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POSSIBILITIES, PROBLEMS AND PROFITS OF MILKING THREE TIMES A DAY

W.G. Merrill, W.A. Knoblauch and L.E. Chase

COOPERATIVE EXTENSION

Department of Animal Science, New York State College of Agriculture and Life Sciences,
A Statutory College of the State University, Cornell University, Ithaca, N.Y.

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POSSIBILITIES, PROBLEMS AND PROFITS OF MILKING THREE TIMES A DAY

W.G. Merrill, W.A. Knoblauch and L.E. Chase [a]

Increasing economic pressure and the consequent quest for more efficient use of fixed assets has resulted in an upsurge of interest in milking three times per day. Automated and high performance milking systems that enhance labor efficiency improve the likelihood that changing from two to three times per day milking will increase not only milk output but also profit.

PRODUCTION INCREASE

Three times a day milking increases milk yield. Numerous reports prove this point although there is wide variation in the extent of response. Many factors can affect the response; in many research trials or field studies, these factors have not been well controlled to determine their relative effects. Most studies are short term comparisons; few deal with full lactations and little is known concerning feeding and management practices necessary to optimize results for more than one lactation.

A 10 to 15% milk yield increase as a herd average is most common, with a range between 5 to 20%. There are reports of 2 to 54% increases in yields in individual herds, but these have to be regarded as spurious, often due to unusual conditions or extreme changes in management, or to very high or low previous production levels that affect the percentage calculation. Within any herd situation there is the typical large variation in response from individual cows.

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[a]Professor of Animal Science, Associate Professor of Agricultural Economics, and Associate Professor of Animal Science, respectively, Cornell University.

Research results have shown that a 5 to 10% increase in yield from three times a day milking is due to physiological factors directly affecting milk secretion, i.e., (1) reduced intramammary pressure, (2) lower concentrations of milk components which exert negative effects within the milk secreting cells, and (3) stimulation and release of certain hormones which may increase milk yields. The remainder of the increase is due to better feeding and management.

A .1 to .2 decrease in milkfat percent is typical since the increase in yield of milkfat is not as great as for milk yield.

Does age affect percentage increase in milk yield? Most of the early reports state, and it is often repeated, that heifers have a higher percentage increase in milk yield from 3X/day milking than older cows. However, three of the more recent and best evaluations show that percentage responses were higher, the same as, or lower than among older cows. Again, variation seems to be the result of the particular conditions that exist before and after the switch to 3X/day milking, including the relative production levels for 2X cows which affect the calculation of percentage values.

Stage of lactation affects milk yield response. Patterns of milk yield responses from 2X and 3X/day milking are shown in Figures 1 and 2 as an example of stage of lactation effects.

First calf heifers milked 3X versus 2x/day tend to increase yield during early lactation with differences remaining nearly constant or diminishing with advancing lactation.

For older cows, there is usually little or no increase in production from 3X/day milking during early lactation. The greatest increase starts at or just beyond peak production (6-10 weeks). Peak yield is maintained slightly longer, thus extending the

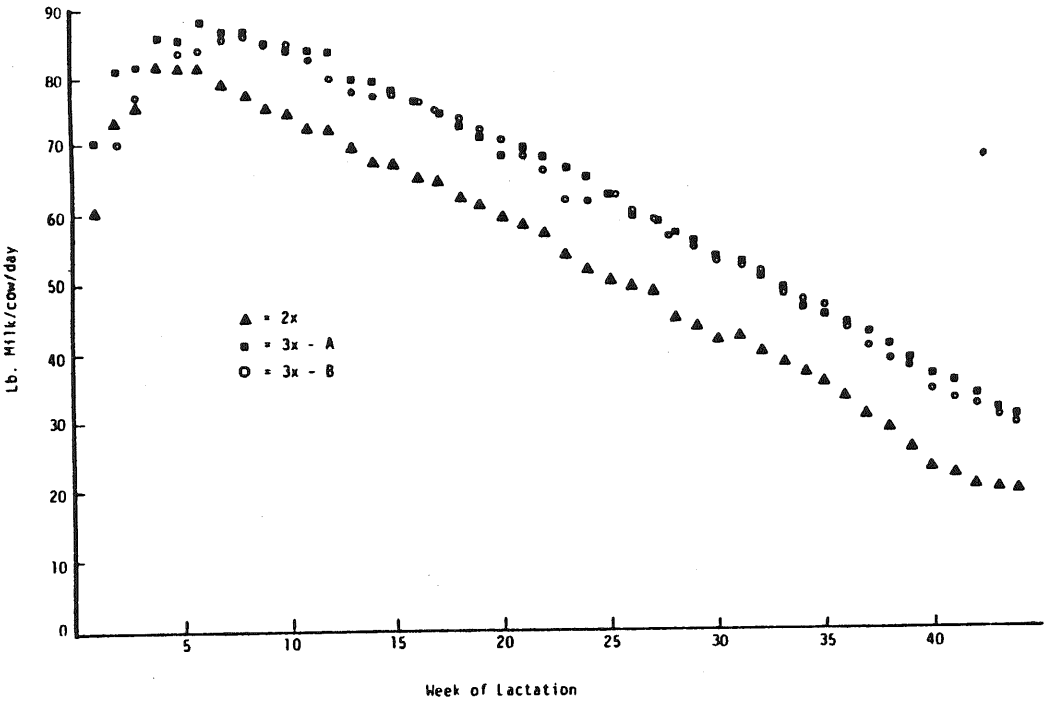

Figure 1. Milk Production of Older Cows

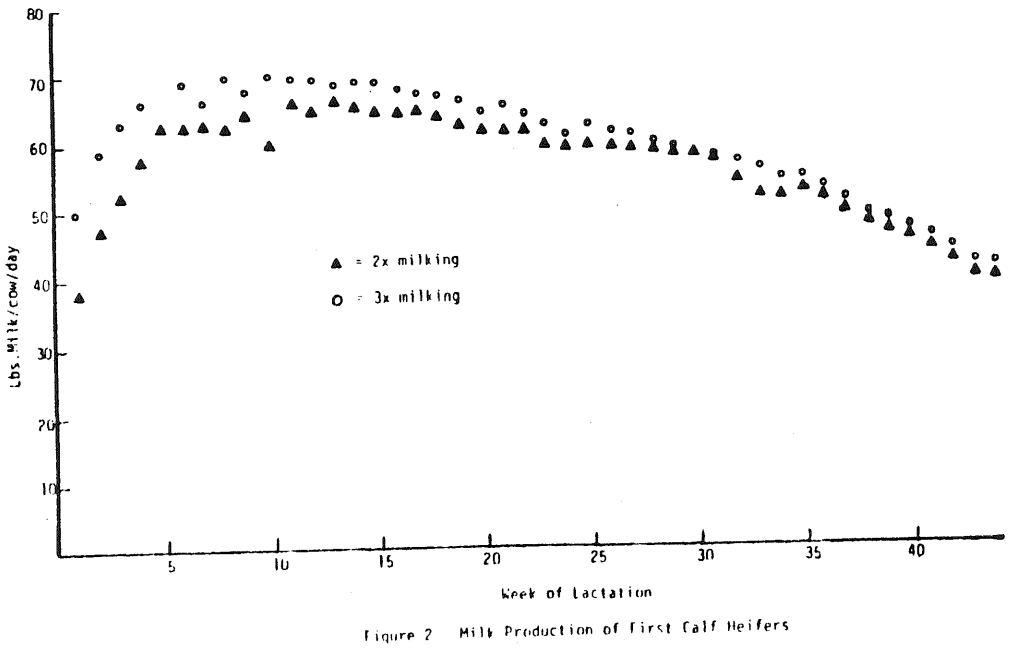

Figure 2 Milk Production of First Calf Heifers

Smith, N.E. and E.J. DePeters. 3X vs 2X Daily Milking for the Entire Lactation. 21st California Dairy Cattle Day, March 31, 1982.

time before the rate of decline begins. The rate of decline is similar for 2X and 3X cows. Therefore, the absolute difference in yield is maintained from peak to the end of lactation which means the percentage increase becomes progressively greater as lactation advances. There is little or no advantage in switching cows back to 2X milking during late lactation. Milking the entire herd 3X/day may simplify management in most herds.

The amount of production increase in any given herd cannot be predicted with any degree of accuracy. It can be determined only by trying it and measuring the results. A six-month trial will provide an estimate of the long-term response, but an overall herd effect can be determined only after complete lactations or about one year. In some cases it has been reported that 3X/day production gradually slipped back to or near the 2X/day level. This may be likely if management intensity is not maintained, especially with feeding.

FEEDING AND BODY CONDITION

Feed intake does not increase in proportion to milk yield for cows milked 3X/day. The additional nutrients are provided by mobilization of body tissue and loss in body weight. Feeding programs for 3X/day milking must make it possible for cows to regain lost body weight and achieve good body condition if high milk yields are to be sustained in subsequent lactations.

Consequences of 3X versus 2X/day milking on feed intake and body weight changes are illustrated by results of a recent study in California. Both first calf heifers and older cows were milked for complete lactations. They were fed free choice total mixed rations of alfalfa, beet pulp and commercial grain mix in three combinations (forage : concentrate D.M. ratios of 40:60, 56:44 and 67:33) according to ranges in production levels during lactation.

Feed intake not proportionate

Actual milk production, dry matter intake and body weight changes are shown in Table 1. The average increase in milk production for older cows on 3X versus 2X/day milking was about 18% while dry matter intake increased only 4%. First calf heifers increased yield by about 6% with little or no increase in feed intake. The additional nutrients needed by 3X cows, but not provided by additional feed intake, had to be provided by body tissue loss as indicated by changes in body weight.

Later and less body weight gain

The pattern of body weight change for older cows showed similar losses (ave 105 - 140 lb/cow) for both groups. Cows on 2X milking reached minimum BW at week 7 post-calving and had a steady weight gain from then through the rest of lactation, reached post-calving weight at week 26, and gained 139 lb. by the end of lactation. Cows on 3X milking reached minimum BW slightly later at week 9 but showed little weight gain until after week 20, didn't reach post-calving weight until week 39, and gained only 39 lb. by the end of lactation, or 100 lb. less than that for 2X cows.

The effects of 3X milking on relative patterns of BW changes for heifers were similar to but much more pronounced than for older cows. Weight changes for both 2X and 3X heifers were similar during the first 15 weeks after calving. However, between weeks 15 and 44 of lactation, average rates of gain were 1.13 lb/day for 2X and 0.54 lb/day for 3X heifers. Over the entire lactation 3X heifers gained 137 lb. less BW than 2X heifers.

Special feeding emphasis required

Assuming that weight gains equivalent to those for 2X cows are desirable or required for optimum body condition as preparation for the next lactation, cows milked 3X must gain the extra weight during the dry period under the conditions of this trial. This is especially critical for first-calf heifers. Weight gains of these magnitudes during the dry period may not be possible, and it certainly emphasizes the importance of late lactation and dry period feeding for cows milked 3X per day.

However, instead of putting all the emphasis on dry period feeding to re-establish post-calving BW, perhaps some additional delay in changing ration groups during lactation should be considered. Time at which cows are changed to another ration group would need to be based on weight gain or body condition rather than only on daily milk yield as shown in Table 2. Routine body condition scoring should be an essential part of the feeding management system.

It is important to recognize that 3X milking results in a prolonged drain on body reserves during lactation and that a feeding program, including the dry period must be designed to meet these added requirements. Failure to do this is likely to have detrimental carryover effects on the next lactation and probably explains those situations where the production advantage of 3X milking has dwindled after a year or two.

Feed efficiency

Some reports imply greater feed efficiency relative to increased production from 3X/day milking. There is no "magic" for this that is specific or unique to milking frequency. Basic nutritional principles and relationships apply here as well.

Table 1. Total lactation performance.

Group	Production(lb)		Dry Matter Intake		Body Weight (lb)		
	Milk	Fat	Total (lb)	% BW	Begin	End	Change
Older cows							
2X	16,522	568	13,166	3.09	1397	1536	+139
3X	19,550	666	13,703	3.16	1485	1524	+ 39
First-calf heifers							
2X	17,320	626	12,249	3.22	1213	1387	+174
3X	18,328	672	12,222	3.32	1229	1266	+ 37

Smith and DePeters, Univ. California, 1982.

Table 2. Conditions at time of ration changes.

Group	Ration Change			
	High to Medium		Medium to Low	
	Week	Milk (lb/day)	Week	Milk (lb/day)
Older cows				
2X	19.8	59.5	25.3	48.9
3X	22.8	64.1	28.8	51.6
First-calf heifers				
2X	31.8	50.3	34.5	43.6
3X	26.5	56.2	38.3	44.0

Smith and DePeters, Univ. California, 1982.

Higher milk yield (even with a proportional increase in feed intake) increases gross efficiency because feed used for maintenance, growth and reproduction becomes a smaller percentage relative to total feed intake and milk output. Feed efficiency will appear even greater if body tissue nutrients used to subsidize milk yield are not accounted for. Total nutrients used for milk production must be accounted for, whether used directly for milk synthesis or indirectly to replenish body tissue used previously for milk synthesis, and whether fed during lactation or the dry period.

In economic analyses of 3X milking, added feed costs are often determined as the cost of concentrates alone based on simple ratios such as 1 lb. per 2.5 to 3 lb. milk, or based on using NRC nutrient relationships. (This is a simple and usefully adequate estimate for the purpose even though a more detailed method could include a portion of added nutrients from forages, especially during late lactation and dry period feeding, the efficiency of weight gain during lactation versus the dry period, and the efficiency of indirect use of body tissue for milk synthesis).

Labor

A major factor in the decision to milk 3X/day is availability and cost of labor. It is often difficult to synchronize available labor units to herd size and labor needs. If labor is now balanced with need, a third milking will require another partial labor input. In most cases, it is not reasonable to extend existing labor to milk all three shifts. It is unsatisfactory to work at the odd hours required and the routine becomes drudgerous and fatiguing. When the manager is also part of the extended routine labor force, management intensity is likely to decrease when in fact it should be increased. This is most likely to be the case in smaller herds.

Additional labor may be available from other family members or hired labor willing to work part-time. Sometimes favorable shifts can be made as a result of 3X milking, especially in larger herds, where the third milking is done by a separate crew and the regular milkers can finish their two milkings earlier. If a full time worker must be added to cover the extra milking, other useful work must be found to make it profitable.

Milking 3X/day puts more demands on the milker to do a good job. Cows will milk out faster and milkers will need to be more alert and more efficient without being rushed and slacking off on proper milking procedures. An added management requirement is to ensure that all milkers do a good job even if direct supervision is not possible.

Labor costs are sensitive to production per cow and degree of mechanization. Other things being equal, or nearly so, labor costs per hundred pounds of milk will decrease as herd average production increases. High production per cow is required for profitable 3X milking because milk production will not increase at the same rate as will labor costs. Also, the extra cost of a third milking will be less per hundred weight of milk if a milker can milk 150 cows daily in a highly automated parlor than in a 75 cow herd that cannot justify the cost of a high degree of mechanization.

Herd Health and Reproduction

Milking 3X/day, or high production per se, need not affect herd health if management is adequate. In fact, it is often stated that herd health problems improve when cows are switched from 2X to 3X milking, although as in other aspects, results are variable.

For example, many "say" there is less mastitis when milking 3X/day. It is felt that udder health improves because more frequent milking reduces stress on the udder, milk and mastitis organisms are removed from the udder more frequently and fewer cows leak milk between milkings. Less clinical mastitis occurs and less income is lost to treatment costs and discarded milk. Since most dairymen do not keep good records about mastitis, and since clinical occurrences or "flare-ups" are variable, their comments may not be a careful evaluation. However, most field observations favor the view that udder health is improved.

On the other hand, it has been reported that 3X/day milking resulted in increased mastitis where poor milking practices are followed, milking equipment is not properly operated and maintained, there is poor sanitation and inadequate cleaning of milking equipment, and where environmental mastitis problems already exist. That is, where poor milking management and inadequate mastitis control exists, an extra milking per day only compounds the problem.

Improved reproductive performance may be possible as a result of 3X/day milking because more time is spent in the barn and improved heat detection may occur. Other problems also may be noticed sooner, such as illness, injury, calving difficulties, etc. On the other hand, it has been reported that increased exposure of cows to concrete resulted in more feet and leg problems which decreased the ability of cows to show signs of heat by mounting. Higher production with longer periods of weight loss may diminish signs of heat. Some herds have switched back to 2X/day milking because calving intervals and reproductive performance have deteriorated, possibly because people were "busier" and didn't have time to carry our or supervise overall management as effectively.

ECONOMIC CONSIDERATIONS

Milking 3X/day can increase profit if costs are controlled, labor availability and scheduling is not a problem, and a significant production response is attained. The increased costs associated with 3X/day milking are difficult but not impossible to estimate. Increased returns are most difficult to estimate without actually trying 3X milking and measuring the production response in the specific herd. However, responses from farms who have milked 3X/day can be used as a starting point.

An example calculation demonstrates the use of three worksheets which when completed provide an estimate of the economic benefit of milking 3X/day. Blank worksheets are provided at the end of this paper for use with a specific dairy farm. If the economic benefit looks promising, further work should be undertaken to more closely calculate additional costs, especially for feed, and for scheduling and managing labor requirements.

Expected Change in Returns

Worksheet 1 can be used to estimate the increase in returns from milking cows three times per day. Pounds of milk sold from the farm milking 2X/day and expected pounds of milk sold when milking 3X/day can be calculated. Pounds of milk sold for the previous year from milk plant records can be substituted for the calculation on Line 4, but be careful to base expected pounds of milk sold from 3X/day milking on the same cow numbers as for 2X/day milking. If only a portion of the herd will be milked 3X/day or for only a portion of the year, make adjustments in cow numbers (Line 3) and/or expected annual increase in milk production (Line 2).

Milk price before and after the change to 3X/day milking is also needed. Remember to adjust the price for the expected decrease in milk fat for 3X/day milking. If milk is marketed under a base/excess plan, the milk price calculation is slightly more complex. When this worksheet analysis is completed and 3X/day milking appears profitable, do a more detailed analysis of milk price under a base/excess plan.

A comparison of the value of milk sold from the farm with 2X and 3X/day milkings will result in the "Expected Change in Returns". Expected pounds of milk sold will be greater, but fat adjusted milk price will likely be lower for 3X/day milking. The interaction of these two factors will be responsible for the extent of the "Expected Change in Returns".

Expected Change in Expenses

Worksheet 2 can be used to estimate the change in expenses. Examine the business financial records and determine last year's costs for the categories listed on the worksheet. Estimate the proportional increase or decrease based upon your knowledge of the operation. Ranges for proportional increases are provided on the worksheet. Milking labor and feed costs deserve critical attention. The method of calculating labor costs depends on the objective of the analysis. If the analysis is conducted to estimate the impact on cash flow, do not include a charge for nonpaid family or operator labor. If the analysis has a profitability objective, use the cash wage or an alternative wage that could be earned by the nonpaid family or operator labor.

To estimate feed costs, the simple formula discussed earlier in this paper can be used. Remember, however, that this procedure is likely to overestimate

WORKSHEET 1

CHANGE IN RETURNS RESULTING FROM 3X/DAY MILKING

Pounds of Milk Sold

1)	Pounds of Milk Sold Per Cow Per Year, Milking 2X/day	14,622	lbs.
2)	Expected Pounds of Milk Sold Per Cow Per Year, Milking 3X/Day (most likely increase would be 10 to 15 percent per year, ranging from 5 to 20% per year, multiply line 1 by 1.05 to 1.20)	16,450*	lbs.
3)	Number of Cows In the Herd (milking and dry cows in the herd last year or expected this year)	84	head
4)	Pounds of Milk Sold From the Farm, 2X/Day Milking (Line 1 x Line 3)	1,228,278	lbs.
5)	Expected Pounds of Milk Sold From the Farm, 3X/Day Milking (Line 2 x Line 3)	1,381,800	lbs.

Milk Price

6)	Net Milk Price, 2X/Day Milking, $ Per Cwt., (Net of all per cwt. charges; hauling, co-op dues, etc.)	12.10	$/cwt.
7)	Net milk price, 3X/Day Milking, $ Per Cwt. (Expected tenths of a percentage point reduction in milk fat 2, most likely reduction would be 0.1 to 0.2 in milk fat test, multiplied by $ per cwt. deducted for each tenth of a percentage point of milk fat below 2X/Day test .17 equals reduction in milk price $.34 cwt. Subtract the reduction for milk fat content from 2X/day milk to obtain 3X/day milk price)	11.76	$/cwt.

Change in Returns

8)	Value of Milk Sold, 3X/Day Milking, (Line 5 ÷ 100 x Line 7)	$162,500
9)	Value of Milk Sold, 2X/Day Milking, (Line 4 ÷ 100 x Line 6)	$148,622
10)	Expected Change in Returns (Line 8 - Line 9)	$13,878

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*A 12.5% increase is used in this example calculation.

WORKSHEET 2

CHANGE IN EXPENSES RESULTING FROM 3X/DAY MILKING

Increased Expenses

		Current Costs		Proportional Increases		Cost Increase
1)	Milking Labor	$10,000	x	.50 / (0.30-0.50)*	=	$5,000
2)	Utilities, Associated With the Dairy Milking Facilities	$2,000	x	.50 / (0.50)*	=	$1,000
3)	Supplies	$2,050	x	.50 / (0.50)*	=	$1,025
4)	Milking Equipment Repairs	$1,500	x	.50 / (0.50)*	=	$ 750
5)	Production Testing	$1,200	x	.15 / (0.00-0.30)*	=	$ 180
6)	Feed (for each 2.5 to 3 lb increased milk, add cost of 1 lb grain, Worksheet 1, Line 4 minus Line 5 divided by 2.5 to 3 equals pounds of additional grain times $.10 cost/lb = estimated cost increase for feed $5,583. Allow for 5 percent feeding loss by multiplying the above result by 1.05)				=	$5,865**
7)	Other _____	$_____	x	_____	=	$_____

Expenses Which May Increase or Decrease

		Current Costs		Proportional Increase or Decrease		Cost Change
8)	Veterinary & Medicine	$_____	x	_____ / (-.10 to +.10)*	=+ or -	$_____
9)	Breeding Fees	$_____	x	_____ / (-.10 to +.10)*	=+ or -	$_____
10)	Total Expected Increase in Costs (add Lines 1 - 9)					$13,820

*Most likely proportional change.

**2.75 lbs of increased milk per 1 additional lb of grain used in this example calculation.

WORKSHEET 3

EXPECTED CHANGE IN PROFIT AND BREAKEVEN PRODUCTION INCREASE

Change in Profit

1)	Expected Change in Returns Resulting from 3X/Day Milking (Worksheet 1, Line 10)	$13,878	
2)	Total Expected Increase In Costs Resulting from 3X/Day Milking (Worksheet 2, Line 10)	$13,820	
3)	Expected Change in Profit (Line 1 minus Line 2)	$ 58	
4)	Expected Change in Profit Per Cow (Line 3 divided by Worksheet 1, Line 3)	$ .69	
5)	Expected Return Per Dollar of Increased Cost (Line 1 divided by Line 2)	$ 1.01	

Breakeven Production

6)	Herd Increase in Production Required to Cover Increased Costs. Change in Milk Price (Worksheet 1, Line 6 - Line 7) multiplied by cwt. of milk sold from the farm 2X/day milking (Worksheet 1, Line 4 divided by 100) plus total expected increase in costs from 3X/day milking (Worksheet 2, Line 10) divided by 3x/day milk price (Worksheet 1, Line 7)	1,530	cwt.
7)	Production Per Cow Increase Required to Cover Increased Costs (Line 6 multiplied by 100 divided by Worksheet 1, Line 3)	1,822	lbs.
8)	Percent Production Per Cow Increase Required to Cover Increased Costs (Line 7 divided by Worksheet 1, Line 1)	12.46	%

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increased feed costs. Forage consumption increases would be desirable because nutrient costs per unit is generally lower for forages than concentrates. Emphasis should be placed on a feeding strategy which increases forage intake.

Total the cost increases and cost changes to obtain "Total Expected Increased Costs". This value along with the "Expected Change in Returns" from Worksheet 1 are used to calculate "Expected Change in Profit".

Expected Change in Profit

Worksheet 3 puts the previous worksheets' calculations in a form which allows for determination of the benefit of 3X/day milking. By subtracting the "Total Expected Increase in Costs" from the "Expected Change in Returns" the "Expected Change in Profit" will result. If this calculation yields a positive number, the change will be of benefit. If it is negative, 3X/day milking will not be profitable.

"Expected Change in Profit" can also be calculated on a per cow and per dollar of increased costs basis (Worksheet 3, Lines 4 and 5). By doing this the magnitude of any increase can be better judged.

"Breakeven Production" allows for the determination of the increase in hundredweights of milk sold that must be obtained to cover the increased costs. This can be calculated on both a total farm and per cow basis. By examining the breakeven production, more information is obtained on whether or not to pursue 3X/day milking.

If these calculations show 3X/day milking to look promising, re-examine your extimates to make certain they are the best possible. Give detailed attention to feeding program formulation and to scheduling and managing the milking labor. Remember, it is much easier to formulate or change plans before, rather than after they are implemented.

BEFORE STARTING TO MILK 3X/DAY

1. You should make sure adequate management is possible.

a) Make sure you are already a "good 2X/day manager".

If your herd average on 2X/day milking is not in the top half of DHI herds (or above about 16,000 lb for Holsteins) it is better to achieve that goal first; otherwise it is not likely you will provide the management required to achieve and sustain an adequate increase in production from 3X milking. Much of the increased production from better feeding and management associated with 3X milking could be achieved without the third milking.

b) Make sure you are likely to be a "good 3X/day manager".

More management time, interest, ability and attention to detail are required to sustain the benefits of 3X/day milking. If you do not use DHI records, or some other adequate production record system, you are not likely to have sufficient information to manage properly and measure results.

You must plan and monitor a more intensive total management strategy. For example, the feeding program becomes more critical in which dry matter intake, ration composition and nutrient density, body weight changes and body condition status should be frequently and carefully evaluated throughout lactation and the dry period. If milking procedures, sanitation, environmental conditions and mastitis control are not adequate, 3X/day milking may only aggravate the problems; if these aspects are managed well, 3X milking may have additional benefits for mastits control. With higher production it may be more difficult to get cows to conceive on schedule, etc.

Responses to 3X/day milking are very sensitive to management ability; excellent management is required if it is to remain profitable for successive lactations. The best plan cannot be expected to succeed if it is not properly implemented.

2. You should make sure labor is available and can be scheduled and managed to effectively milk 3X/day.

3. You should make a thorough economic analysis of your dairy enterprise, before and after. Make sure there is economic potential. Know how much production increase is necessary to break even. Responses among farms is highly variable and each dairy farmer must monitor production and economic relationships carefully to know that 3X response is effective. Give special attention to feed and labor costs. Factors that increase in proportion to the 50% increase in number of cows milked daily, i.e., labor, utilities, supplies, etc. also warrant careful examination. If you don't have the necessary information for making an economic analysis, then establishing and using a good finincial record and business management system should receive a higher priority than 3X/day milking.

WORKSHEET 1

CHANGE IN RETURNS RESULTING FROM 3X/DAY MILKING

Pounds of Milk Sold

1)	Pounds of Milk Sold Per Cow Per Year, Milking 2X/day	_____	lbs.
2)	Expected Pounds of Milk Sold Per Cow Per Year, Milking 3X/Day (most likely increase would be 10 to 15 percent per year, ranging from 5 to 20% per year, multiply line 1 by 1.05 to 1.20)	_____	lbs.
3)	Number of Cows In the Herd (milking and dry cows in the herd last year or expected this year)	_____	head
4)	Pounds of Milk Sold From the Farm, 2X/Day Milking (Line 1 x Line 3)	_____	lbs.
5)	Expected Pounds of Milk Sold From the Farm, 3X/Day Milking (Line 2 x Line 3)	_____	lbs.

Milk Price

6)	Net Milk Price, 2X/Day Milking, $ Per Cwt., (Net of all per cwt. charges; hauling, co-op dues, etc.)	_____	$/cwt.
7)	Net milk price, 3X/Day Milking, $ Per Cwt. (Expected tenths of a percentage point reduction in milk fat _____, most likely reduction would be 0.1 to 0.2 in milk fat test, multiplied by $ per cwt. deducted for each tenth of a percentage point of milk fat below 2X/Day test _____ equals reduction in milk price $_____cwt. Subtract the reduction for milk fat content from 2X/day milk to obtain 3X/day milk price)	_____	$/cwt.

Change in Returns

8)	Value of Milk Sold, 3X/Day Milking, (Line 5 ÷ 100 x Line 7)	$_____	
9)	Value of Milk Sold, 2X/Day Milking, (Line 4 ÷ 100 x Line 6)	$_____	
10)	Expected Change in Returns (Line 8 - Line 9)	$_____	

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*A 12.5% increase is used in this example calculation.

WORKSHEET 2

CHANGE IN EXPENSES RESULTING FROM 3X/DAY MILKING

Increased Expenses

		Current Costs		Proportional Increases		Cost Increase
1)	Milking Labor	$_____	x	_____ (0.30-0.50)*	=	$_____
2)	Utilities, Associated With the Dairy Milking Facilities	$_____	x	_____ (0.50)*	=	$_____
3)	Supplies	$_____	x	_____ (0.50)*	=	$_____
4)	Milking Equipment Repairs	$_____	x	_____ (0.50)*	=	$_____
5)	Production Testing	$_____	x	_____ (0.00-0.30)*	=	$_____
6)	Feed (for each 2.5 to 3 lb increased milk, add cost of 1 lb grain, Worksheet 1, Line 4 minus Line 5 divided by 2.5 to 3 equals pounds of additional grain times $_____ cost/lb = estimated cost increase for feed $_____. Allow for 5 percent feeding loss by multiplying the above result by 1.05)				=	$_____
7)	Other _____	$_____	x	_____	=	$_____

Expenses Which May Increase or Decrease

		Current Costs		Proportional Increase or Decrease		Cost Change
8)	Veterinary & Medicine	$_____	x	_____ (-.10 to +.10)*	=+ or -	$_____
9)	Breeding Fees	$_____	x	_____ (-.10 to +.10)*	=+ or -	$_____
10)	Total Expected Increase in Costs (add Lines 1 - 9)					$_____

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*Most likely proportional change.

**2.75 lbs of increased milk per 1 additional lb of grain used in this example calculation.

WORKSHEET 3

EXPECTED CHANGE IN PROFIT AND BREAKEVEN PRODUCTION INCREASE

Change in Profit

1) Expected Change in Returns Resulting from 3X/Day Milking (Worksheet 1, Line 10) $_____

2) Total Expected Increase In Costs Resulting from 3X/Day Milking (Worksheet 2, Line 10) $_____

3) Expected Change in Profit (Line 1 minus Line 2) $_____

4) Expected Change in Profit Per Cow (Line 3 divided by Worksheet 1, Line 3) $_____

5) Expected Return Per Dollar of Increased Cost (Line 1 divided by Line 2) $_____

Breakeven Production

6) Herd Increase in Production Required to Cover Increased Costs. Change in Milk Price (Worksheet 1, Line 6 - Line 7) multiplied by cwt. of milk sold from the farm 2X/day milking (Worksheet 1, Line 4 divided by 100) plus total expected increase in costs from 3X/day milking (Worksheet 2, Line 10) divided by 3x/day milk price (Worksheet 1, Line 7) _____ cwt.

7) Production Per Cow Increase Required to Cover Increased Costs (Line 6 multiplied by 100 divided by Worksheet 1, Line 3) _____ lbs.

8) Percent Production Per Cow Increase Required to Cover Increased Costs (Line 7 divided by Worksheet 1, Line 1) _____ %