PREPPING COWS: WHO NEEDS IT?

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Prepping cows, who needs it? The simple answer to the question is YOU DO! Every dairy and especially those using confinement housing should optimize pre-milking cow prep to meet quality standards of today. Although optimal pre-milking cow prep contributes to increasing milk yield, lowering "machine on" time, and improving udder health these are not the main reasons that pre-milking cow prep will be recommended in the future. Current trends indicate that main reason future dairies will optimize pre-milking cow prep is to satisfy the consumer mandate for milk quality and safety. Do not despair. The pursuit of quality is a winner for everyone; the cow; the farm; the processor and the consumer. Cow health, and productivity is maximized; the dairy farm efficiency and profitability will be realized; Processor product yield and quality is optimized; and consumer confidence and satisfaction is assured.

However, milkers, compelled by the speed of pre-milking cow prep rather than thoroughness, often fail to achieve either adequate teat sanitation or consistent milk letdown stimulus. In herds where there is more than one milker, there is usually a great variation in milking routine. All of these factors can contribute to lower milk quality, yield and poor udder health as well as inefficient milking. **It must be realized that whatever bacteria are not removed from the teat surface before machine attachment will end up in the milk.**

In the "real world," nothing is perfect; there will be tradeoffs between what is optimal and practical. While there are basic scientific principles that govern what is acceptable cow prep procedure, every farm is different. Therefore, there is no single cow prep procedure that fits all dairy farms. Review of the following list of factors may be helpful in determining what is best for your dairy. The ideal pre-milking cow prep routine should:

- Minimize water use
- Focus attention on teat surfaces
- Use a sanitizer (i.e. prep-dip)
- Assure complete pre-dip coverage of teat surfaces
- Allow pre-dip 30 seconds contact time
- Provide a minimum let down stimulus (teat massage, fore-stripping, teat drying) of 10-20 seconds
- Provide a prep-lag time of 45 –90 seconds
- Remove **all** dirt from teat surfaces
- Minimize machine-on time
- Minimize variation between milkers
- Not slow down milking

Inspired by the description of a standardized teat cleaning procedure used in an English study (17) and with the above list of factors in mind the so-called "Minnesota Pre-milking Cow Prep Method" was designed. The method has proven a successful means of achieving optimal pre-milking cow prep. There are two training videos currently available that describe this technique. For more information contact the following:

One-Step Cow Prep , 3M Animal Care Products, Sheri Kaddatz, 1-800-848-0829

Milk 'Em For All They're Worth, ABS Global or an ABS Representative, 1-800-ABS-STUD

In the context of a parlor we have found that preparing cows in groups of 3 or 4 work best (Figure 1). For stall barn application the use of an end-of-milking indicator is helpful in organizing the milking routine.

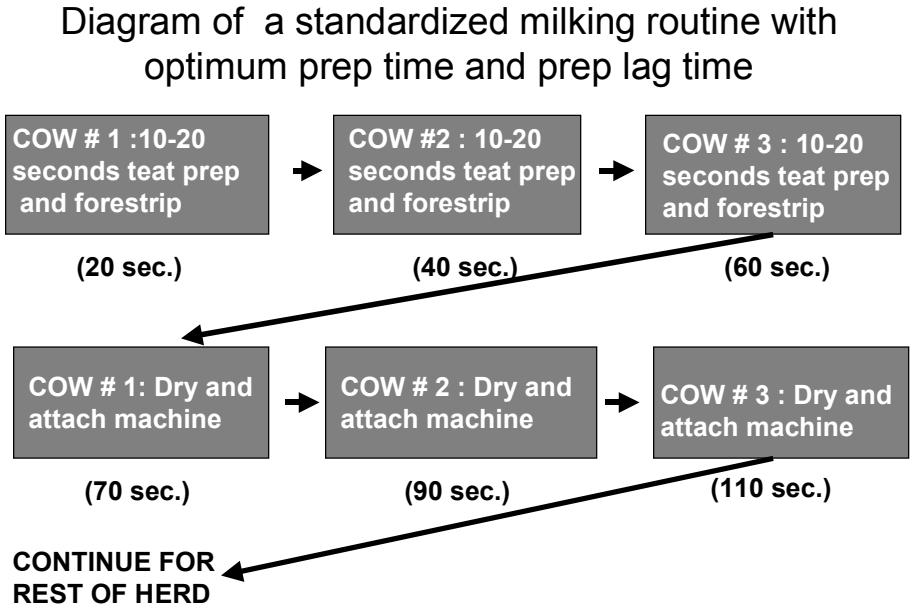

Figure 1: Flow diagram of the ideal pre-milking cow prep procedure in a milking parlor

Components of Pre-milking Cow Prep

Pre-milking stimulation. Prep time is defined as the time taken to manually clean and dry the teat surface. The object is to be sure that the teat surfaces are consistently clean and dry before the milking machine is attached and that adequate teat massage has occurred to stimulate milk letdown. With regard to pre-milking cow prep, Mein (18) states, "Today's high producing Holstein cows require very little stimulation for normal milk letdown. Therefore, the basis of a good pre-milking cow prep should be to ensure that teat cups are applied:

1) to visibly clean and dry teats with meticulous attention to detail, to reduce the risk of mastitis and to maintain top quality milk.

2) at or soon after milk ejection when teats are plump with milk.

3) with minimal time and effort for stimulation."

Some have interpreted "minimal time and effort" to mean no prep at all. Careful study of Mein's statement (above) and of the available data on this subject does not support that conclusion whatsoever. Recent studies demonstrate that less than 10 seconds is inadequate stimulus for consistent milk letdown response in all cows. While manual stimulation for 10 seconds will provide adequate milk letdown stimulus for American Holsteins in early lactation, it is not adequate for late lactation American Holsteins or European Fresians and Jersey cattle (21). Manual stimulation (washing, drying, forestripping) of 10 to 20 seconds does appear to be consistently adequate for most cows regardless of stage of lactation or milk production. It is often difficult to convince some milkers that taking sufficient pre-milking udder prep time to be assured of achieving adequate teat sanitation and milk letdown stimulus does not significantly lengthen total milking time.

Forestripping. Forestripping to check for clinical mastitis is a recommended premilking cow prep procedure. Today, many milkers resist forestripping because it is physically tiring and labor intensive. Forestripping, however, is a very powerful milk letdown stimulus and, therefore, is best used early during the cow prep procedure. However, if the premilking cow prep procedure is greater than 20 seconds, the addition of forestripping will add little advantage to milking efficiency (21). Therefore, in those circumstances where minimal cow prep (10 seconds) is being used the addition of forestripping to the cow prep procedure will ensure consistent milk letdown response.

Timing of machine attachment. Prep lag time is the time between the beginning of teat preparation to the application of the milking machine (Figure 2). Rasmussen (22) defines optimal milking efficiency as the highest possible milk yield obtained without milking on empty teats. **U.S. and Denmark studies have determined that prep lag timing is the most important factor in optimizing milking efficiency.** These studies report the ideal prep lag time to be 1.3 minutes (1 minute and 18 seconds) (21). The range of 60 to 90 seconds is accepted as the optimal prep lag for all stages of lactation. Prep lag times of greater than 3 minutes were found to result in more residual milk and lower milk yields regardless of stage of lactation (21). Excessively long prep lag times are more common in stall barn milking and likely limit herd performance. It seems clear that more effort needs to be made in using routines that optimize prep lag times.

Standardization. Cows love routine. They perform best when all feeding, milking, or any other management routine is done the exact same way every day (15). Complete lactation studies demonstrate a 5.5% increase in lactational yield when a standardized milking routine was used compared to an impulsive and variable milking routine (20). This evidence supports the

recommendation that the milking routine be designed so every cow is milked exactly the same at every milking regardless of stage of lactation or who is milker.

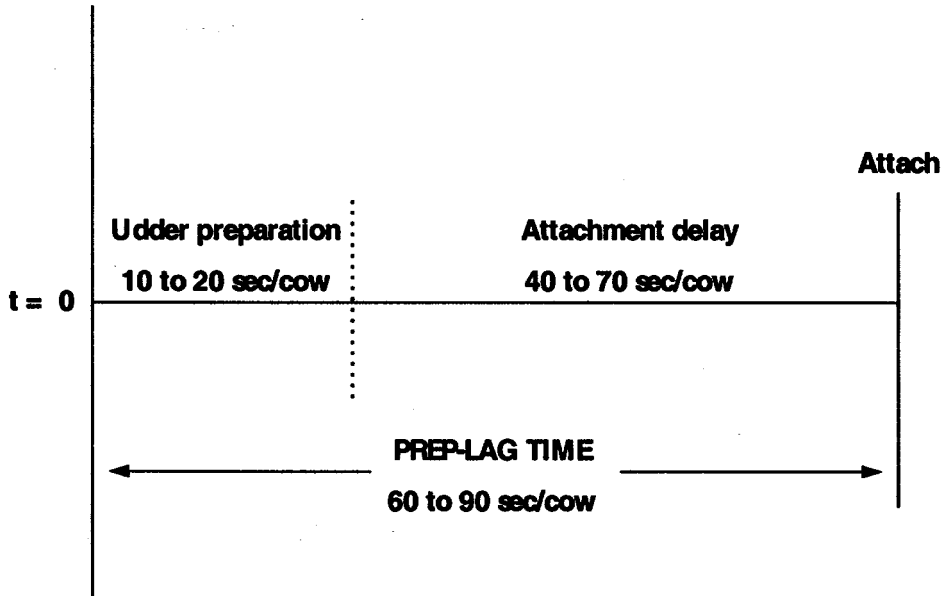

Figure 2. Division of prep-lag time into periods for udder preparation and attachment delay

Teat Cleanliness, Milk Quality, and Udder Health. Studies show that good cleaning and drying with separate towels will reduce bacterial populations on teat surfaces 75% (12). Predip data demonstrate that improved teat sanitation reduces intramammary infection rate (10, 13, 19). A French study demonstrated that clean teats are good predictors of herd BTSCC (11)(Table1).

Table 1: Relationship between teat cleanliness and somatic cell counts in French dairies

Cleanliness of Teats	Number of farms	Average somatic cell count
Very Clean	141	173,000
Clean	524	211,000
Average	299	241,000
Dirty	64	268,000
Very Dirty	13	281,000

Cow cleanliness has a great effect on cow prep efficiency. It is estimated that dirty cows will easily double cow prep time and, thus, unnecessarily slow down parlor throughput. Management practices such as clipping or "flaming" udders, docking tails, and providing freshly bedded, clean, dry and comfortable stalls will help to facilitate efficient pre-milking cow prep while improving milk quality and reducing mastitis risk.

Model to Describe the Effect of Prep-lag Time and Milk Flow Rate on Throughput

A rule-based model was written to describe the effects of prep-lag time and milk flow rate on throughput in herringbone and parallel parlors (24). The model is simply a collection of equations and values that were developed to represent the available literature (1, 2, 3, 4, 7, 8, 14). The model was developed for herringbone and parallel parlors up to double-20 in size. Rapid-exit was included for herringbone parlors with 10 or more stalls per side. The labor efficiency of each size parlor was set to be equal to the mean of the literature values used to calibrate the model. The model does not differentiate between herringbone and parallel parlors since the data indicates that the difference in throughput is slight or nonexistent (2). A detailed description of the model and the results of the study can be found at *www.ansci.umn.edu/dairy/dairyupdates.htm*

The most important rule used in the model is an equation that was developed to describe the impact of milk yield (lb/cow/milking) and prep-lag time (as defined in Figure 1) on milk flow rate. Milk flow rate and yield determine the unit on-time in a parlor and can have a significant impact on throughput. A graph of this equation is shown in Figure 3. The relationship was developed based on information provided in the literature (1, 8, 14, 21) and reflects observed trends. The graph clearly indicates that milk flow rate increases significantly with increases in milk yield and prep-lag time. Furthermore, as prep-lag time was increased from 60 to 90 seconds, the increase in milk flow rate was not as great.

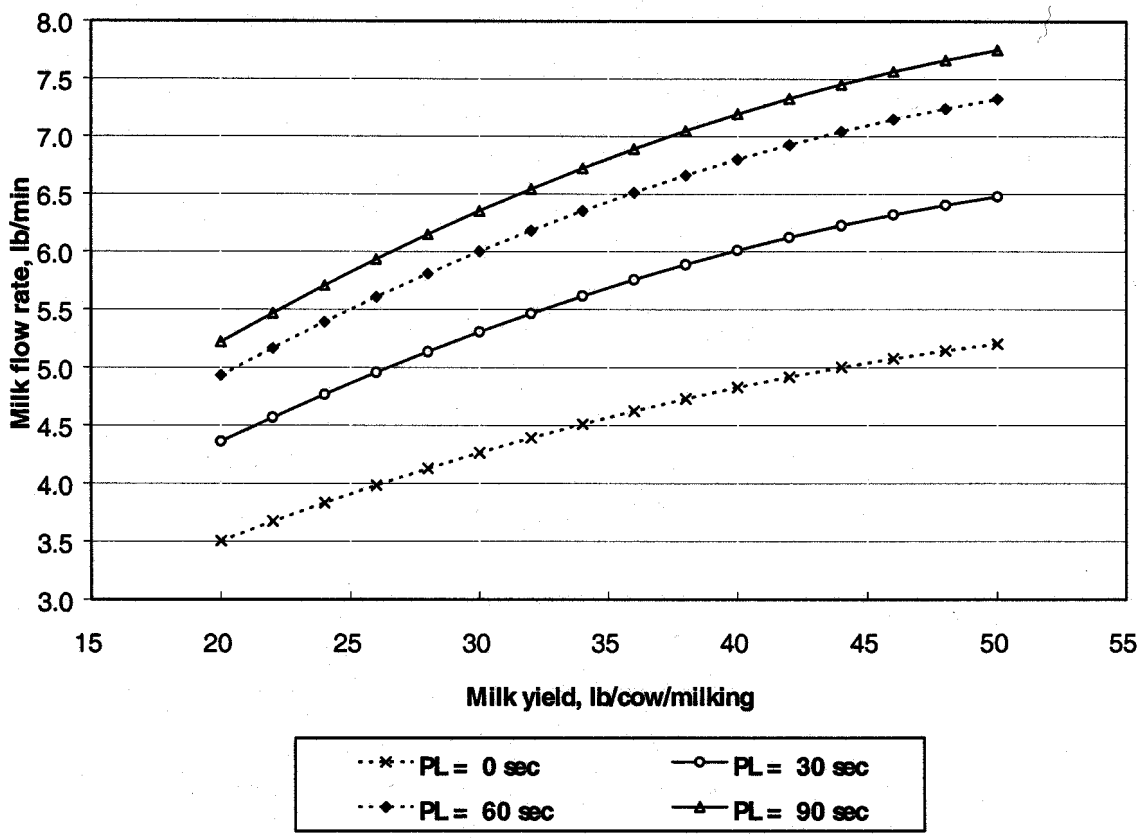

Figure 3. Variation of milk flow rate used in the model

Model Results. The model was used to calculate the effects of prep-lag time and the resulting milk flow rate on steady-state throughput rates of double 6, 8, 10, 12, 16 and 20 parlors with one operator. Prep-lag time was varied from 0 to 120 seconds, and milk yield was varied from 20 to 40 lb/cow/milking. Optimizing prep-lag is any combination of 10 to 20 seconds stimulation with an attachment delay to make a total of 60 seconds prep-lag time. The amount of time spent on non-prep tasks and delays was held constant. It should be noted that actual values can easily vary ± 10% around the model estimates due to variations in milk flow rates between herds, grouping of cows, operator skill and cow cleanliness.

Model results for a double 8 parlor is shown in Tables 3. The shaded regions in the table indicate the maximum throughput rates for the parlor. As was stated previously, research indicates that the optimum prep-lag time is from 60 to 90 sec/cow (21). The model results indicate that the optimum throughput rate also occurred at 60 seconds of prep-lag if milk yield was 25 lb/milking or more. **That is, the increase in milk flow rate associated with a higher quality udder preparation procedure was more than sufficient to offset the additional time required.** For a low producing herd, 20 to 25 lb/cow/milking, the optimal throughput rate often occurred at 30 to 40 sec/cow prep-lag. However, a prep-lag of 60 sec/cow was not detrimental.

The model also indicated that throughput rate suffers if too little or too much time is devoted to prep-lag. If the prep-lag time is between 0 and 30 sec/cow then the lower milk flow rate reduces throughput rate. If prep-lag time is more than 60 sec/cow then the increase in milk flow rate is not adequate to offset the additional prep-lag time. Therefore, to achieve optimal throughput, milk flow rate must be optimal. Milk flow rate is optimized at a prep-lag time of 60 sec/cow based on our review of the literature.

Table 3. Steady-state throughput (SST) for a double-8

Prep-	Milk yield, lb/cow/milking							
Lag, sec	20	25	27	30	33	35	37	40
0	71	65	63	60	57	55	54	52
10	75	68	66	63	60	58	57	55
20	77	70	68	65	63	61	59	57
30	79	72	70	67	64	63	61	59
40	79	73	71	68	65	64	62	60
60	79	73	71	68	66	64	63	61
90	76	70	69	66	64	63	61	59
120	70	66	64	62	60	59	58	56

It is interesting to note that the model results are in very close agreement with a 1985 milking routine study in a double 8 parlor where the "Minnesota method" was used (23). In spite of increasing the cow prep time 150% the total milking time for 534 cows was only slightly increased with the higher quality pre-milking cow prep procedure (Table.4).

Table 4: Effect of cow prep method on milking parlor throughput for a Wisconsin dairy

Milking group	Milk(lbs) per milking	Average DIM	Pre-milking cow prep method	
			Drop hose & water	"Minn. method"
Herd	27.5		73	71
Group 1	37.5	65	65	62
Group 2	31	132	68	65
Group 3	22.5	184	82	80
Group 4	14	265	90	91

Food Safety and Quality is the Bottom Line

While milking speed may be the short-term goal of many milkers and herd managers, production of quality milk is key to long-term success. **Remember!! Whatever bacteria are not removed from the teat surface before machine attachment will end up in the milk.** In the past, we have worried more about mastitis pathogens and the risk of mastitis; however, there is building concern about those bacteria affecting milk quality and food safety. There has been concern about Psychrotrophic bacteria and milk quality for some time. Psychrotrophic bacteria are normal inhabitants of the cows' environment. Teat surfaces are usually contaminated with these bacteria. These bacteria are undesirable contaminants of milk because they thrive well at refrigeration temperatures and can survive pasteurization. They are measured by preliminary incubation (PI) counts. The Dairy Practices Council recommends that PI counts should not exceed 100,000; that desirable PI counts are less than 25,000; and the goal should be less than 10,000. Boor et al (9) recently found that 42% of the 855 New York Dairies surveyed had PI counts greater than 100,000. Wisconsin studies have found that these bacteria are the source of proteolytic enzymes or plasminogen activators that reduce dairy product shelf life and yield (5). Plasminogen is a normal component of milk. In the presence of plasminogen activators, it is transformed into the active enzyme for Plasmin. Plasmin degrades milk casein. Plasmin activity continues during cold storage and survives high temperature treatment of dairy processing. In addition, the recent reports on the relationship of high SCC in pasteurized milk on taste quality and shelf life continue to add pressure on the need to produce higher quality raw milk at the farm (16). This is of great concern among dairy processors. Salmonella and Listeria are bacteria of human health concern. These are also found in the cows' environment and could easily contaminate teat surfaces. In light of these emerging concerns, it is doubtful that there will be any lessening of current PMO (Pasteurized Milk Ordinance) requirements to clean teat surfaces prior to milking. Dairy managers need to find practical ways to include pre-milking teat sanitation into every milking routine in order to ensure milk quality and safety.

The Attitude Factor is Important

Are you just milking cows or are you producing quality milk? Do you dip teats or do you consistently immerse teats in a teat dip? There is a difference and that difference is attitude.

Barkema et al. (6) may be one of the first studies where there has been demonstrated a direct and significant BTSCC difference between dairy farmers who were categorized by their management style as "clean and accurate" (BTSCC $<150,000$) and those categorized as "quick and dirty"(BTSCC 250-400,000). The association between management style and BTSCC was high ($p < 0.001$). Seventy-three percent of the high BTSCC (250-400,000) herds were categorized as "quick and dirty" and 74% of those farms with low BTSCC ($<150,000$) were categorized as "clean and accurate. The farmers categorized as "clean and accurate" were characterized as younger, more education minded, better record keepers and more hygienically meticulous. The most striking difference between the "clean and accurate" farmers and the "quick and dirty" farmers was that the former preferred to work precisely while the latter preferred to work quickly. For example, "clean and accurate" farmers:

- were more likely to use records daily
- rarely forgot to take milk samples for culture on the clinical cases
- enjoyed milking more
- were more likely to believe it is important to work hygienically with clean hands, boots, etc.
- less likely to start milking later than planned
- kept farmyard, milking parlor and bulk tank room cleaner as determined by a standardized hygiene scoring system

What Should be Done on Your Farm?

1. Do a complete analysis of your present milking routine in light of the above principles.

2. Design a practical milking routine with due consideration of your facility, milking equipment and milking personnel. Develop a written milking routine protocol for use as a job description and for training new employees.

3. Have routine milker meetings to train milkers, boost morale and to problem solve. Use available milking routine training videos (e.g., One-Step Cow Prep - 3M, or Milk Them for All Their Worth - ABS) as training aids.

4. Establish specific standards of performance (e.g., 100,000 SCC, or less than 5,000 Standard Plate Count) and keep milkers informed of how they are doing by charting performance measures of milk quality and mastitis. Praise milkers when they are doing a good job and challenge them to be continuously looking for ways for improvement.

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