

QUALITY MILK STARTS WITH QUALITY MANAGEMENT

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Introduction

Dairy farming is a business and successful dairy producers are generally profitable. Maximizing profitability is the result of applying proven management principles. Management principles that have been documented and tested in most industries, have not had widespread application in the dairy industry until the recent expansion in the size of dairy farms. Management of large dairies is improving; milking centers are the heart of large dairies and their design and management is crucial to their success (14).

Milk quality is milk produced to predetermined standards (6). Measurements such as bacteria levels, somatic cell count, butterfat, protein and others are dependent upon management strategies implemented in the milking parlor. For example, Galton demonstrated a direct relationship between premilking hygiene procedures and both bacteria counts in milk and incidence of clinical mastitis (7,8). At the same time, adding steps to milking routine can reduce milking parlor profitability. In a performance analysis of parlor design and management strategies, Thomas concluded that abbreviated milking procedures (unit attachment and post dip vs. predip, wipe, unit attach and post dip) resulted in a 6% increase in performance. (13)

As dairies grow larger, management of the milking facility becomes crucial in delivering quality milk while maximizing profitability of the dairy. Parallel parlors with greater than 50 units per side and rotary parlors greater than 80 stalls pose new questions regarding how to manage for both quality and profitability. (2) This paper will both review milking management principles and demonstrate practices to improve quality and productivity.

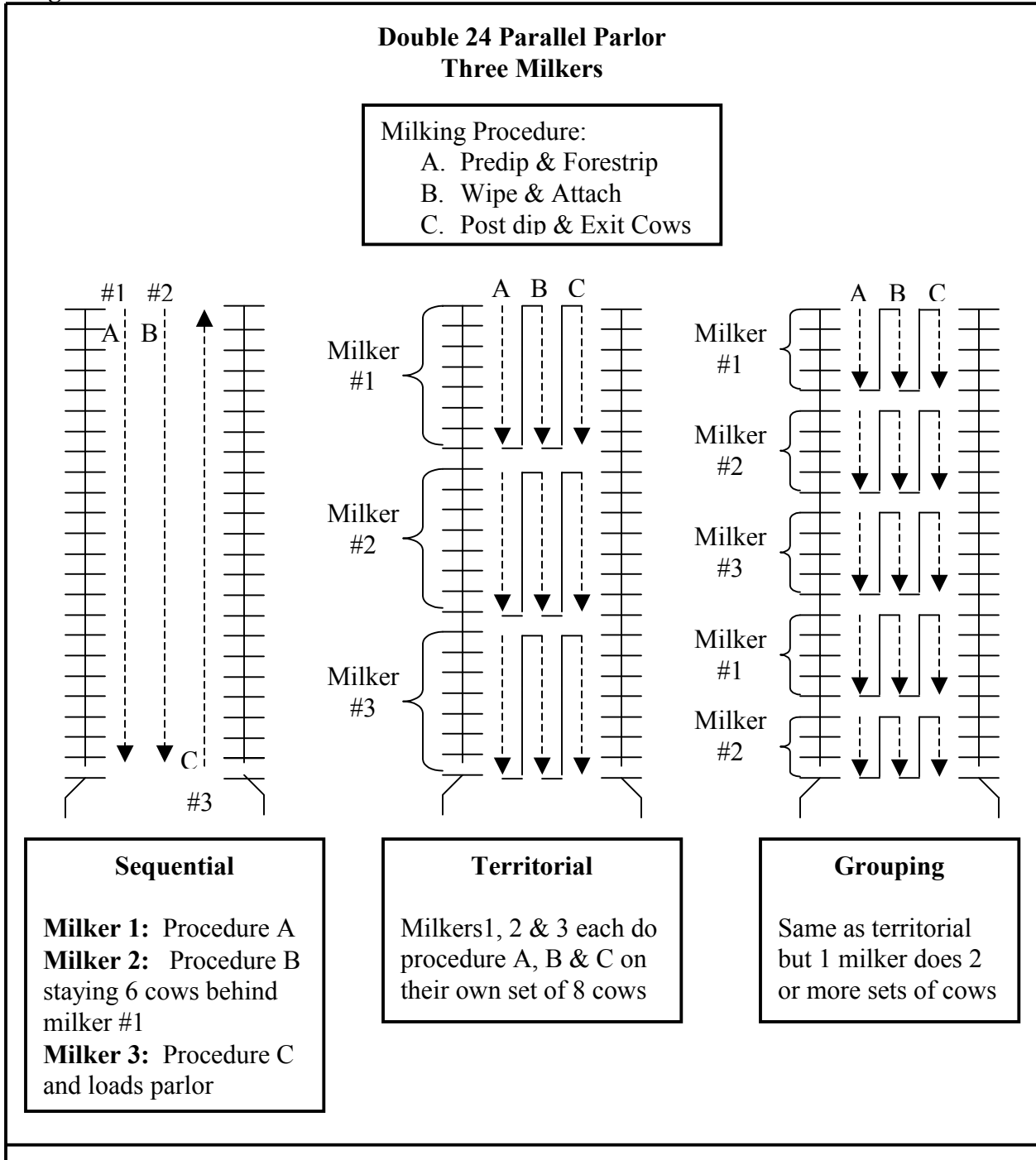
Milking Parlor Management: Principles and Practices

Milking parlor management is deciding upon a specific milking routine for a specific parlor configuration. Once the optimal routine is decided upon, training and monitoring milkers to implement that routine completes the parlor management process.

Milking routine can be defined different that milking procedure. Although the distinction between these two terms is not universally recognized, milking routine can be described as “the system by which milkers move through a milking parlor”. Milking procedures are appropriately defined as “the steps that define the routine”(e.g. cowside activities performed by each milker). Smith and Armstrong (12) define three types of milking routine: territorial, sequential, and batch milking. A fourth is proposed: group milking. Sequential milking routine occurs when one milker, in sequence, follows another milker down the side of cows in a parlor applying a different procedure such that milking units are applied, then detached and cows are released. Territorial

routine differs in that one milker performs all procedures on all cows within one territory. Group milking routine is territorial routine when one or more milkers perform all procedures within two or more territories in larger parlors. Clarification of sequential, territorial and group milking is seen in diagram 1. Batch milking is very inefficient, rarely used and so it will not be discussed.

Diagram 1



Milking procedures are the steps within the routine and have been described in scientific literature. Armstrong and Quick (1) performed time and motion measurements on various

milking parlor configurations and sizes and identified not only specific milking procedures, but also identified specific times required to apply each procedure. Table 1 modified from their paper provides guidelines for the times required to apply procedures or groups of procedures within milking routines.

Table 1

Time Requirements for Pre-milking Hygiene Procedures		
<u>Procedure</u>	<u>Time (sec)</u>	
forestrip	4-6	} 12-26 sec
predip	4-5	
wipe	6-8	
attach	8-10	

Armstrong & Quick 1986

Prep time has been defined as the time to manually clean and dry the teat surface. Prep lag time is the time between the beginning of teat preparation to the application of the milking machine (11). While critical times have been defined for these terms (10 to 20 seconds for prep time and 1 to 1.5 minutes for prep lag time) specific milking procedures required to assure these times are met have not been universally implemented for each type of milking routine.

Specific milking procedures such as predipping and forestripping have been proven to be beneficial to improve milk quality (7,8,9). There is mounting evidence that pre-milking procedures to stimulate milk let down improves milk yield (10) although this concept is not universally accepted (14). Apparently the milk let down reflex is complicated and the exact stimuli to maximize milk let down is not clearly elucidated (11). However it would seem logical to group two procedures together to produce a favorable outcome (such as combining predip and forestrip to both clean teat skin and improve milk let down). If premilking procedures were to be combined, the sequence within which to group procedures has not been studied. For example, whether to predip then forestrip, or perform these two procedures in reverse order is a matter of opinion rather than fact.

Smith and Armstrong (12) divided premilking hygiene into three groups: none, minimal and full. Herds using full preparation averaged 9 lbs. of milk per cow more than those using minimal udder preparation. They theorized the difference could be explained by improved milk let down since they observed partial let down followed by no milk flow through machine clusters for one to one-half minutes before a second milk let down occurred when minimal teat preparation was used.

In rotary milking parlors it is possible to determine the specific milking procedures to incorporate within a milking routine and then predict cow entry time and the number of cows milked per hour depending upon the number of operators used. From table 1, the times required to execute each procedure are identified. Rotary parlor efficiency will be limited to the time it takes to execute the longest premilking procedure or group of procedures. For example, cow entry on a rotary parlor could occur as rapidly as every 8-10 seconds if one operator was responsible for machine attachment, or as long as 14-16 seconds if one operator was required to do both the wipe and attach procedures. Depending upon the size of the rotary parlor, this decision impacts parlor efficiency since it determines rotations per hour. At the same time, spacing of milkers in a rotary parlor affects parlor efficiency and quality results. For example, predip and forestrip procedures done simultaneously by one milker require approximately 10 seconds and can improve teat cleanliness and milk let down. Locating a second milker 6 stalls away from the first milker to wipe teats (requiring 6-8 seconds) optimizes prep lag time (approximately 60 seconds) and may reduce machine on time. But to maximize cow entry a third milker is required to attach units (requiring 8-10 seconds) since the combination to wipe and attach units by one milker requires 14-18 seconds and limits rotary parlor efficiency.

Parallel and herringbone parlors have been studied to evaluate efficiency relative to procedures used within milking routines. In these parlors, milkers “move to cows” rather than cows to operators as in rotary parlors. Milk quality goals of the manager dictate the number and type of milking procedures utilized within a milking routine. The extent to which milkers correctly implement procedure is the difference between theoretical and actual parlor efficiency and milk quality results. Theoretical parlor efficiencies can be calculated when specific milking procedures are selected and the number of operators is known for each parlor size according to the following formula:

$$\text{Time to attach units on a side} = \frac{(\text{No. stalls/side} \times \text{Time required for pre-milking hygiene})}{\text{No. of operators}}$$

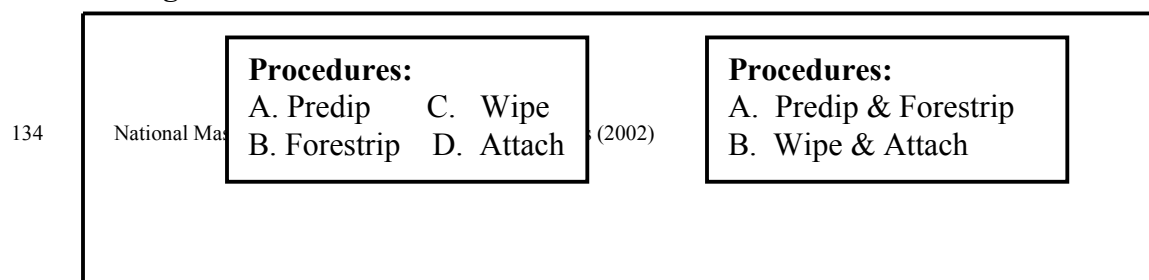
(from Armstrong et al)

Milk quality goals and results dictate the number and type of milking procedures utilized within a milking routine. An illustration incorporating milking procedures within a specific milking routine is presented in diagram 2 on the following page.

Milking Parlor Management: Systems, People and Monitoring

Management defines what is to be done, who is to do it and what results are expected. A written milking routine is the system milkers implement to produce quality milk. The system is composed of processes, milking procedures, each of which is further defined by tasks or the properly sequenced details of each milking procedure. Flow charts can be used to define a specific milking routine for any milking parlor configuration and size. Diagrams 3, 4 and 5 illustrate two different flow charts to describe a milking routine for a double 16 herringbone parlor.

Diagram 2



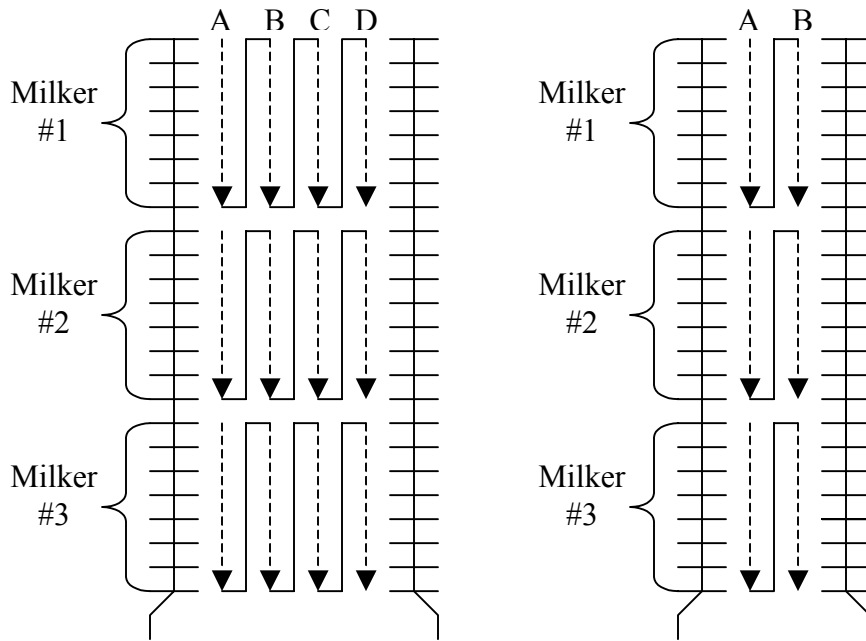
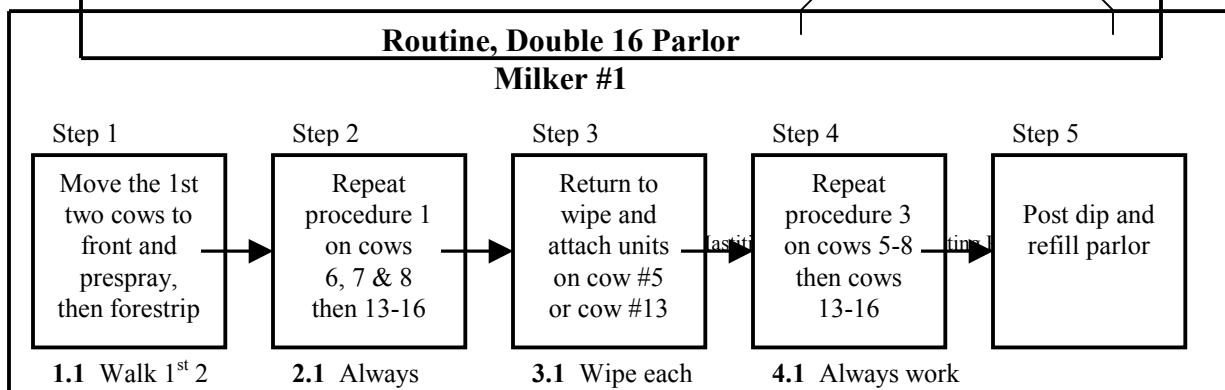
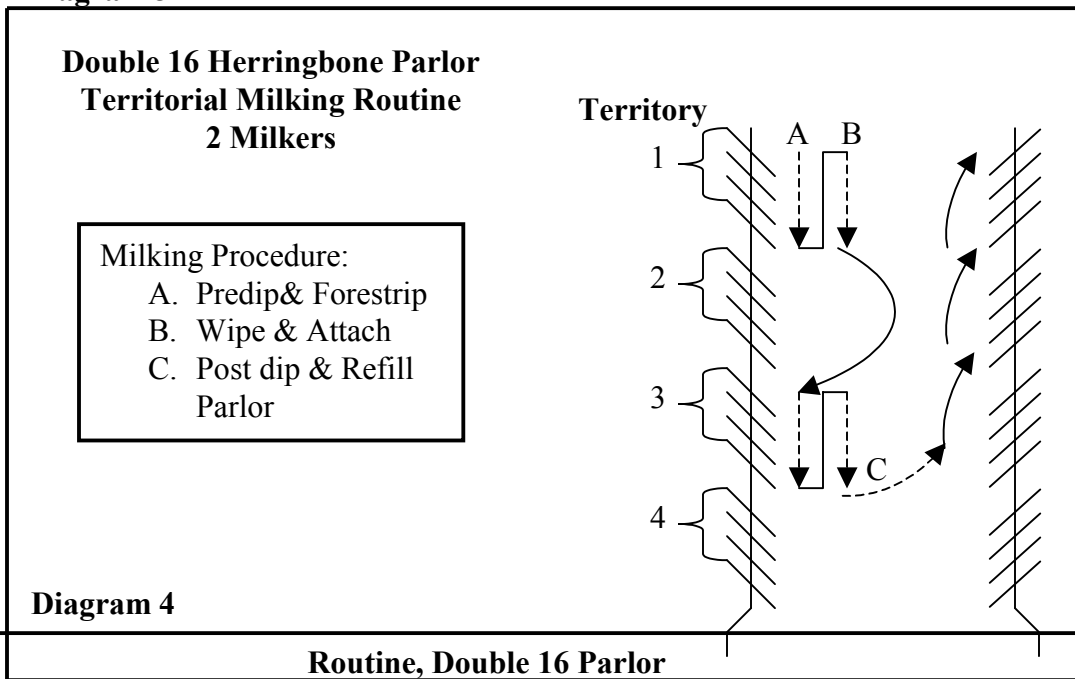


Diagram 3



Milker training is crucial to successful milking parlor management (12). Employee training techniques are clearly defined (5) but seldom used by dairymen to explain milking routine and procedure to milkers. There are five steps to effective employee training: 1. *prepare* the employee, 2. *explain* the system, 3. *demonstrate* the system, 4. have the employee *perform* the system, and 5. *summarize* the employees' role in the system. This approach to employee training should be used once a specific milking routine has been determined. The flow chart facilitates

the training process because it forces the manager to define the system with details of each milking procedure. It documents the routine and clarifies questions regarding implementation steps. Alternative training methods such as videotapes can be used (3). These work best when customized for each parlor configuration and specific for the requirements of each dairy manager.

Monitoring the milking parlor completes the management process. The goal is to monitor both the system and the workers; both employee performance and milk quality results need to be evaluated. Since milking is a continuous process, monitoring should occur frequently. Deficiencies need to be identified and corrections made promptly. When performance and results are acceptable, positive reinforcement motivates employees and assures them that their work routine is correct.

Which performance traits and milk quality results should be evaluated? How frequently? And to what level are results anticipated? Answers to these questions are found in a concept called: "Key Performance Indicators"(KPI). KPI's: 1. a small number of strategic measurements, 2. collected from each area of the dairy (e.g. the milking parlor), 3. which represent general performance, and 4. can be measured and monitored daily. For example, milking parlor performance can be measured by cows per hour, pounds of milk harvested per man, per shift, per hour, or per stall. Each measurement has strengths and weaknesses regarding interpretation. From a management perspective, pick one! Monitor one parameter consistently. Recognize that while not completely comprehensive, it is a key indication of parlor routine and milker function. Milk quality measurements to evaluate milker and cow performance could include somatic cell count (from the bulk tank, from individual cows or as a composite of the herd), Standard Plate Count, coliform count, Laboratory Pasteurized Count, Preliminary Incubation Count, incidence of clinical mastitis (as new cases or repeat cases) and several more indices. Managers benefit from monitoring just one, two, or three of these indices. For example, SPC measures bulk tank bacteria numbers. When low, there is generally no need to measure other bacterial indices. When elevated, drilling down through other data may be necessary to troubleshoot the source of the problem. Baseline data evaluated daily is critical to ensure that systems are in control.

Information management on a dairy goes through four steps: collect, analyze, interpret and act upon. First, decide what to collect. The KPI concept might guide one to select cows per hour, SPC, SCC and incidence of clinical mastitis as key indices. Resolve issues such as who, how frequently and what form data collection should take. Entering information into one data collection point leads to the second step, analysis. Data is organized into spreadsheets, tables or graphs to permit its interpretation. This third step is accomplished by comparing actual results against predetermined standards. Ideally, this can be done on a daily basis to permit timely interpretation of results. When results exceed written standards, systems are in control and employees are implementing systems correctly; positive reinforcement through information feedback motivates them to continue to work correctly. Results less than anticipated require investigation to determine whether the problem is the work routine or the workers.

Summary

Quality management can be defined, understood and implemented; quality milk and optimum profitability result. A successful strategy to manage milking parlors requires defining (writing) a specific milking routine based upon scientific principles. Large parlors of various configurations require a time and motion analysis to determine which milking procedures are appropriate and much of this information exists in scientific literature (12). New guidelines will provide assistance to determine the milking procedures necessary to maximize milk yield, milk quality and cow throughput.

As parlors become larger, training employees to implement a specific milking routine becomes critical. Training principles are well documented; practical on-farm milker training is not currently done to the level implemented by many other business enterprises. Increasingly milkers coming from non-farm backgrounds are employed. Many are Hispanic and both cultural and language barrier pose hurdles for American dairy producers to overcome. Assisting dairy producers to both devise specific milking routines customized for each parlor and training milkers appear to be areas of opportunity for the milk quality consultant.

Technical advances in milking equipment data collection makes monitoring milking routine and milker performance timely and efficient (4). Dairy managers like their counterparts in other industries will increasingly utilize this information to improve quality outputs and manage their agribusiness enterprises.

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