Managing Mastitis in Today's Parlors

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Mastitis is still the most costly disease facing dairymen. This is a complex disease resulting from many causes and is affected by many factors. When a herd has a mastitis problem, it is important to look at the entire picture on the dairy. The most important areas are the cows' environment, the milking system and the people milking the cows. Rarely is one single cause responsible for a herd mastitis outbreak.

Today's modern dairies continue to get larger with many hired employees. Managers and owners have much less time to spend with details of managing mastitis and milking performance. It is important for owners and managers to understand what needs to be done with mastitis management and also how to direct and monitor employee performance in this regard. This paper will outline the 3 key areas of mastitis management; cow comfort and environment, milking systems, and milker performance. In addition, recommendations for monitoring these areas will be discussed.

The level of mastitis is directly related to the new infection rate and the cure rate. A mastitis control program must focus on reducing the new infection rate. Cure rates are often dependent on the cow's own immune system and the type of infecting organism, therefore, treatment protocols cannot be relied upon to have a high rate of cure. The new infection rate is directly related to the number and type of bacteria present on teat skin when units are attached to the cows, and therefore, can be managed. The key factors for reducing the new infection rate are:

- minimize the contamination of the skin and teat ends between milkings
- keep bacteria from entering the teat canal during milking
- reliably dip all 4 teats completely with an effective product after milking
- keep teat skin and teat ends healthy

Teat skin contamination is related to the cow's environment. Whether cows are housed in free stalls or dry lots, the bedding must be clean, dry and comfortable. Cows should be relatively clean. Udders and legs should be free from large areas of dried manure and bedding. A scoring system can be utilized which evaluates the number of cows with clean udders and legs versus cows with obvious manure and dirt. For example, Pharmacia has provided a scorecard system in their Q-Max Quality Plan for producers, which has photographs and descriptions of cow cleanliness levels. A score of 1 is a clean cow with no observable dirt on the udder, thigh or body, while a score of 4 shows a cow with very large areas of dirt and manure over the udder, legs and thighs. A goal should be set by managers regarding the acceptable number of cows having a score of 3 or greater, with the vast majority of cows scoring a 2 or less. Monthly or regular scores should be collected and employees involved in bedding care should be informed of the results. When results do not reach desired goals, action should be taken in the form of a procedure review, with discussion involving the people performing the work, and revision of procedures as needed.

Managing milking systems is important because milking machine function directly affects teat end health and entry of mastitis pathogens while the machine is attached. Teat end condition is directly related to milking duration. Milking duration is affected by udder preparation, vacuum level and take-off settings. Goals should be set for vacuum level and vacuum stability. Vacuum stability in the receiver jar and milk lines should be within .6" at all times during normal milking. Recommended peak flow claw

vacuum levels should be between 11.5" to 12.5" Hg when measured between the 1st and 2nd minute after unit attachment. It is important for producers to understand that lower vacuum levels result in longer machine on-time and slower milk out. Increased machine on-time will cause significant wear and tear on teat ends causing teat end hyperkeratosis lesions. Hyperkeratosis lesions greatly inhibit the cow's ability to naturally exclude bacteria from entering the teat end, and also make cleaning these teat ends very difficult. Automatic take-offs (ATO's), if used, should be adjusted to minimize machine on-time. With properly adjusted ATO's, and good pre-milking preparation, cows can be trained to milk out completely and quickly resulting in greater throughput and greater milk yield. A qualified professional should thoroughly evaluate milking machine function at least monthly in accordance with established National Mastitis Council guidelines.

A large dairy parlor can be managed more efficiently when cows enter with clean, dry legs and udders, and are milked with properly adjusted and maintained milking equipment. Many of today's larger milking parlors are typically run by hired personnel with little training or cow experience. Milker education and strict adherence to established protocols is of utmost importance in mastitis prevention and control. Regular evaluation of milking employee performance and additional follow-up coaching and training is absolutely required to prevent unwanted variation in routine and the development of unacceptable milking habits. It is natural for employees to drift from procedure and modify habits when owners and managers are rarely available to show an interest in their activities.

Milking routine and procedures should be customized for individual dairies. The size, style of parlor and number of employees available will determine what routine and procedures are necessary to arrive at the goal of milking clean, dry, stimulated teats at every milking. Milking routine refers to the positioning, timing and movement of people milking the cows. Milking procedures refer to the actual tasks performed during the routine. The most efficient types of pre-milking routines that will maximize milk quality as well as cow throughput, involve pre-milking hygiene and forestripping choreographed in a way that allows time for the cow to achieve proper milk let down. Management's goal should be to bring cows to the holding pen as clean as practically possible at every milking and in as calm a manner as possible. Cows handled in a calm manner move slower and have less manure splash on the front of their feet and lower body than do cows that are pushed aggressively to the parlor. Calm cows will more willingly enter the parlor and will have better primary oxytocin letdown during the pre-milking period, resulting in efficient throughput and improved milk yield.

Udder preparation is the key factor to reducing the new infection rate. The number of bacteria present on teat skin dictates the new infection rate. There is no one right way to prep cows. However, there are certain physiological principals that hold true for all cows. Manipulation of cows' teats during the pre-milking period is achieved by forestripping and toweling activities. This stimulation results in a nervous impulse that travels to the brain of the cow very quickly. The pituitary gland located below the brain then releases oxytocin after stimulation of the teats. This occurs very rapidly, within one to two seconds after the nerve impulse reaches the brain. The oxytocin is carried within the bloodstream and from there it is dispersed through the cow's body. It takes approximately 20 seconds for the oxytocin to reach the mammary gland and an additional 20 to 30 seconds to have full milk letdown affect. Renau and Chastain have reviewed and analyzed research data concerning oxytocin letdown and proper milking procedures. They state that a teat cleaning and drying process with a stimulation time on the teats of ten to twenty seconds is adequate to consistently achieve milk letdown while effectively sanitizing teats. In addition, a prep lag time of 60 seconds, which is the length of time between first stimulation to machine attachment, reduced average milking time per cow by .6 minute, increased mean milk yield by .7 pounds per milking and increased the average milk flow rate by .7 pounds per minute per cow. Therefore, the goal of any

pre-milking protocol is to effectively stimulate and sanitize teat ends of several cows before the first machine is attached to the first cow stimulated approximately one minute later.

The actual milking period when machines are attached is extremely important because this is the time when most cows are infected with mastitis bacteria. A major goal is to limit the number of audible liner squawks, a sign of outside air entering the system from around the base of the teats. Liner squawking, audible or not, may directly result in high velocity impacts of milk and bacteria back against teat ends, resulting in penetration of the canal by bacteria causing mastitis. Cows with adequate oxytocin letdown, dry and clean teat skin and properly positioned milking units will have few liner squawks, fewer units kicked off and, therefore, decreased new infection rates. In addition, properly stimulated cows will decrease flow rate abruptly at the end of milking allowing for rapid unit detachment. Adjustments should be made to equipment and management practices that are geared to milking cows as quickly, as gently, and as completely as possible. Milking cows quickly, gently and completely will minimize the machine effects on teat end and skin condition.

As soon as practically possible after the units are removed from the cows, teats should be dipped with a sanitizing, post milking teat dip. The primary purpose of post milking teat dipping is to flush off the milk film present on teats when units are removed and to leave a germicide on the teat skin. Application of post milking teat dips is important also to maintain soft, healthy teat skin, which is more resistant to colonization by bacteria. It is recommended to use non-return dip cups for applying dip rather than spraying. It is more difficult to quickly and adequately cover the entire teat surface with product from sprayers. Spray mechanisms also require a significant increase in dip consumption as compared to the dip cup. Remember to never return used dip to an original container and to clean dip cups after every milking.

Consistent cow handling, effective pre-milking stimulation, proper machine function and adjustment, and post milking teat dipping will reduce the new infection rate. Most dairymen are already well aware of these principles. However, these same dairymen are increasingly tempted to omit as many of the steps as possible in an effort to increase cow throughput. Because first calf heifers have lower overall SCC scores, when a new dairy begins with mostly first calf animals, the SCC will likely be acceptable regardless of the udder preparation or lack of udder preparation protocols adopted. If the same management and milking procedures are followed for the next several years, the dairy will likely have significant issues of both high somatic cell count and high levels of clinical mastitis.

Managing mastitis requires the monitoring of clinical case rates and somatic cell counts; however, in order to interpret the results of your monitoring effort, it is necessary to Know Your Enemy. Mastitis causing organisms are very different and have different prognoses for cure and varied potential for causing devastating outbreaks, therefore samples must be collected for culture. Mastitis bacteria are divided into two main groups, the contagious bacteria and the environmental bacteria. Contagious bacteria include *Strep. ag*, *Staph. aureus* and Mycoplasma species. These organisms are generally classified as parasites of the udder not typically found in the cow's environment and, therefore, infected quarters are the primary source of new infections in the herd. *Staph. aureus* and mycoplasma are considered to be chronic or permanent infections, generally not responding to treatment. The second group of bacteria is the environmental bacteria, which are typically found outside of the cow with very high numbers occurring in moist and soiled bedding areas. The most common types of environmental organisms are Streptococci bacteria (or Strep species bacteria) and coliforms. Coagulase negative staph species (CNS) are also common but are normally found on teat skin and hair, not soiled bedding. Staph species infections are also typically less severe than strep and coliform infections, but under certain circumstances may significantly contribute to elevated somatic cell counts and clinical mastitis. Any

mastitis causing bacteria, whether considered to be contagious or not, can contribute to contamination of the milking environment via infected cow's milk and lead to an infection of another cow.

Mastitis prevention programs were first developed to control the contagious mastitis organisms of *Strep ag* and *Staph aureus*. The most effective control program for contagious mastitis involves sample collection and culture of all animals, followed by the identification and segregating of infected animals for treatment, permanent segregation and/or culling. It is critical to identify any and all cows that are infected with these organisms because remaining infected animals are usually sub-clinical which means the milk appears normal even though they are infected. These animals will continue to contaminate the milking environment and spread infection to other animals, thereby, indefinitely perpetuating the problem. In the case of *Strep. ag*, the vast majority of animals can be treated successfully and recover or, in the case of chronic *Strep ag* cows or *Staph aureus* cows, the animals can be segregated and milked last until they are removed from the herd. Additional management procedures primarily used to limit the spread of these two organisms are effective post milking teat dipping, blanket use of dry cow therapy and milking procedure hygiene such as wearing gloves and single use towels. To prevent re-introduction of contagious pathogens, it is essential to establish an on-going system for sampling all new replacements and new clinical quarters. Consideration for sampling all fresh cows should be made if there is evidence of lingering infection within the herd. Mycoplasma control programs are fashioned very closely to those for controlling *Staph aureus*. Mycoplasma infections may become latent which means the cow will culture negative but may begin to shed contagious organisms again at a later time. Mycoplasma culture is performed as a separate process from the other organisms and likely will require a special culture request at most labs.

Many dairies have eliminated *Strep ag* and may have a very low prevalence of *Staph aureus* due to the successful implementation of such programs. On the other hand, clinical mastitis from environmental organisms is now the primary problem on many well-managed dairies. Additionally, mycoplasma infections will tend to appear sporadically due to the fact that the organisms can be carried in the respiratory or reproductive tract of normal healthy cows. Therefore, it is recommended that large dairies continually culture new clinical cases and monitor these organisms routinely. The best monitoring program consists of having individual somatic cell count data available on all cows on a monthly basis as well as bacteriological examination of both tank milk and clinical mastitis cases. Clinical mastitis records are very important for identifying repeat cases, problem cow groups, and treatment results. Minimal records should consist of the cow id, the quarter infected, and the date. On many dairies this information can be recorded in the herd's management software. Routine evaluation of this information is essential to determine the herd's current status and trends that are occurring in the herd over time.

Most new environmental infections occur at the time of dry off if dry cow therapy is not properly practiced. Dry cow bedding should be kept equally as clean and dry as the lactating herd. Another major source of new environmental intramammary infections is the period just before or right after calving. Sanitation practices must be optimized to minimize the new infection rate at this critical time. On some dairies the use of bedded pack areas for calving can essentially make it impossible to control these organisms even with good milking procedures after cows calve. The environmental bacterial load on the teats must be reduced before calving to reduce the new infection rate during the subsequent lactation.

Routine bulk tank culturing is one of the best ways to monitor the overall herd mastitis level and milking procedures. When quantitative bulk tank cultures are performed, high levels of environmental streptococci, environmental staphylococci and coliform organisms indicate breakdowns in the udder preparation process. The majority of these organisms present in bulk tank milk is coming from teat skin contamination but may also be significantly elevated in the case of chronic Strep non-ag infections.

Coliform infections in cows rarely result in elevated bulk tank coliform counts, while *Strep ag* and non-ag infections may elevate bulk tank plate counts to illegal levels. Bulk tank cultures also are important to demonstrate the presence of contagious organisms such as *Strep ag, Staph aureus*, or Mycoplasma species. However, a certain percentage of animals need to be infected and shedding bacteria for a bulk tank culture to report back as positive. A contagious mastitis problem may not be identified based on bulk tank monitoring alone until there are literally dozens of animals infected in a large herd. Therefore, large dairies should culture individual heifers and cows at freshening and segregate these animals until the cultures come back negative.

In conjunction with recommendations from the herd veterinarian, treatment protocols should be established and adhered to based on the organisms found. It is not always necessary to delay treatment until results are known but this may be something to consider. Some large dairies will segregate animals with contagious or otherwise non-treatable chronic infections such as *A. pyogenes*. *A. pyogenes* causes abscessation in the udder and is very difficult to treat. These cows tend to have recurring mastitis in the affected quarter. Dairy managers may also decide not to treat animals with mild coliform infections since most coliform infections do not respond more favorably when standard mastitis tubes are used. The results of whatever treatment protocol adopted should be regularly evaluated and changed if necessary. An important reason for culturing all clinical cows routinely is that one of the main causes for treatment failure could be mycoplasma or other opportunistic organisms such as yeast or Nocardia, which is introduced during treatment procedures when strict infusion hygiene is not adhered to. If dairy managers wait until an outbreak occurs before identifying a disaster such as this the dairy will likely lose many more animals than necessary.

If a routine bulk tank culture shows a positive mycoplasma result, the first place to look is the hospital treated group. Mycoplasma can be dynamite in a large dairy barn with many animals presented for intra-mammary treatment in close proximity. Collect samples from all animals currently undergoing treatment, or at least a sample of co-mingled waste milk from these animals. If no animals are found that have the infection and a follow-up bulk tank culture is still positive for mycoplasma, then it is necessary to culture samples from strings of cows to determine where the mycoplasma problem exists on the dairy. Occasionally, on every dairy that monitors bulk tank samples for mycoplasma, sporadic positive results will occur with no positive animals found. String samples are collected directly from the cold side of milk transfer lines and should represent only milk from animals of a particular group or corral. When sampling strings, milk filters should be changed between groups. Dairies can monitor for contagious pathogens, somatic cell counts and other parameters routinely using this technique with much greater sensitivity. This is especially important for operations of several thousand animals.

Individual cow cultures will be necessary for entire herds or strings of cows when contagious mastitis becomes a persistent problem on the dairy. Sampling technique is especially important in herd cultures to insure the results are meaningful and will yield a benefit for the dairy. If herd cultures or string cultures are necessary, additional personnel should be in the parlor when samples are taken. These individuals must be properly trained and understand the principles of collecting aseptic milk samples rapidly. Under no circumstances should samples be collected from an in-line system or milk metering devices for culture. Milk samples should be chilled immediately and kept frozen or on ice until brought to the lab for culture. Be sure the laboratory has a good reputation in your area and that they can be ready to handle large amounts of samples before you collect them. An ideal lab will provide information and materials for collection and will be able to report results back in a practical and timely manner. Two days for contagious Staph or Strep and seven days for mycoplasma should be sufficient.

Several other bacterial tests are currently run on bulk tank milk. Milk plants will run a standard plate count, which is the number of bacteria after incubation of 48 hours at 90 degrees Fahrenheit. Elevated standard plate counts (SPC) may be due to many different causes. High SPC can be due to poor or inadequate pre-milking hygiene, equipment cleaning and sanitation, or incubation of bacteria in the milk handling system. Mastitis may contribute to elevated SPC in the case of *Strep ag* and environmental Strep infections. If a lab pasteurized count (LPC) is run in conjunction with a normal standard plate count, a much better diagnosis of high bacteria counts is available for the dairymen. A lab pasteurized count is the number of bacteria per milliliter of milk, which survived laboratory pasteurization at 143 degrees Fahrenheit for 30 minutes. The LPC test typically kills the normal mastitis causing bacteria leaving only those organisms from the environment, which can survive the elevated temperatures. Normally LPC counts should be below 100. An LPC below 10 indicates excellent equipment hygiene. Another routine test on bulk tank milk is the coliform count. An ideal coliform count would be less than 10 organisms. Coliform counts between 100 and 1000 are generally an indication of poor milking hygiene. When these tests are available, it becomes easier to diagnose bacterial problems in the bulk tank milk. If equipment sanitation problems are present, there will be an elevated LPC count. When there is incubation of bacteria in the milking system, there can be both a high coliform count and/or high LPC count. Inadequate milking hygiene may result in elevated coliform counts but not high LPC counts.

Bulk tank culture (mastitis organisms and bacteria counts) can be very useful to monitor the effects of milking practices and changes to milking protocols and management changes when counts are taken before and after the changes are made. Charts and graphs of sequential bulk tank culture results from a dairy are most valuable for looking at the trends on the dairy. If only one bulk tank culture is available, be very cautious of making a diagnosis based on that information. The trends over time in bulk tanks are much more important than individual bulk tank cultures.

In summary, managing mastitis in today's parlors requires a system to measure and monitor all three areas of critical control, which are the cow's environment, the milking system, and the milking team. By setting goals and measuring results in specific areas, such as cow hygiene scores, bulk tank bacteria counts, presence of contagious pathogens in milk cultures, or somatic cell counts, the producer can monitor the success of the various programs on the dairy. When the results do not match the goals, then the program undergoes review and revision by the dairy management team.