Over the years, many methods of milk culturing have been employed to provide information regarding mastitis prevention, treatment, and control. In general, these efforts have centered on culturing in a laboratory located at a university, milk processor, or veterinary clinic. Products available on the market and efforts required to culture milk on the farm have, in general, been unsuccessful for various reasons. The main reason for frustration with on-farm milk culturing stems from the fact that it has been difficult to train, equip, and motivate farm personnel to ensure ongoing and accurate culturing for making treatment and prevention decisions.

On the other hand, by the time culture results of clinical infections are reported back to the dairy for treatment decisions from off-farm laboratories, too much time has elapsed to be useful. This paper is intended to report on both success and failure in on-farm culturing, based on a methodology reported by Hess et al. (1).

When confronted with an elevated herd somatic cell count (SCC) or an increased number of clinical mastitis cases, most managers of dairy herds are quite knowledgeable about effective measures for controlling and dealing with these problems. It is not so much an issue of lack of knowledge as it is a lack of attention to the details of implementation that make the real difference in the production of quality milk. It is simply a matter of milking clean, dry, and comfortable cows with properly functioning milking equipment. Mastitis researcher J. Woodrow Pankey was fond of saying that “there are only four ways that a cow gets mastitis: left front, right front, left rear, right rear!” The trick is to ensure that the bacteria on the outside do not become the bacteria on the inside. There are many strategies for doing this, but they all boil down to two basic tenets: decrease the exposure to bacterial pathogens and increase the resistance of the cow to these infections. Despite all of our advances in both strategies, cows continue to develop intramammary infections, and will for the foreseeable future. The ability to identify these bacteria allows the producer and his employees to devise both prevention and treatment plans to deal with the reality of clinical mastitis.

Bacteria that are commonly associated with mastitis in dairy cows are most commonly categorized by the type of stain that they take in the laboratory. The most commonly employed stain is the Gram stain, and it has two possible outcomes. Gram-positive bacterial cells will have a purple or blue color when observed under the microscope. Staphylococcus and Streptococcus organisms are common Gram-positive bacteria. Gram-negative mastitis causing organisms, such as E. coli, Aerobacter, and Klebsiella, have cells that stain with a red color when observed under the microscope.
**Technique**

The culturing and treatment technique described by Hess et al. (1) involves collecting milk samples from all clinical cases of mastitis on the farm when first detected, and culturing the samples on differential media in order to determine if the causative organism is either Gram-positive or Gram-negative. Cows that show up as new cases of high SCC on the DHIA monthly test report are California mastitis test (CMT) scored. All suspected high SCC quarters are cultured, as well. The decision to treat or not to treat a quarter is based on the growth of either a Gram-positive or a Gram-negative infected quarter. Gram-negative and all no-growth quarters are left untreated. However, in some cases they may be re-sampled and re-cultured after a 1 to 2 week interval, if there has been no improvement in the nature of the secretion from the affected quarter.

Those quarters with no growth or a Gram-negative infection, identified as growth on MacConkey’s agar, are not treated with intramammary antibiotics. Depending on the assessment of the cow’s condition, supportive systemic therapy is employed according to a set of treatment protocols that are based on observable symptoms and previous favorable responses of animals with similar symptoms within the herd. Gram-positive cultures are treated with intramammary infusion according to treatment protocols that are based on previous favorable treatment outcomes. Cows are not treated either way until there has been a determination of growth or no growth on culture media.

On-farm culturing allows for monitoring of good sampling technique and shortens the time required to recover and identify organisms. It also demonstrates clearly when poor sampling technique has been used, resulting in recovery of mixed organisms in the same sample. It is uncommon for mixed infections in the same quarter to occur; therefore, culture of more than one organism from a quarter is an indication of poor sampling technique or contamination of the sample.

The clear advantage of on-farm culturing is how quickly results can be obtained. Gram-negative organisms can be readily identified, as growth on the agar occurs in as little as 6 to 8 hours. Most of the common Gram-positive organisms will show growth by 24 to 48 hours. Timeliness in recovery of organisms offers a clear advantage because treatment plans can be implemented as soon as the bacteria are identified. Outsource milk samples to a laboratory for routine organism identification can result in costly delays in initiating an on-farm treatment plan.

On-farm culturing techniques are not designed to identify clinical mastitis caused by mycoplasma. If mycoplasma is suspected, milk samples should be sent to a diagnostic laboratory for special culture techniques required to identify the organism.

**Equipment**

To effectively culture milk samples on the farm, a reasonably supply of fresh culture plates needs to be on hand. Both bi-plates with just two media on them and plates containing three or four selective media are designed to more specifically differentiate the Gram-positive infectious organisms. In my experience, these plates are best obtained from a commercial source, and only in quantities that allow for timely use. Usually it is best to stock no more than a 3 to 4 week supply of culture plates, as they are prone to either getting contaminated or drying out in refrigerated storage. Sterile collection tubes, a 0.01 ml inoculation loop, a Bunsen burner or small propane torch, and an incubator are required for on-farm culturing. Some means of systematically recording and retrieving culture results is necessary. This can be as sophisticated as using a computer or other electronic device, or as simple as the use of a notebook.

**Three components**

A successful on-farm culturing plan has three components. First, and by far the most important, is a well-trained person with an interest in doing on-farm microbiology. Second, a mechanism for recording culture results and treatment outcomes is necessary. The third key element is a timely review of the results, which leads to an action plan for treatment and prevention.

Training the appropriate people can be accomplished in many ways, but in my circumstances, I have assumed the role of microbiology instructor on dairies that want to implement on-farm culturing.

The most important key to successful on-farm culturing is the commitment of the person who is responsible to see that samples are plated properly, observed, and recorded in a timely manner. It is in this area where both my biggest failures and successes have occurred. Without someone who will plate samples, read and interpret results, and record these results, the entire process of on-farm culturing will be an exercise in futility. Human nature being what it is, there is a tendency to become complacent after an initial period of good compliance. That being said, when farm management and the employees believe that milk quality can be continually improved through better informed treatment protocols, then on-farm culturing will contribute to successful outcomes.

**Other requirements**

A trained and committed person must be in charge of culturing. They must have a designated area and access to the materials and equipment necessary to culture milk. Second, the results of culturing and treatment outcomes must be recorded in order to devise protocols that improve treatment decisions. Treatment protocols based on valid culture results should be tailored to the organisms identified. Identification of mastitis pathogens allows the dairy to develop management strategies aimed at reducing exposure to those types of bacteria. Clinical cases can be reduced if farm management works with...
employees to discuss culture information, milking practices, and housing facilities. Through these discussions, a strategic plan can be developed to reduce exposure to pathogens causing clinical mastitis.

In successful culturing programs, herd managers reduced their use of intramammary antibiotics by half, because they no longer treated quarters that cultured no-growth or had Gram-negative infections. Substantial savings resulted from the use of less antibiotics and a decrease in milk discarded because of antibiotic treatment. Additionally, untreated cows did not pose a violative residue risk to the farm.

In this author’s observations of on-farm culturing, the program’s success or failure was not based on agricultural or educational backgrounds, but based on the commitment of the person selected to be in charge of culturing. In farms where the program failed, they initially had good compliance to the protocol, but as time progressed, they didn’t perceive any tangible benefit for their efforts. Culturing clinical samples took time away from other duties, and their work schedules were already over extended. Despite encouragement and enthusiasm on my part at each and every herd visit, the program quickly fell into disuse. No amount of brow beating or cajoling from me was successful at reinstituting the culturing program. Their incubators lie unplugged and gathering dust on cabinet shelves. In defense of their decision, they already had reasonable milk quality, and they did not believe that their rates of clinical infection could be improved significantly. In other words, they did not yet have a perceived problem, and without conviction on their part, the culturing program became a dead issue. At some point in the future, should they perceive a problem, or my communications skills improve, then culturing on their farm may yet become a reality.

Summary

On-farm milk culturing is a viable and useful tool, under the right circumstances, for improving treatment protocols and overall milk quality. The success or failure of these programs is highly dependent upon the motivations, training, and support of the personnel involved in this activity. The materials necessary are easily obtained, economical, and reasonably straightforward to use with proper training. Information derived from culturing is valuable for its timeliness in identification and treatment of mastitis pathogens, as well as its usefulness in the development of control strategies. Overall success is a function of the commitment and motivation of the personnel in charge of culturing.

Reference