12.00 |
| 19,000 | 5.05% | 0.43% | 4.17% | -0.27% | 3.32% | -0.95% |
| 20,000 | 6.54% | 1.67% | 5.60% | 0.92% | 4.69% | 0.19% |
| 21,000 | 8.02% | 2.91% | 7.02% | 2.11% | 6.06% | 1.34% |
| 22,000 | 9.50% | 4.15% | 8.45% | 3.30% | 7.43% | 2.48% |
| 23,000 | 10.98% | 5.39% | 9.87% | 4.49% | 8.81% | 3.63% |
| 24,000 | 12.47% | 6.63% | 11.30% | 5.69% | 10.18% | 4.78% |
| 25,000 | 13.95% | 7.87% | 12.72% | 6.88% | 11.55% | 5.92% |
| 26,000 | 15.43% | 9.11% | 14.15% | 8.07% | 12.92% | 7.07% |

Table 10. Sensitivity Analysis of Return on Investment (Line G) to Milk Price

| | Premilking hygiene protocol | | | | | |
|---|---|---|---|---|---|---|
| | 20 sec/cow | | 30 sec/cow | | 40 sec/cow | |
| | Production level (lbs milk sold per cow per year) | | | | | |
| | 21,000 | 24,000 | 21,000 | 24,000 | 21,000 | 24,000 |
| Milk price | Base feed | Base feed | Base feed | Base feed | Base feed | Base feed |
| $14.00 | 13.13% | 18.31% | 11.93% | 16.91% | 10.79% | 15.58% |
| $13.50 | 10.57% | 15.39% | 9.48% | 14.10% | 8.43% | 12.88% |
| $13.00 | 8.02% | 12.47% | 7.02% | 11.30% | 6.06% | 10.18% |
| $12.50 | 5.46% | 9.55% | 4.57% | 8.49% | 3.70% | 7.48% |
| $12.00 | 2.91% | 6.63% | 2.11% | 5.69% | 1.34% | 4.78% |
| $11.50 | 0.36% | 3.71% | -0.34% | 2.88% | -1.02% | 2.08% |

Figure 1. Different Milking Routines for Parallel and Herringbone Parlors



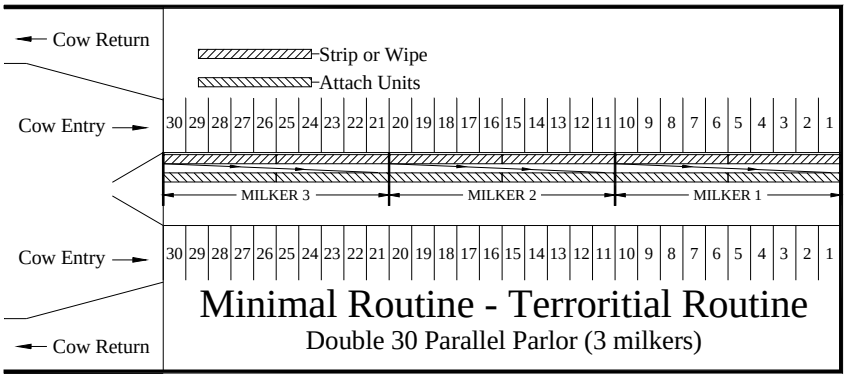



Figure 2. Return on investment vs. milk production by premilkng hygiene protocol

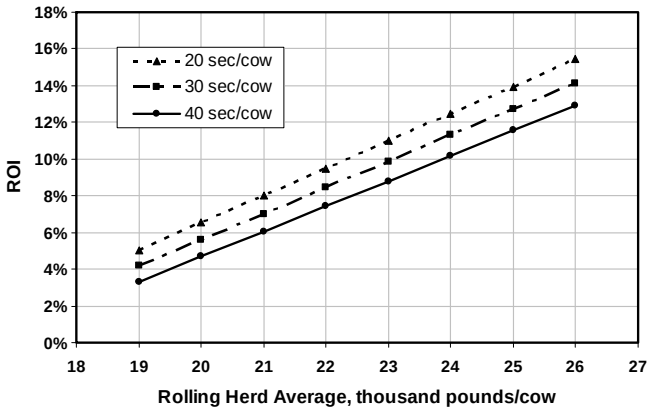



Figure 3. Return on Investment vs. Premilking Hygiene Protocol

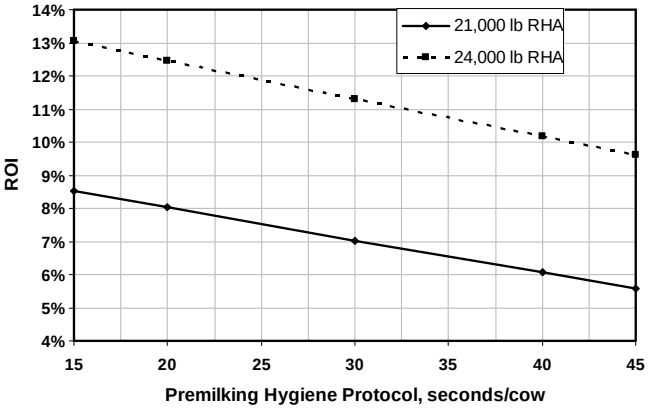
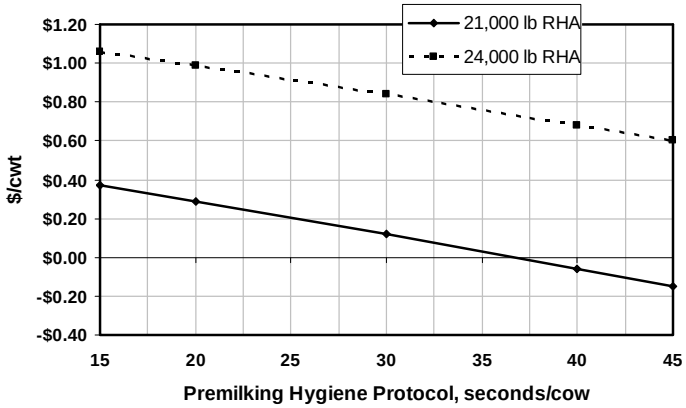



Figure 4. Return over Total Costs vs. Premilking Hygiene Protocol



## Training and Motivating Employees

Since cows are milked by the employees in a dairy, employees are the most important resource of a dairy. Managers are responsible for employee training and development, and employees, in turn, are accountable to management. Team Work is defined by Webster as "joint action by a group of people, in which individual interests are subordinated to group unity and efficiency". **T**ogether **E**veryone **A**chieves **M**ore! To have a team working environment, it must be clear who makes up the team and what each member of the team's role is.

A flow chart should clearly define the chain of command within the team, and, who is accountable for each and every member of the team. If a member of the team answers directly to more than one person, the chart organization should be re-visited.

The milking parlor is the heart and soul of any dairy. Harvesting quality milk requires more than just milkers in a parlor. Typically a shift supervisor or leader will be directly responsible for the milking during their shift. Cow pushers bring cows to the parlor to be milked and return them to their pens. In some parlors, cow pushers play a role in the milking routine used to milk the cows. Spreadsheets and other tools may be incorporated to monitor the daily activities in and surrounding the milking parlor.

The most important aspect to training and communicating effectively to employees are through Standard Operating Procedures (SOPs). SOP's provide a clear understanding of responsibilities of a specific job and they prepare employees to succeed. Each SOP should have a specific set of objectives associated with it. In other words, if the SOP is followed precisely, employees will be very successful, ultimately contributing to the overall success of the dairy farm. Designing jobs (with input from employees) to be effective yet simple thus allowing each employee doing the same job to perform equal amounts of work will minimize employee turnover and improve labor efficiency. Well designed SOPs fit the person to the job, not the job to the person. Standard operating procedures should be written (in the language of choice) and given to all employees prior to performing a job. It is also beneficial to have SOPs posted in plain site in each work area for everyone to see.

## Summary of Economic Analysis

When the time required for premilking hygiene is decreased, the total investment cost increases due to the increased number of cows that can be milked through the milking parlor. The increase in cow numbers requires additional investment in cow housing, manure management system, etc. However, the investment per cow decreases due to the cost of the milking parlor being spread over more cows. As the time required for premilking hygiene decreases, return on investment and return over total cost increases.

## Conclusion

Decisions concerning the milking parlor are very complex. One procedure or routine will not meet the needs of all dairy producers. The true test of a milking procedure and routine is in the end results relative to milking quality, udder health, and parlor throughput. Productivity is

determined by people, which includes the caliber of employees, their level of motivation, and the effectiveness of management. A TEAM approach is critical to the success of an operation. Clearly defined goals need to be established, monitored, evaluated, and re-evaluated. The economics clearly indicate that when the time required for premilking hygiene is reduced without compromising udder health that profitability can be increased.

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