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Milk quality and mastitis: troubleshooting & control program

By Jim Reynolds, DVM, MPVM
University of Calif., Davis VMTRC

Milk quality and mastitis are separate but very interrelated areas on a dairy. Milk quality refers to specific parameters in the saleable milk; in this case somatic cell count (SCC), total bacteria count or standard plate count (SPC), coliform count, and laboratory pasteurized bacteria count (LPC). Other milk quality issues such as flavors in milk and milk components will not be considered in this discussion. Milk quality is directly affected by mastitis and also by milk equipment sanitation and milk storage and handling.

Mastitis in cattle is defined as inflammation in the mammary tissue, usually caused by bacterial infection. There are many factors associated with infection of the mammary gland and controlling mastitis is one of the main management areas on a dairy. A mastitis program on any dairy has basically two components:

– preventing new infections
– doing something about a mastitis infection when it does happen

Because mastitis is caused by bacteria after they get into the udder, it is clear that mastitis control should focus on keeping bacteria out of the mammary gland. The bacteria that cause mastitis can be listed in two groups: contagious pathogens, and environmental pathogens.

Contagious mastitis is controlled by using control procedures in the milking parlor (identifying and segregating infected cows and keeping the milk from each cow away from the teat ends of other cows) and by post-milking teat dipping. Environmental mastitis is controlled by reducing the amount of bacteria at the teat end when the machine is attached.

In general, contagious mastitis is often seen as subclinical infections and herd SCC between 300,000 and 500,000; environmental mastitis is usually clinical, with sudden spikes in the SCC for cows or the bulk tank. Contagious pathogens are from within the cow's mammary gland and are spread cow-to-cow during the milking process. Environmental pathogens get on the cow's teat skin from dirt and manure the cow lies on and generally are not spread from cow-to-cow during milking.

Control starts with identification . . .

Pathogens are controlled by identifying infected cows from milk samples and either treating, segregating or culling them. Milkers must follow contagious control procedures such as using separate towels to clean and dry cows, and washing their hands after getting milk on them.

Environmental mastitis pathogens are controlled by keeping the cow's environment clean and dry and by sanitizing teats prior to milking.

Mastitis pathogens are grouped as follows, and are very useful in understanding how to prevent and control mastitis:

contagious
- *Staphylococcus aureus* (coagulase positive staphylococcus)
- *Streptococcus agalactia*
- Mycoplasma

environmental
- Coliform (eg: *E. coli*)
- *Streptococcus uberus* and *dysgalactia*
- Staphylococcus species (coagulase negative staphylococcus)

It is imperative that cows' teats be clean and dry before milking machines are attached. Bacteria on the skin of teats and udders are likely to enter teats through the teat sphincter during milking and cause mastitis. The end of the teat, the teat sphincter, is the cow's primary defense mechanism against mastitis infections. The main goal of mastitis prevention is to keep bacteria away from the cow's teat end before, during and after milking.

There are many factors involved in preventing and controlling mastitis infections. For contagious pathogens the first step is to identify infected cows. *Staph. aureus* and mycoplasma can be brought into the herd with purchased cattle or fresh heifers. Both *Staph. aureus* and mycoplasma have reservoirs outside the mammary gland and therefore cows can develop *Staph. aureus* and mycoplasma mastitis from themselves.

Mycoplsama exists as a commensal organism in many cows. That is, the bacteria lives in the lungs or the reproductive tract without causing clinical disease. It can flair up and go to the mammary gland and cause mastitis at any time. *Staph. aureus* is mostly an udder pathogen, but there are some cows with the mastitis strain of *Staph. aureus* on their skin. These out-of-the-mammary-gland reservoirs can provide bacteria for new infections.

Control of contagious mastitis pathogens in large herds requires routine sampling of milk from all purchased cows and all clinical cases to detect the presence of *Staphylococcus aureus, Streptococcus agalactia,* or mycoplasma. It is recommended that cows infected with *Staphylococcus aureus* or mycoplasma be culled immediately because these pathogens do not respond to treat-

ment and infected cows will serve as reservoirs to infect other cows during the milking process. Cows infected with *Streptococcus agalactia* can be successfully treated and kept in the herd.

If purchased cows are not sampled for contagious mastitis pathogens there is a probability that some will be infected and the organisms will spread in the herd.

The second main step in controlling contagious mastitis is to use individual towels to clean and dry cows prior to milking. Using a towel between several cows risks taking bacteria from the teat end of one cow to the teat ends of other cows. The hands of milkers must also be kept clean of any milk that gets on the hands during the milking process.

The final step in controlling contagious mastitis pathogens is to dip cows' teats after milking with an approved post-milking teat dip. This is because *Staphylococcus aureus* and *Streptococcus agalactia* can be at the teat end after milking and can colonize the tissue and invade up through the teat sphincter and into the mammary gland. Properly dipping the teat after milking kills these bacteria and can reduce new infection rate with contagious pathogens.

Post-milking teat dip should have an emollient system in it to maintain the integrity, or health, of the teat skin. This is very important on drylot dairies during winter when cows' teats can be expected to be exposed to wind, rain, mud and manure. Teats can become chapped and crack under these conditions. This can be painful to the cow and she may not let her milk down when the machine is attached due to the discomfort. The post-milking teat dip must be selected to maintain the health of the teat skin during different times of the year.

Environmental pathogens essentially come from the environment the cow lives and lies down in, and therefore are best controlled by keeping cow housing clean and sanitary. Cows lying in manure, mud and water will have more environmental bacteria on their udder and teat skin when they enter the milking parlor and will be at higher risk of them entering through the teat sphincter and causing mastitis.

The first step in controlling environmental mastitis is to keep corrals clean and dry. Procedures at the milking parlor can only clean a small amount of manure, dirt and bacteria from the udder and teats. Wash pens are often necessary to remove the majority of manure. It is absolutely necessary that cows' teats and udders be clean and dry before the machine is attached to control mastitis. It is sometimes recommended that the cows' teats be dipped with an approved disinfectant prior to milking and that this pre-dip be wiped off before the machine is attached. Pre-dipping can help clean the teats and help decrease cases of environmental mastitis.

A very important part of mastitis control on dairies is detection of clinical cases. Milkers must be trained to detect cows with mastitis and hold or separate them from the rest of the pen, and they must be treated, segregated or culled. Cows with clinical mastitis have inflammation in the mammary gland (heat, swelling, pain) and changes in the milk (watery milk or clumps of protein). If cows with clinical mastitis are not detected and taken care of correctly, the infections are likely to become sub-clinical. Sub-clinical infections are not detectable by observation of the milk, and cows with sub-clinical infections from contagious pathogens will serve as reservoirs of bacteria to infect other cows during the milking process. It is commonly recommended that all clinical cases have milk samples taken and cultured by a mastitis laboratory to detect cows with contagious pathogens.

Because mastitis is inflammation in the mammary gland, the products of inflammation can be used to monitor mastitis in cows and the herd. The most common way is to measure the somatic cell count (SCC). Somatic cells in the mammary gland are

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mostly white blood cells (neutrophils) and SCC increases during infection. The amount and time of increase in SCC depends on the type of bacteria causing mastitis, the cow's immune system, and chronicity of the infection. The relationship of SCC level in a cow or herd to infection and management can be described as:

Somatic Cell Count = new infection rate X duration of infection

For example: if no cows on a dairy get mastitis, SCC will be low. If all the cows get mastitis but are detected immediately and treated perfectly, SCC will be low. If cows get mastitis but the cases are not detected or treated appropriately, SCC will be high. This simple equation exemplifies the fact that the dairy must do all it can to prevent mastitis (keeping the cows clean and dry, finding the cows with contagious pathogens), and also detect the cases that do happen quickly and treat, segregate or cull the new cases appropriately.

The following summary of factors associated with mastitis is taken from Sears et al, *"Procedures for mastitis diagnosis and control"*, in The Veterinary Clinics of North America, Food Animal Practice, Update on Bovine Mastitis, November 1993, pg. 448:

Environmental organisms (usually clinical)
Coliforms, *Strep.* species, *Staph.* species
associated factors:
clean/dry bedding
clean udders
premilking udder preparation
proper milking procedure
milking machine maintenance
dry cow management
adequate vitamin E/selenium

Contagious organisms (usually high SCC)
Staph. aureus, Strep. agalactia (also mycoplasma)
associated factors:
proper milking procedures
milking machine maintenance
teat dipping
maintain closed herd
culture purchased animals

There are two basic ways to know if your herd has too much mastitis: the mastitis case rate and somatic cell count. The mastitis case rate is the more sensitive measure if cases are being detected early because SCC increases (for most bacterial mastitis) as the infection progresses and because individual cow SCC is reported only once per month at test day. The California Mastitis Test can be used on suspect cows to improve the detection of mastitis.

It is commonly advised that less than 3 percent of cows in the herd should be in the hospital pen with mastitis and waiting for treatment withdrawal, or less than 1 percent of the herd have mastitis on any day.

A normal mammary gland has 200,000 SCC/ml of milk or less. Above 200,000 is considered inflamed and therefore infected. Individual test day SCC can be graphed by most dairy software programs to determine the number or proportion of cows without infections, with new infections, recovered from infections, or having chronic infections (current SCC by last test SCC). This can help the dairy determine how well mastitis is being detected and treated. Less than 10 percent of the herd should have high SCC in both the current test SCC and the previous test SCC. If more than 10 percent is in this area, then either cows with mastitis are not being detected (poor detection by the milkers), the herd has a high rate of subclinical mastitis (possible contagious mastitis problem), or cases are not being held out and treated properly.

Mastitis control on large dairies should be thought of as a system that provides clean and dry housing, moves cows into and out of the milking parlor calmly, sanitizes udders before machines are attached, detects mastitis quickly, and treats or culls infected cows promptly. Cows should be routinely sampled and screened for contagious mastitis, and herd SCC used to monitor level of inflammation in the herd and the detection and responses to treatment.

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For further information contact:
Dr. Ragan Adams, Editor
ILM, CSU-VTH
300 W. Drake Road
Fort Collins, CO 80523
970-297-0371
radams@lamar.colostate.edu