



UNIVERSITY OF
FLORIDA

IFAS EXTENSION

Milking Management II - Mastitis¹

Bray, D. R. , Schearer, J. K. ²

Mastitis is the costliest disease of the dairy industry today. Losses are estimated to be as much as \$200 per cow annually. It is obvious that dairymen must control this disease to achieve maximum profit from their enterprise.

As explained earlier, epithelial cells synthesize milk constituents (protein, fat, lactose). Mastitis is a bacterial infection and destroys these milk-secreting cells. Scar or connective tissue replaces the milk secreting tissue which results in a permanent loss of productive ability.

Mastitis organisms enter the udder through the teat end and streak canal. The streak canal is held closed by a circular muscle that holds milk in and foreign matter out, and is lined with keratin, which traps and kills organisms that attempt to invade through the teat end.

MASTITIS-CAUSING ORGANISMS

About 95% of all infections are caused by *Streptococcus agalactiae*, *Staphylococcus aureus*, *Streptococcus dysgalactiae*, *Streptococcus uberis*, and *Escherichia coli*. The other 5% are caused by other organisms.

Contagious Organisms

These are spread by hands, milking units, etc.

S. agalactiae lives in the udder and cannot exist outside the gland for long periods. It is susceptible to penicillin and, once eliminated, usually does not return to the herd unless infected cows are purchased.

S. aureus lives in the udder and on the skin surfaces of an infected cow. It can be controlled effectively with good management and is moderately susceptible to antibiotics when the infection first infects the gland, older infections usually do not respond to treatment. Severe cases may cause death.

S. dysgalactiae may live almost anywhere: in the udder, rumen, and feces and in the barn. They can be controlled with proper sanitation and are moderately susceptible to antibiotics.

Mycoplasma is a unique organism. It does not fit the description of a bacterium or a virus and is classified as a microbe. Mycoplasmas do not have cell walls, leaving them unaffected by most antibiotics that interfere with cell-wall formation. Since no effective treatment is available, the best way to control this disease is to avoid purchasing cattle from known positive-tested herds. In addition, if

1. This document is DS63, one of a series of the Animal Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date April 1993. Reviewed June 2003. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

2. Extension Agent III, Dairy Science Department; Associate Professor, College of Veterinary Medicine; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611.

cattle are routinely purchased, the bulk tank and pot herd milk should be sampled monthly. Mycoplasmas can be spread through the use of contaminated bottle mixes, syringes, and teat tubes in treating mastitis cows. Other infected cows are major sources of infection which can be transmitted by the milking machine components, hands of the operator, use of common rags and sponges, and directly from the environment. Teat dipping is essential for proper control.

The spread of contagious organisms is controlled by teat dipping and are eliminated by dry cow therapy. Herds with contagious mastitis problems usually have to get back to dip cups and cover the whole teat to the base of the udder to control the spread.

Environmental Organisms

These live in the cows' environment and are always present.

E. Coli bacteria are environmental pollution organisms; they live in feces, polluted water, and bedding material. Excellent sanitation is needed for their control. They are not susceptible to antibiotics.

S. uberis live most everywhere; in the rumen, feces and even in the udder. They can be controlled by proper sanitation and milking clean, dry udders.

Pseudomonas aeruginosa lives in wet, muddy areas. It often is introduced through the teat canal as a result of careless treatment procedures. Dairymen must take care to scrub the teat ends with cotton and alcohol before injecting antibiotics into the udder. This organism can be controlled with good sanitation.

Infections

The rates of new infections are the highest during the first two weeks of the dry period and the last two weeks of the dry period. New infection rates are also high in early lactation and diminish as the lactation proceeds.

To understand mastitis infection, you must realize how its level changes on a herd basis. New infections can be brought into the herd in four general ways:

- new infections during lactation;
- new infections during the dry period;
- infected heifers entering the herd; and
- infected cow purchases.

Infections are eliminated in four general ways:

- spontaneous recovery, elimination by the animal's own defense mechanism, 20% effective;
- use of lactation therapy, usually 30 to 40% effective;
- dry period therapy, usually 80 to 90% effective; and
- culling the animals, very effective (100%).

Somatic Cells

Somatic means of the body. Thus, a somatic cell is simply a body cell. Examples are skin cells, muscle cells, bone cells, or virtually any cell in the body. In milk, however, the predominant cell types are epithelial and white blood cells.

Epithelial cells of the alveoli are most numerous and active during early lactation when milk production is greatest. Throughout the cow's lactation these cells slowly age and gradually are sloughed into the milk. Milk production drops during late lactation as these cells become fewer and less productive. While this is a dynamic process, the number of epithelial cells found in milk is relatively constant throughout lactation.

The other group of cells consistently found in milk are the infection-fighting cells of the body, the white blood cells. They always are present in the udder. However, in the presence of an inflammation they increase to tremendous numbers. Since inflammation generally results from infection, high somatic cell counts in milk are associated with mastitis.

MASTITIS CONTROL PRACTICES

Mastitis can decrease total milk production by 15 to 20%. To minimize loss and achieve maximum milk yield, a practical milking management scheme should be followed.

Proper Milking Procedures

Proper milking procedures are important for the prevention of mastitis and for insuring complete milk removal from the udder.

The term milking management also includes care for the environment in which cows are housed or pastured. The dairy cow should have a clean dry environment. This helps reduce the potential for mastitis and increases milking efficiency by reducing time and labor to clean udders before the milking process.

Cow Movement

Movement of cows should be in a quiet gentle manner. If cows are frightened or hurried, the milk letdown process may be disturbed. Therefore, rough handling of dairy cattle should be avoided.

Mastitis Detection

Milking may begin with a check of all quarters for mastitis. It is acceptable to strip milk onto the floor in a milking parlor or flat barn. Any cows that show clinical mastitis should be examined and appropriate action taken. If foremilking is not done, visual checking for inflamed quarters is done by milkers and herd health people.

Udder Preparation

The object of udder preparation is to ensure that clean dry udders and teats are being milked. The pasteurized milk ordinance (PMO) also states that a sanitizer must be applied before milking. This task may be accomplished by using an approved sanitizer injected in the floor mounted cow washers or by using a hose and water with a sanitizer on the parlor. Single service paper towels or washed and dried cloth towels may be used.

Premilking Teat Dip

Predipping with teat dip has become popular. The advantages may just be getting the water out of the milking barn so wet udders are not being milked.

The procedure for predipping involves washing of teats with water and a sanitizer. The teats are then dried with an individual paper towel and dipped or sprayed with the sanitizer. A 30-second contact with sanitizer is needed to kill organisms. Then the sanitizer is wiped dry with a paper towel. The cows are milked and teats are dipped with the same type of sanitizer to prevent chemical reactions that could cause irritation to teats.

Predipping may be beneficial in reducing mastitis, but the actual dipping, dip contact time, and wiping with a towel increase the total milking time. If the dip is not wiped off, excessive chemical residues in milk may occur. If contact time is not sufficient then it's a very expensive premilking regime.

Milking Unit Attachment and Detachment

To attach the milking unit to the teats, apply the cluster allowing a minimum of air admission and adjust to prevent liner slip. Air entering the unit may cause the propulsion of mastitis organisms from one infected teat into a noninfected teat. This also may happen when one teat cup is removed before the others.

Machine stripping usually is not needed on dairy cows. Machine stripping should not take more than one minute and no air should be allowed to enter the teat cups while this is being done. A downward force applied to the cluster while massaging the udder with the other hand is all that is needed.

Following milk-out, the machine should be removed only after the vacuum to the teats is shut off. This is accomplished most commonly by use of a vacuum shut off valve or milk hose clamp which prevents the backjetting of bacteria from one teat to another.

Use of Backflush

Backflushers have been developed to sanitize the liners and claws between milkings. Most units on the market have four or five cycles. The first cycle is a water rinse, followed by an iodine or similar sanitizer rinse, a clear water rinse, and positive air dry cycle.

Research has demonstrated that backflushers do reduce the number of bacteria on the liners between cows, but do not reduce the number of bacteria on teats. Backflushers also may stop the spread of contagious organisms, but this can also be accomplished at a much lower cost by teat dipping. There is no effect on environmental pathogens that are encountered between milkings.

Backflushers may be effective in stopping the spread of contagious mastitis; however, there is limited research to support this view. Because of the high initial cost, need for daily maintenance, and limited efficacy, backflushers are not routinely recommended.

Post-Milking Teat Dip

There is only one way to effectively stop the spread of mastitis in the dairy herd, and that is by applying teat dip to every quarter of every cow after every milking. Teat dips are used to remove milk residue left on the teat and kill organisms on the teat at the time of dipping. They also leave a residual film of sanitizer between milkings.

Are teat dips effective against all mastitis organisms? Yes, teat dips have been shown to effectively reduce mastitis caused by *S. aureus* and *S. agalactia*, the most common types of mastitis found in Florida.

There seems to be much controversy about the effectiveness of teat dipping on environmental pathogens *E. coli* and *S. uberis*. Some research has shown that teat dipping does not control these organisms. These pathogens are found in the cow's surroundings; if there is udder-deep mud, the teat dip will be removed and a new infection may occur.

There are many effective teat dips, including iodine at 0.1%, 0.5%, and 1.0%, and chlorhexidine at 0.5%. Also, although it is not labeled for teat dipping,

hypochlorite at 4.0% with a sodium hydroxide content less than 0.05% was effective in field trials. There are many more teat dips on the market that are effective in preventing new infections. Effective coverage of the teats is more important than the type of dip being used.

If contagious bacteria is present in your herd, *S. agalactiae*, *S. dysgalactiae*, *S. aureus*, or mycoplasma, you must dip the whole teat to the base of the udder to stop the spread. Wand sprayers are acceptable for herds that have environmental mastitis, since teat colonization is not a factor. Hand-held spray bottles are almost worthless in getting proper coverage of dip on the cow's teats, so they should not be used.

Dry Cow Therapy

Dry cow treatment is administered after the last milking of the cow before the dry period. Care must be taken to scrub the teat end with cotton and alcohol before infusion and to use teat dip after infusion.

There are many antibiotics available for dry cow therapy. High levels of penicillin and dihydro-streptomycin, the cloxacillins and other products specifically for dry treatment are effective.

The idea of dry period therapy has been accepted because antibiotics can be put into a slow release base that allows them to stay in the udder longer. They are not constantly being milked out of the udder as is the case with lactation therapy. Antibiotics can be administered in higher quantities because there is no concern for milk levels and antibiotic residues.

While dry treatment is very effective, it must be administered properly and the dry cows must have favorable environmental conditions. Teat ends must be scrubbed clean with cotton alcohol pads before injecting the dry treatment. If the teat ends are not cleaned properly, you may inject into the udder very high numbers of bacteria, which would overwhelm the antibiotic just administered. Unsanitary treatment procedures cause rather than eliminate mastitis.

Management of dry cows also is very important in mastitis control. If dry cows are exposed to muddy or dirty conditions, risks of mastitis will increase. This is especially true at the time of calving; cows are

under much stress during this period and if an udder is exposed to wet dirty conditions, mastitis will increase. If you believe that your dry cow therapy program is ineffective, it may be because of poor treatment procedures and/or improper management of the cows during the dry period and at calving.

Culling

Culling cows for mastitis is effective in eliminating mastitis in the herd. Cows that have been treated many times in a single lactation are prime candidates for culling, as they may no longer be profitable because of discarded milk and antibiotic costs. It is usually more profitable to carry out preventive mastitis control procedures and cull only old chronic cows rather than to try and control mastitis by routine culling.

Milking Machine Factors

Research has demonstrated that "liner slip" is one area in which the milking machine may increase mastitis. This is when air is admitted through the top of the teat cup. Milk and bacteria, if present, may be propelled into the teat end of an adjacent teat, thus causing a new bacterial infection. Also, the use of malfunctioning pulsators can cause teat end damage and increased the rate of new infection.

The milking machine has little effect on mastitis if properly operated and functioning according to the manufacturer's specifications. Clearly though, when operated improperly, milking machines can have a role, and malfunctioning equipment can cause mastitis in several ways. If the pulsator is dirty and does not function properly, this will cause the massage phase to be eliminated with the teat end being damaged. A vacuum controller that is dirty also will not function properly and again damage the teat end. Damage to this entry area for organisms increases the risk of mastitis.

SUMMARY OF RECOMMENDATIONS FOR MASTITIS CONTROL

Mastitis is a very costly disease, but losses can be reduced greatly by following an effective control program, which should include the following items:

- Handle cows gently to achieve highest production.
- Follow proper milking procedures, milk clean, dry udders, apply milking units properly, and make adjustments to prevent the admittance of air into the teat cup liners and prevent liner slip.
- Dip cow's teats after milking to prevent new infections.
- Treat all cows going dry with an approved dry cow drug in commercially prepared tubes to eliminate existing infections and prevent new infections during the dry period.
- Cull chronically infected cows.

TROUBLE-SHOOTING A PROBLEM HERD

Since mastitis can be caused by man, machine, and the cow's environment, all items must be checked to determine its cause.

What is a mastitis problem herd? Any herd that continually has a cell count above 400,000 cells/ml can be considered a problem. But herds that have a cell count of nearly 750,000 cells/ml, and are close to losing their market, are usually considered a problem.

Variations in Clinical Mastitis

The number of cows or quarters treated for clinical mastitis can vary from herd to herd even though they may have identical mastitis occurrence. The time or season of the year also may be a factor. An average of 1 to 3% of the cows in the pot herd (per day) over a year's time is probably typical for a Florida herd.

An increase or decrease in the number of clinical mastitis cases may result from a change in the people doing the milking. If the milkers stop checking for clinical mastitis, the number will decrease. If no one had been checking for clinical mastitis and suddenly started checking, the number of cases would increase dramatically even though nothing had changed in the mastitis level of the herd. In many herds, number of cases increases during hot, muddy conditions when environmental organisms are the cause.

Do you have a herd mastitis problem, or just a few cows with a mastitis problem? By recording cows treated during one consecutive month and comparing them with the cows treated in the previous month, you can determine if the same cows are being treated over and over again. If so, you may consider removing those cows from the herd.

If most new cases of mastitis occur at calving, you should review your dry cow program by asking yourself three questions.

- Are all cows dry treated with an approved dry cow antibiotic?
- Are teat ends cleaned with cotton and alcohol before treatment?
- Are dry cows kept in a clean dry environment and allowed to calve in a clean dry place?

Problem Solving When Cell Count Range Is 400,000-750,000 cells/ml

1. Clean pulsators.
2. Clean vacuum controllers.
3. Check milking procedures. Are you milking clean, dry udders and shutting off vacuum to the claw before removing the unit?
4. Check teat dipping procedures. After milking, is there any visible dip on the teats? In problem herds, teat must be dipped with a cup not sprayed - dip to base of udder.
5. Review your dry cow program. Are all quarters dry treated before going dry?

Problem Solving When Cell Counts Are Above 750,000 cells/ml

1. Follow procedures 1 through 5 above.
2. You are in danger of losing your milk market; you may wish to use the paddle test or use individual cow cell counts to identify high count cows. Late lactation pregnant cows can be dried off early. You may wish to cull late lactation cows that are not pregnant. If this does not lower your cell count enough to sell milk, more drastic measures must be taken. Treating all the high

cell count cows will usually lower the cell count but, because of the high cost of drugs and dumped milk, it will be very expensive.

3. Consult your veterinarian, county agent, or sanitarian for further help. Your county agent also has other fact sheets available on mastitis and checking milking equipment.

How to Handle Mycoplasma Problem Herds

You only know if you have mycoplasma if you sample for it. Since it's untreatable, you should prevent it, or at least prevent the spread of it.

No Sample Approach

- Teat dip to stop the spread from cow to cow during milking.
- Use only commercial tubs - use no bottle mixes to treat intramammary.
- Examine cows for the following usual mycoplasma symptoms:
 - More than one quarter with clinical mastitis.
 - Mastitis does not clear up with treatment and the cow does not show any sign of sickness.
 - Drop in milk production.

If you routinely cull the above type animals, mycoplasma will come and go and you will never know it. It won't spread if you do a good job of teat dipping and no bottle mixes are used.

Simple Sample Approaches

Perform regular bulk tank analysis. When mycoplasma appears:

- Make sure you are doing a good job of teat dipping and use no bottle mixes.
- Cull cows with multiple quarters exhibiting clinical mastitis that doesn't clear, and cows that seem healthy.

This approach usually will take care of these problems.

Full Scale Samples

Full-scale samples are expensive. Therefore, take great care in sampling. Use rubber gloves that are sanitized between cows, or you will spread from sample bottle to sample bottle and think you have an epidemic when you only have a couple of cows infected. Epidemics usually happen by spreading from cow to cow using bottle mixes. If you have an epidemic and use bottle mixes, review your pot herd records; these are your mycoplasma cows.

What Not to Do in a Mycoplasma Problem

- Panic.
- Sample the whole herd (expensive).
- Rinse milkers with water.
- Buy backflushers.
- Try to separate cows (unless you have hundreds). This usually changes milking routines and cause many other problems and is not effective anyway.

Trouble-Shooting a Herd with a High Bacteria Count

High bacteria counts usually are caused by poor cleaning of milking equipment or improper cooling of the milk and herds with *S. agalactia*.

1. Check hot water temperature in the wash sink at the start of wash-up. It should be 160°F at the start, and 110 to 120°F at the end of the wash cycle.
2. Check hot water temperature during the rinse cycle. It should be cool, not hot. Rinse water should be discarded.
3. Be sure the proper amount of pipe line cleaner is being used. The cleaner must be stored with the cover on. Chlorine will evaporate if cover is left off.
4. Use a dairy sanitizer before each milking. Bulk chlorines don't always work.
5. Be sure the air injector works. If it does not, poor cleaning will result.
6. Clean out all vacuum lines, from pump to trap, and all pulsator lines with a lye or cleaning solution.
7. Replace every rubber or plastic hose in the system, including liners.
8. Dismantle and clean the milk pump.
9. Check milk temperature. If high, recharge the cooling system.
10. If there is a build up of material in the lines, it may be necessary to dismantle all milk lines and clean them with a brush. The bulk tank also may have to be manually scrubbed to remove build-up.
11. If you have a high somatic cell count (SCC) along with a high bacteria count, you may have a cow problem and you must treat it like a high SCC problem.