

Mastitis Management for Today's Dairies

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Introduction:

For most dairy producers, mastitis is the costliest animal disease that must be managed. When the udders of cows become infected, a host of expenses and losses occur: milk must be discarded and production potential is reduced, animals sometimes must be culled which results in added replacement costs, potential superior genetics are lost, treatment expenses reduce profitability, reproductive performance can be reduced, extra labor must be expended, and an immeasurable level of stress on the management personnel occurs. These costs are estimated to be at least \$185/cow annually in the U.S. If mastitis didn't exist, the lives of all dairy producers would be much easier (so would the lives of the cows). But since there is mastitis, producers must know how to manage it to remain profitable and stay in business.

When talking about mastitis we usually speak of "controlling" the disease. I would rather talk about "managing" the disease. In my dictionary one of the definitions for control reads "to check or regulate". Also in that dictionary the word management is defined as "the judicious use of means to accomplish an end". To me, that definition better describes what producers must do with mastitis. They must use their resources wisely when dealing with mastitis to produce a profit from their business, in spite of the limitations and challenges created by mastitis. They must do more than just check or regulate the disease.

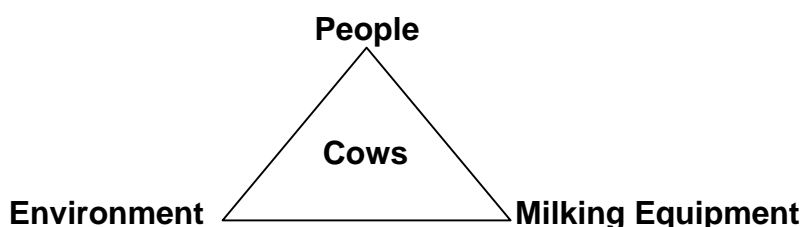
Discussion:

To manage mastitis, dairy producers must be willing to change old habits or ineffective/incorrect practices that may be causing or permitting new intramammary infections (IMIs) to occur. Dairy herd managers should establish a team of consultants to both develop a mastitis management program for the dairy, and also to conduct a semi-annual review (or more frequently if warranted) of the effectiveness of the program. People to involve on the team should be the veterinarian, milk handler field representative, nutritionist, milking equipment representative, and other knowledgeable consultants who provide advice, information, and service to the dairy producer concerning herd management practices.

Many of the program concepts of HACCP (hazard analysis and critical control point) and TQM (total quality management) are incorporated into the approach of using a team to establish and monitor a mastitis management program. Determining what practices might cause mastitis and low quality milk, and then making the changes necessary to prevent those situations from occurring is the objective of HACCP. Likewise, the TQM program emphasizes the importance of having all people involved in the production of milk follow established practices that will insure the production of high quality milk.

Every dairy producer should incorporate the objectives of these two programs into their mastitis management program.

In developing a mastitis management program it must be remembered that the dairy cow is affected by people, milking equipment, and the environment. These three categories of external forces can affect the cow either independently or by interaction between them. Quite often the effect of one force will cause another force category to have an impact on the cow, which ultimately results in a new IMI or a clinical case of mastitis. Consequently, practices included in any mastitis management program must consider more than just the direct or immediate effect on the cow.



From my perspective, mastitis management can be divided into three areas of activity: prevention strategies, treatment strategies, and eradication strategies. Dairy producers and their “consultants” apply these strategies to three groups of cattle: lactating cows, dry cows, and heifers. Many of the strategies apply to all three animal groups, while some strategies apply to just one group. The various components of these three strategy areas that I think should be included in a “Modern Mastitis Management Program” are discussed below.

A. Mastitis Prevention Strategies:

I encourage dairy producers to do all they can to **prevent IMIs from occurring** in their herds. I think that prevention is a much better way to manage mastitis than is trying to treat and eradicate the disease. Preventative practices that I suggest producers incorporate into their mastitis management programs include the following:

- **Clean udders/teats before milking.** Cleaning the teats before attaching the milking machine is a very important step in preventing bacteria from getting into the teat canal during the milking process. Environmental organisms such as *Strep uberis*, *Strep dysgalactiae*, and the coliforms (*E. coli*, *Klebsiella*, and *Enterobacter*), are in the soil (dirt) and manure which get onto teats. These contaminants must be cleaned off and the bacteria killed before attaching the milking unit. If they are not, there is a strong possibility that bacteria could be forced into the teat during the milking process, resulting in a new IMI.
- **Use proven effective pre and post milking teat dips.** Teat dips reduce the number of bacteria on teats and thereby help lower the number of new udder infections. Germicidal teat dips have been proven in numerous research trials to be effective at killing bacteria on the teat surface and reducing the incidence of new

udder infections. They should be routinely used by all dairy producers. Pre-dips should be left on the teats at least 20 seconds before wiping off. I prefer that a proven effective germicide be dipped onto the teats rather than sprayed on because of the likelihood that dips will be used properly more often than will sprays. Dip containers must be kept clean in order for the germicide to be effective. Dip cups should be cleaned between each milking, or more often if needed depending on herd size and cow cleanliness, so they don't become "bacterial contamination cups", and spread mastitis to and between cows rather than help prevent its spread. There are many different brands and formulations of teat germicidal products on the market. Use only products that have been proven effective at killing bacteria on teats. Dairy producers should ask their veterinarian or dairy consultant for suggestions on which product would be best to use in their herd. The product used may change with the effectiveness in the herd, the season of the year, or the prevalent infection type and level in the herd.

- **Minimize the use of water to wash udders and teats.** Water is an excellent vehicle for transferring/transporting bacteria, so use water to wash only the really dirty teats and lower udder sidewalls. When water must be used, minimize the amount used and have the water pressure level set low. Be sure the water hoses are flushed out before each milking so that stale water in the hoses that might contain *Pseudomonas aeruginosa* bacteria is removed and not sprayed onto teats. If teats are consistently dirty, correct the causes (poorly maintained bedding in stalls, not cleaning alleys often enough, not enough stalls for the herd size, poorly maintained walkways to pastures/exercise lots, etc.).
- **Use paper towels or reusable cloth towels to clean and dry teats.** One paper or cloth towel should be used for each cow to wipe the teats clean and dry before the milking unit is attached. Be sure that the teat ends are cleaned thoroughly so any dirt (contains bacteria) that is on or around the teat opening is removed. If reusable cloth towels are used to clean and dry the teats, be sure the towels are washed properly before being used again. Towels should be washed in hot water (minimum temperature of at least 145⁰F/62⁰C) with a strong detergent or bleach, and then dried in a hot-air dryer. The hot water, detergent or bleach, and hot-air dryer are needed to remove any soil and kill bacteria that are in the previously used towels. Disposable towels that contain a germicidal product to kill bacteria are preferred by some producers. While these type of towels are convenient to use, they may be more costly to use than are a teat dip product and a paper or reusable cloth towel. Milking parlor routine and worker preference may also direct which type of cleaning/drying method to use in a particular dairy operation.
- **Fore-strip milk from each quarter.** This practice should be done before attaching the milking unit to check for clinical infection, remove milk from the teat cistern that will most likely be higher in somatic cell count (SCC) and bacteria numbers than milk in the udder, help stimulate milk let-down, and increase milk flow rate. Some people prefer to fore-strip each quarter before the teat dip is applied and the teats are wiped clean and dry. Others prefer to do the fore-stripping after the cleaning process is

done. Both ways work equally well in realizing the benefits of fore-stripping. Several field trials have shown that fore-stripping will increase milk flow rate and decrease unit on-time. Some studies have also shown that the total amount of milk removed at each milking may be increased when cows were fore-stripped. Fore-stripping has the potential in many dairy operations to improve milk quality and teat end health, reduce the rate of new IMIs, and improve parlor performance.

- **Use milking equipment properly.** All personnel who use the milking equipment should be trained on how to properly attach, adjust, and remove (if required) the milking unit. Preventing air admission during the attachment process, and adjusting the unit so it hangs properly under the cow are important in preventing/reducing new IMIs and realizing complete, even, and rapid milk out. Whether cows are milked from the side or between the rear legs, proper unit adjustment is required and needs to be observed closely. Most milking parlors and many flat milking barns have automatic milking unit detacher devices that measure milk flow rate, shut off the vacuum, and remove the units from the cows. If cows are properly prepped before milking and the units are properly adjusted after being attached, there should be very few times when units have to be reattached because of incomplete milk out. In fact, some people advocate no unit reattachment because of the extra labor and time required, and the disruption of the milking routine. Quarters that don't get milked out completely should be left alone until the next milking. Seldom should that procedure result in a clinical mastitis case. More potential harm could be done by reattaching the unit. Another practice that some people do which should be avoided is to remove the inflation from one or perhaps two quarters that milk-out fast prior to removing the entire milking unit from the cow. It is very likely that air will be leaked into the claw when this practice is done, which could cause milk droplet impacts on the teat ends of the other attached quarter units. When teat-end impacts occur, it is likely that bacteria in the milk will be forced into the teat canals of the quarters that still have units attached, which might result in a new IMI. Using milking machines properly is an important part of a milking parlor or milking barn routine, plus an important component of a mastitis management program.
- **Have milking system checked/serviced regularly.** This should be done to check for proper operation and to replace wearable parts (e.g. inflations, hoses) according to recommended schedules. The frequency of the service inspections will be determined by the number of cows milked daily and the age of the equipment. Larger herds and older equipment will need more frequent checks. Once a year is a minimum service period for small herds, while larger herds should have the milking system checked at least 2-4 times a year. Some large herd managers have their milking equipment serviced monthly. Inflations, hoses, and other items that wear out should be replaced according to the manufacturer's recommendations. Producers should not run the risk of causing teat end health problems, increased rate of IMIs, or slower milking rate because the inflations or hoses aren't replaced often enough.
- **Provide comfortable, properly designed and bedded free stalls.** This is important for promoting the use of the free stalls by cows and heifers. Cows that rest

in clean, comfortable free stalls are going to have cleaner udders/teats, will have less teat end exposure to bacteria than do cows which lay in dirty alleys, and should have fewer IMIs. Proper stall width and length, divider rails design and open front stalls that permit cows to get up and lay down without any impediment are necessary to promote cow use. Various types of base materials and coverings are used in stalls. Mattresses have proven to be acceptable in many operations. A minimal amount of bedding material is often added to the mattresses as a surface cover. The kind of bedding material used in the stalls affects the level of bacterial load to the teats. Sand is a better bedding material than are organic materials, since sand does not provide a food source for bacteria as do wood products and straw. Pine, cedar and other softwoods are better than hardwood products for bedding stalls. If organic materials are used as a bedding material, use a material that has a large particle size since it will support less bacteria growth. Bedding saver devices may be needed at the backs of the stalls to reduce the wastage of bedding. Curb height is important for reducing the amount of manure that is dragged into the stalls by the cattle or that is pushed into the backs of the free stalls when the alleys are cleaned. Stalls that are dirty will surely promote new IMIs. Properly designed and maintained stalls are very important for promoting proper use by cows and preventing IMIs. Seek the advice and recommendations of knowledgeable specialists about proper free stall design, maintenance, and bedding materials.

- **Keep bedded-pack lounging areas clean and dry.** Many dry cows and heifers are housed on bedded-packs. Those areas should be kept well bedded to reduce the level of teat-end exposure to bacteria and IMIs. As with free stalls, use sand if possible, or an organic material that will minimize the growth of bacteria. Cows and heifers that are within 2-3 weeks of calving are especially vulnerable to IMIs because their teat canals are often not sealed with a keratin plug. Clean bedding is very important during that time period for reducing the bacteria population to which the udders are exposed.
- **Keep facilities clean and dry.** Free stalls, alleys, feeding areas, parlor holding area, exercise lots, etc. should be kept as clean and dry as possible so the cows will be kept as clean as possible. Scraping/flushing manure from the alleys should be done at least two times a day. Clean facilities means cleaner cows, which means less mastitis.
- **Infuse all quarters of all cows at dry-off time** with an effective dry cow mastitis antibiotic product. This practice is currently being discussed by researchers, veterinarians and others as to whether it is a practice that should still be used in all herds. Some people suggest that herds that have very low IMI rates (less than perhaps 100,000 cells/ml) should consider infusing just individual cows that have an IMI at dry-off time, or that have a SCC above about 200,000 at dry-off. The fact remains, however, that many new IMIs occur during the first few weeks of the dry period in cows that were not infected at dry-off. You don't know which cows may become infected during their dry period. One large field trial study showed that the practice of infusing all cows is still justified, because it will help reduce new infection

first 4 months of the next lactation, and the practice has a positive economic return.

- **Vaccinate for coliform pathogens & *Staph. aureus*.** All vaccinations should be done according to manufacturer and your veterinarian's recommendations. Vaccinating both cows and heifers for these two types of pathogens has been shown to be worth while. Coliform vaccines can reduce the incidence, severity and duration of infections in both lactating cows and heifers. Recent research suggests that a significantly increased level of serum antibody response against J5 *E. coli* can be obtained when four vaccinations were administered rather than the three vaccination scheme currently recommended. Before changing to a four vaccination regimen, dairy producers should consult with their veterinarian about this practice. *Staph. aureus* vaccines can reduce the incidence of new IMIs (one study showed up to a 45% reduction in heifers), as well as increase the spontaneous cure rate, and should be used in herds in which this type of organism is a major problem.
- **Culture bulk tank milk samples.** I believe all producers should have their bulk tank milk sampled and cultured every 1 to 4 weeks (more frequently for larger herds) to establish a baseline of the types of organisms that are present in the herd and monitor any changes. That information can be useful in establishing or changing management practices to prevent or reduce the incidence of new IMIs caused by the predominant organisms. If possible, obtain information on both the types of organisms present in the milk and the number of each type per ml of milk. Producers should consult with their veterinarian or milk quality specialist to interpret the information and decide what management practices should be added/changed to reduce/eradicate the bacteria types from the udders of their cows and prevent new IMIs from occurring.
- **Check udders of cows and heifers while pregnant.** Udder examinations should be done during the first 2-3 weeks of the dry period for cows, and any IMI's that are detected should be treated. Udders should also be examined for IMIs during the last 2-3 weeks of gestation of both cows and heifers, and treated as needed.
- **Consider using a teat sealant on dry cows.** Research results from many studies show that the majority of new IMIs occur during the dry period. Both external and internal teat sealants have been developed to seal the teat end from bacterial invasion, thereby reducing the number of new IMIs. Normally, a keratin plug forms in the teat canals of cows after they are turned dry. The keratin plug acts as a barrier to organisms trying to invade the teat. Keratin plugs, however, don't form immediately. Studies have shown that up to about 25% of cows still have not developed keratin plugs after six weeks dry, and a small percentage of cows (perhaps 3-5%) never do develop keratin plugs. Since it takes several weeks for the keratin plug to form in the teat canals of most cows, sealants can be helpful at reducing the bacterial invasion process before the plugs are formed. External sealants, however, have a limited durability (stays on teats for only a few days up to a week) and require repeated applications. Combining the practice of checking udders, as mentioned above, with

the application of an external sealant should help prevent new IMIs and reduce the incidence of IMIs in a herd. However, the extra labor and logistics of applying an external sealant as frequently as is needed may make this practice impractical in many herds. An internal teat sealant that acts similar to a keratin plug is now available for use by producers. Research has shown the internal sealant to be as effective as antibiotic infusions at dry-off at preventing new IMIs. Studies show that up to a 65% reduction in new IMI's can be obtained when both an antibiotic and internal sealant are infused at dry off. If an internal sealant is used, it must be infused just as carefully as dry cow antibiotics are to prevent introducing bacteria into the teat canal during the infusion process. Additionally, after cows freshen, care must be taken to strip out all the teat sealant that had been infused. While the cost effectiveness of the internal sealant and antibiotic may be questioned by some, new IMI's are certainly more costly than are the preventive treatments available for producers to use.

- **Supplement selenium & vitamin E to all cows.** Research over the last 30 years has shown that cows which do not receive an adequate intake of selenium and vitamin E are likely to have an increased incidence of IMIs. These two nutrients are involved in proper function of the immune system which attacks bacterial infections. Rations should be checked and feeds should be tested for selenium and vitamin E content to be sure that adequate amounts are present and are being consumed daily. In many areas selenium is deficient and should be supplemented to dry cows at the rate of 0.3 ppm of ration dry matter. Vitamin E acts in synergy with selenium and should be added to rations at the rate of 4000 IU/day during the last two weeks prepartum. For lactating cows in deficient areas, supplement rations with 0.1 ppm selenium and up to 3000 IU/day of vitamin E.
- **Provide adequate energy intake at calving time.** It is estimated that between 30-50% of all cows go through a period of subclinical ketosis during early lactation. When blood ketone levels become elevated because cows are in a negative energy balance, the effectiveness of their immune systems is reduced. This situation can lead to an increased incidence of mastitis (IMIs). While it is common for cows to consume less energy than they need during the first several weeks postpartum, dairy managers should check their fresh cow rations for energy level, and be sure the level will meet the needs of their cows when their appetites return to normal.
- **Keep cows cool during hot weather.** In hot weather cows are subject to an increased rate of new IMIs because they are often exposed to an elevated population of bacteria in the environment, and their immune systems can have a lower level of effectiveness because of the heat. When cows are hot and uncomfortable they look for places and ways to cool off. Unfortunately, these areas usually contain high populations of bacteria that can cause new IMIs. Cows may lay in wet, dirty alleys, stand in wet areas (streams or stagnant ponds), or find other "dirty" ways to get cool. Dirty cows means dirty udders that are challenged with elevated bacteria populations. Prevent or reduce the incidence of new IMIs in hot weather by keeping cows cool. Provide shade covers for cows that are kept in or

have access to exercise lots or pastures. Housed-cows should be kept in barns that are properly designed for natural ventilation, and should receive supplemental cooling from properly spaced fans and water misting. Fans and water misting in the parlor holding pens and/or return alleys to the barns is also recommended many times. Always provide an adequate supply of cool water for the cows to consume. This is especially important in hot weather. Ration adjustments may also be helpful in hot weather at reducing the effects of heat stress on cows. Consult with a nutritionist about what changes should be made in the level of energy and various minerals and vitamins fed lactating cows during hot weather.

- **Learn the sources & control strategies for the most common mastitis pathogens.** Knowledge about the most common types of bacteria that cause IMIs, the sources of those bacteria, and how they are spread to and between cows is important for knowing how to control them. The table shown below was developed by Dr. Karen Jacobsen, DVM from Athens, Georgia. It can serve as a handy reference for dairy herd managers and workers.

Types of mastitis-causing pathogens

(Table developed by Karen Jacobsen, DVM, Athens, GA.)

Bacteria	Source	Means of Spread/Control
<i>Staph. aureus, hyicus</i> (coagulase + <i>Staph.</i>)	Infected udders, teat lesions, udder skin, etc.	Cow to cow by contaminated udder wash rags, teat cups, hands, etc.
<i>Staph. spp.</i> epidermidis micrococcus, etc. (coagulase – <i>Staph.</i>)	Normal inhabitant of udder skin	Poor udder preparation, milking wet udders & teats
<i>Strep. ag.</i> (causes high SCCs)	Infected udders	Cow to cow by udder wash, contaminated rags, teat cups, hands, etc.
<i>Streptococcus</i> non-ags (<i>uberis, faecalis, dysgalactia</i>)	Numerous locations on the cow: hair, lips, vagina, feces, bedding, muddy lots, etc.	Environment to cow by wet, dirty lots and bedding, milk wet teats, poor udder preparation
Coliforms – <i>E. coli, Klebsiella</i> , etc.	Manure, bedding, especially sawdust	Same as <i>Strep.</i> non-ags
<i>Cornyebacterium bovis</i>	Teat canal	Inhabits teat canal. Gets in bulk tank milk when don't pre-strip cows
<i>Arcanobacterium Pyogenes</i>	Moist environment, cracked liners, drug contamination, water hoses, refrigerators	Common sequel to lacerated teat sphincter. Carried by flies.

<i>Prototheca</i>	Soil initially, secondarily contaminated treatment materials, hands, and sponges	In environment. Initially spread by contamination in infusions. Becomes contagious.
<i>Mycoplasma bovis, californicum</i>	Infected cows, udders, nasal & possible vaginal secretions in calves and older heifers	Infusion procedures in cows; spread by milking equipment & hands
Miscellaneous <i>Bacillus, Pseudomonas</i>	Hoses, dirty water, milk, manure, bedding, etc.	Same as <i>Strep.</i> non-ags

The information in the table above shows that the source of new IMIs is either by transfer from one cow to the next (contagious mastitis organisms), or by transfer of the organisms (environmental pathogens) from some source in the environment into the udders of cows. Most producers have done a very good job of eliminating *Strep. ag.* caused contagious mastitis from their herds, and have made good progress at reducing the amount of *Staph. aureus* and *Mycoplasma sp.* caused contagious mastitis in their herds. While that progress has occurred, the amount of mastitis caused by environmental organisms has increased, or at least has become the predominant cause of mastitis in many herds. How to prevent, reduce the incidence, and treat IMIs caused by environmental pathogen is the current continuing challenge to producers.

- **Use fly control practices.** Flies can cause new cases of IMIs by two routes or ways. The first way is by an indirect route. Cows which are harassed by flies often times congregate in groups to fight-off the flies. As they stand in the groups they stomp around in dirty alleys or lots and get their teats and udders dirty. As mentioned previously, dirty teats and udders lead to new cases of IMIs. So, controlling the fly population in barns and on the cows is important for this reason. The second route flies can cause new IMIs is by directly transmitting bacteria from the teat ends of one cow to the next, or by biting the teats and causing injuries that allow bacteria to enter the teat ends more easily. Research has shown that biting fly injury to teats is a prominent way of causing IMIs in prepartum heifers. It can also be a serious problem in multiparous cows. Fly control is an often overlooked area that needs to be incorporated into a mastitis management program.
- **Check udder health status of cows and heifers before purchasing them.** Many producers purchase cows and/or heifers, and move them into their herds without a concern about the udder health status of the animals. Before buying those animals they should be examined for udder infections, udder health records should be obtained, SCC or CMT records should be reviewed, and milk from lactating cows should be cultured. When the purchased animals arrive at the new farm they should be isolated from the herd for up to two weeks to minimize the transfer of diseases. This practice may be difficult to do, but facilities should be assigned for this purpose to prevent economically devastating diseases, including mastitis, from infecting an entire herd. Don't buy mastitis!

- **Use proper udder infusion techniques.** Anytime a canula is inserted into a teat end the person doing the infusion should be sure to follow proper techniques to prevent introducing organisms and causing new IMIs. The correct procedures to follow are as follows: Teats should be cleaned and dry, and the quarters milked out. Scrub the end of each teat to be treated with a cotton pad or ball soaked in 70% alcohol. Sanitize teats furthest away first, then the nearest teats. Be careful not to contaminate the end of the infusion tube. Insert the canula only 1/8 to 1/4 inch into the teat end. Infuse nearest teats first, then teats farthest away. Gently infuse the contents of the infusion tube. Dip teats in a germicidal, post-milking teat dip. Identify the cow that was infused to avoid contaminating the milk supply. Follow the withdrawal recommendations.
- **Handle clinical mastitis cows separately.** Cows that have clinical mastitis should be put in a separate group of treated animals, or at least milked last or with a separate milking unit used for only treated cows. The units should be flushed out between milking infected cows. People milking the cows should wear latex gloves that are washed off between cows. These practices are designed to minimize the possibility of transferring the infectious organisms between animals. They may take extra time or be disruptive to the routine of the dairy producer, but they are important precautions to take.
- **Regulate day length during the dry period.** Recent research has shown that the immune system of dry cows is affected by the number of hours of light to which they are exposed. Limiting light exposure during the dry period to 8-10 hours/day enhances the immune system, which should help destroy bacteria that invade the udder. Additional research is needed to determine if fewer IMIs occur in cows kept in reduced hours of light daily during the dry period. Another benefit of limiting the daily light period of dry cows to 8-10 hours is that the cows will produce more milk the following lactation when they are returned to daylight lengths of 14-16 hours/day. One research study reported a response of about 7 pounds more milk per day during the 16 weeks trial period. Additional research is needed on the effects of short day light periods on dry cows, but the reports to date suggest this practice is one that dairy producers should consider incorporating into their management programs.
- **Breed mastitis immunity into your cows.** Many producers try to select sires that transmit characteristics onto their daughters that help make them less susceptible to getting mastitis. Traits such as udders held tight up against the body, teats that are just the right length, and sphincter muscles on the teats that stay tightly closed between milkings are desired characteristics in cows. If producers are not selecting sires that have daughters with these characteristics, they should be. The net merit formula used in sire evaluation considers the SCC scores of the daughters of bulls. In the future, producers may also be able to select sires that transmit the ability to their daughters to have an altered immune system that will help the cows be resistant to mastitis causing organisms and the toxins they produce. Research is progressing towards this objective. Through genetic manipulation researchers

believe they can alter the genetic code of cows to have an immune system that will make the cows naturally resistant to the organisms that cause mastitis. Until that goal is realized, however, other practices already discussed must be used to manage mastitis.

- **House milk-fed calves in separate pens.** This practice will prevent calves from nursing each other, which in turn reduces the transmission of bacteria into the teats/udders of calves. Heifers should be monitored after they are put into groups after weaning for animals that may nurse others or themselves. Heifers that attempt to nurse should be separated and preventative measures implemented.
- **Give more attention to preventing IMI's in heifers.** Most studies show at least 1/3 of heifers and at least 1/4 of quarters become infected prepartum. *S. aureus* infection rate is usually low (as low as 3% of quarters), with most of the IMIs caused by CNS and non- ag streps (environmental pathogens). Many of the IMIs will be cured spontaneously. In most herds the IMI rate in heifers at parturition is higher than suspected (probably at least 20%). Producers who have many heifers freshening with IMI's should discuss this problem with their veterinarian and do cultures of infected quarters. They may want to consider infusing all their heifers at 2 weeks prepartum with an appropriate antibiotic if the culture results indicate the infectious pathogens would be sensitive to an antibiotic.

B. Mastitis Treatment Strategies:

When preventative practices fail to prevent new IMIs, various treatment practices must be implemented. The following treatment strategies are recommended to producers.

- **Culture bulk tank milk samples.** Besides being helpful in monitoring the types of intramammary organisms present in a herd for deciding on ways of preventing new IMIs, bulk tank milk culture information can also be useful for determining how to treat a herd mastitis problem when it does occur. Collecting daily bulk tank milk samples for about 3-5 days, and then culturing the samples for types and counts of bacteria present can provide very useful information to the herd veterinarian when deciding how to treat a herd IMI problem. In large herds, culturing the bulk tank milk from individual groups or strings of cows will provide udder infection status information, and help determine which cows in the herd need to be treated.
- **Culture milk from individual cows with clinical udder infections.** This information will assist in being able to treat those cows according to the type of organism(s) found. Having the samples cultured in a laboratory experienced in mastitis diagnostics will provide the most accurate information, but will take from several hours to a day or two to obtain the results. Often times producers want to or need to treat the clinical mastitis cases immediately, so lab culture information is not obtained. On-farm milk culturing test kits are available to test milk from clinical cows to determine if the infections are caused by Gram+ organisms (*Strep. sp.* and *Staph. a.*), or by the Gram- coliform group of organisms (*E. coli*, *Klebsiella sp.*, *Citrobacter*

sp., *Enterobacter* sp.). Environmental staphs and other Gram+ organisms will respond to antibiotic therapy, so clinical mastitis caused by them should be treated differently than clinical cases caused by the Gram- group. Relying on the appearance of the milk or on the feel of the udder/quarter from clinical mastitis cases is not a very accurate method for determining what type of organism has caused the infection and what treatment method should be employed. Time can be wasted and costs incurred unnecessarily with improper treatment when the “guess” approach is used. Specific treatment regimes to use for a particular clinical case or in an individual herd should be the decision of the veterinarian caring for the herd. Dairy producers and herdsman should not guess how to treat their cattle.

- **Use CMT (California mastitis test) to screen all fresh cows for IMIs.** Early detection of udder infections is important for timely and proper treatment. Studies have shown that by using the CMT, producers can identify a high percentage of IMIs shortly after freshening. Conduct a CMT on the milk of all fresh cows on day 3 or 4 postpartum. Any quarters that show a CMT rating other than negative (greater than zero) should have a culture done on the milk to determine if an infection is present, and what type(s) of organisms are causing the infection. Appropriate treatment therapy can then be instituted.
- **Check udders of cows and heifers while pregnant.** When IMIs are detected during an udder examination, I suggest that a culture be done on milk from the infected quarter. If the infection is caused by a contagious organism, then I suggest that the quarter be treated. If more than 30 days remain in the pregnancy, infuse the infected quarter with a dry-cow antibiotic product. Cows already infused when they were turned dry may need a second infusion. If an infected quarter is detected during the last 30 days of pregnancy, treat Gram+ infections with a lactating cow product. These recommendations are not universally accepted, so I suggest that producers consult with their veterinarian about how to treat IMIs detected during pregnancy for both cows and heifers before implementing these practices in their herds. Be sure to check the milk from fresh cows for antibiotic levels before adding the milk into the herd bulk tank. This practice should also be done when infusing antibiotics into lactating cows.
- **Consult with your herd veterinarian for mastitis treatment regimes.** Producers should utilize their veterinarian’s expertise when deciding how to treat both clinical and subclinical mastitis cases. Rather than deciding to inject or infuse a drug that is in the refrigerator or on the shelf because it worked the last time there was a clinical mastitis case, or because he thinks that he knows what type of organism has caused the mastitis and a drug he has on hand will “cure” the problem, the producer should consult with his veterinarian and treat according to the recommendations given. Discuss with your veterinarian about using extended therapy administration of antibiotics to treat chronic infections. Don’t listen to “experts” who are not knowledgeable about animal medicine, drug treatment regimes, and your herd’s health situation!

- **Combine vaccinations with antibiotic therapy.** *Staph aureus* is one of the most persistent udder infections that producers must deal with. Antibiotic therapy will eliminate some of the infections, especially during the dry period when the antibiotic can be left in the udder for several weeks rather than be milked out a few hours after infusion. Research trials have shown increased success at eliminating *Staph a.* in lactating cows when the antibiotic therapy period was extended beyond the usual 2 infusion regimen. Trials done under the supervision of veterinarians in which cows received extra label treatment of up to 8 infusions of antibiotic on consecutive days resulted in cure rates that were considerably improved over those obtained with the two infusion regime. This practice, however, may not be acceptable for use in all cows because of its cost (drug cost, labor, discarded milk, etc.). Vaccination of cows against *Staph aureus* has also proven to be helpful at eradicating a certain percentage of *Staph aureus* infections. Vaccinating heifers prior to freshening has been shown to decrease the incidence of *Staph aureus* caused IMIs, and increase milk production the first lactation. In recent years researchers have studied the use of combining a three injection vaccination regimen with a six or eight day antibiotic infusion therapy regime. One small study showed a cure rate of 70%, compared with a cure rate of only about 45% for cows receiving antibiotic for just three days, or vaccination plus a three day antibiotic infusion schedule. As mentioned above, the costs involved in this treatment regime may not be practical for use on all cows with chronic *Staph aureus* infections. However, trying to cure IMIs in valuable individual cows might well justify the use of this treatment regime.
- **Strip out clinical infections frequently.** This practice has been recommended for many years as an attempt to reduce the bacteria population and toxin level in the infected quarter(s). Injecting a clinical cow with oxytocin to induce milk let-down so she can be stripped out at least four times a day has been helpful in many cases. Recent research, however, questions the effectiveness of this practice. While the apparent cure rate is higher when frequent stripping is done, the relapse rate is higher than in cows which were treated with antibiotics. Before either starting or stopping the use of this practice, producers should discuss various treatment approaches with the veterinarian who cares for the herd.
- **Consider drying off early.** There may be situations when a cow or quarter is so infected with *Staph. a.* that the producer should consider drying-off the cow early or treating the quarter to cease milk production. This should be done only if the cow is a valuable animal that the producer wants to keep in the herd rather than cull. With early dry-off, massive antibiotic therapy should be given in combination with vaccination to try to eliminate the infection. If only one quarter is severely infected, the producer may want to discuss with the veterinarian the benefits of treating that quarter to stop milk production, keeping the cow in the milking herd the remainder of her lactation, and then culling her if she is not valuable enough to retain in the herd. Milking cows with only three lactating quarters is not routinely recommended for various management reasons.

C. Mastitis Eradication Strategies:

When mastitis prevention and treatment strategies are not successful, then the only option left for producers to follow, if they want to eliminate IMIs from their herds, is to implement an eradication strategy. Unfortunately, this strategy is a costly one for the producer, and a fatal one for the infected cows.

- **Cull chronically infected or incurable cows.** Cows that have a chronic mastitis infection that is incurable should be culled from the herd to prevent the transfer of the infectious organism to other cows. This is a last resort tactic, but one that should be followed when required. Sometimes the only way to eliminate a mastitis problem from the herd is to give the cow a one-way ride from the farm. About 15% of cows are culled each year (according to DHIA figures) because of mastitis and udder problems. The percentage may actually be higher since the cows that are culled because of low production may be low producers because they have subclinical IMI's that reduces their production ability. Producers should strive to lower this costly involuntary culling practice.

Summary:

Each dairy producer should create a mastitis advisory team to assess his herd's situation (management level, facilities, current level and types of mastitis, etc.), and establish a mastitis management program to be implemented in the herd. The program should contain realistic goals that can be attained. Once attained, more challenging goals should be established. A program review and goal reestablishment process should be done as frequently as required for the herd, but certainly at least every six months. Below are listed goals for a mastitis management program that I recommend dairy producers strive to attain. They are challenging goals, but attainable ones. When attained they can certainly help the dairy producer realize more income from his dairy business.

Goals to strive for in your mastitis management program:

- Not over 0.5% of herd has milk discarded due to clinical mastitis
- Less than 12% of cows and 5% of quarters infected
- Not over 3% of herd culled yearly due to mastitis
- Less than 2% new clinical cases per month
- Bulk tank milk somatic cell count (SCC) consistently less than 200,000 cells/ml
- Bulk tank milk standard plate count (SPC) consistently less than 10,000 counts/ml
- No antibiotic contamination of the bulk tank milk
- More than 85% of herd in the DHIA linear score of 4 or less
- Receive quality milk premium payments
- Receive recognition for producing high quality milk

Web site Information:

To read short articles on various Milking and Mastitis Management topics, contact this web address:

http://www.cals.ncsu.edu/an_sci/extension/dairy/Dairyh~1.htm

- click on the Dairy Subject Matter information box
- click on the Milking and Mastitis Management box
- click on the Short Articles line
- click on the article title desired

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Contact me via one of the methods listed below to discuss milking or mastitis management questions.

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