Reducing the Incidence of Clinical Mastitis in Commercial Dairy Herds: Failures and Success With on Farm Culturing

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Take Home Messages:

1. **Timeliness of clinical infection information is enhanced by on-farm culturing.**
2. **On-farm culturing can make treatment decisions more effective.**
3. **On-farm culturing requires committed and trained personnel.**
4. **On-farm culturing can result in reduced treatment costs.**
5. **On-farm culturing may be used to implement more effective control and prevention measures.**

Introduction

Over the years, there have been many methods of milk culturing employed to provide information on mastitis prevention, treatment, and control. In general, these efforts have centered on culturing being done in a laboratory located at a university, milk processor, or veterinary clinic. Products available on the market and efforts required to culture milk on-farm have, in general, been unsuccessful for various and sundry 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 other off-farm laboratories, too much time has elapsed. This paper is intended to report on both success and failure in this endeavor, based on a methodology reported by Hess, Neuder, and Sears. (1)

When confronted with an elevated herd somatic cell count (SCC), or an increased number of clinical mastitis cases, most people who manage dairy herds today 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 bacteria on the inside. There are many strategies for doing this, but they all boil down to two basic tenets; either decrease the exposure to bacterial pathogens or 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. Streptococcus and Staphylococcus 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. In general, most Gram-positive bacteria will show some sensitivity to the beta lactam (penicillin) antibiotic family, whereas the Gram-negative bacteria tend to be resistant to most commercial antibiotics available today for use in lactating dairy cows. As a result, intramammary treatment of Gram-negative clinical mastitis infections has met with relatively poor results.

This paper specifically does not deal with the culturing and treatment of mycoplasma mastitis. Mycoplasma mastitis infections require special culture techniques, with oxygen limiting incubators, and do not respond to any sort of currently available conventional treatment. Suspected mycoplasma mastitis problems should be sent to a qualified laboratory, with well trained personnel who are qualified to give professional advice on milk quality issues associated with mycoplasma infections.

Materials and Methods

The culturing and treatment technique described by Neuder et al. (2003) 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 CMT scored, and all suspected high SCC quarters are cultured as well. The decision to treat or not to treat the quarter(s) is based on the growth of either a Gram-positive or a Gram-negative infected quarter respectively. Gram-negative and all no growth quarters are left untreated, however; in some cases they may be re-sampled and re-plated after a 1-2 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. Cows are not treated either way until there has been a determination of Gram-positive growth or Gram-negative / no growth on culture media.

The clear advantage to on-farm culturing is the timeliness of obtaining results. When there is recovery of a Gram-negative organism, growth on the agar occurs in as little as 6-8 hours. Most of the common Gram-positive organisms will show growth by 24 to 48 hours. 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. Timeliness in recovery of organisms offers a clear advantage to the dairy because treatment plans can be implemented as soon as the bacteria are identified. Outsourcing culturing to a lab can result in costly delays in initiating a treatment plan.

On-farm culturing does, however, require some specialized equipment. A reasonable supply of fresh culture plates needs to be on hand, either bi-plates with just two media on them, or plates containing three or four selective media, 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 3-4 week supply of culture plates, as they are prone to either getting contaminated or drying out in refrigerated storage. Tri and Quad agar plates may be obtained from BioVet USA Inc., 3055 Old Hwy 8, Suite 100, St. Anthony, MN 55418-2590 (phone: 877-824-6838). Bi-plates are available from Physicians Lab Supply, P.O. Box 80853, Rochester, MI 48308 (phone: 800-445-6507). Sterile collection tubes, a .01 ml inoculating loop, a Bunsen burner or small propane torch, and an incubator are the other materials required for on-farm culturing. These supplies may be obtained from NASCO, or from a scientific supply house, such as Fisher Scientific (www.Fisherscientific.com). 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 handwritten chart. There are other types of selective media now available such as Petrifilm™ from 3M Microbiology (St. Paul, MN), but this paper only deals with agar plate media. Papers on other media are available in the Proceedings of the National Mastitis Council. (2)

Discussion

There are three components to a successful on farm culturing plan. 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 of appropriate persons can be accomplished many ways, but in this authors' experience, 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(s) who will see to it that samples are plated properly and observed on a timely basis. 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 toward complacency after an initial period of good compliance. Our clinic has experienced several failures where, for many reasons, the program of culturing that started out so well, soon fell into disuse and eventual cessation. My best estimate for this failure centers on the disconnect between the enthusiasm of the veterinarian for culturing, countered by the mindset of the dairy personnel that there was already a good enough milk quality program in place, and that there was no pressing need for an improved decision making process for treatment of clinical mastitis cases. When this is the case, no amount of external encouragement will facilitate continuation of the program. That being said, when there is a belief on the farm among management and the employees that milk quality can be continually improved, especially through better informed treatment protocols, then culturing can and will contribute to more satisfactory outcomes. In other words, mastitis on a dairy is not a problem until it IS a PROBLEM!

Ongoing experience with a few successful culturing programs led to several insights and conclusions. First, a trained and committed person must be in charge of culturing. They must

have a designated area to perform culturing and the availability of materials and equipment necessary to successfully carry out this endeavor. Second, the results of culturing and treatment outcomes must be recorded in order to devise protocols that improve outcomes of cases. Treatment protocols based on valid culture results should be tailored to the organisms recovered. Identification of pathogens allowed the dairy to develop management strategies aimed at reducing exposure to mastitis causing bacteria. When employees and management teamed together to discuss recurrent infections and strategy planning, positive changes in milking practices and facility management aimed at reducing clinical infection rates resulted. Because everyone involved understood the nature of the problem, it was easier for everyone to understand what and why something was being done to correct the problem. Most employees would much prefer to deal exclusively with healthy and normal milking cows, without large numbers of animals in the "pot" or treated group. In successful culturing programs, herd managers observed that their use of intramammary infusion tubes had been reduced by about half, because they no longer treated no-growth or Gram-negative infections. Substantial savings resulted from the use of fewer tubes. Less milk was discarded, due to fewer antibiotic holds on treated quarters. Additionally, untreated cows did not pose a violative residue threat to the farm.

In a recent case study of a 1000 milk cow 3x herd on BST, housed on sawdust covered mattress freestalls, on farm culturing has been part of a plan to successfully trouble shoot their clinical mastitis/SCC problem.

In this herd, SCC had never been much of a concern until, over a gradual period of time, the herd SCC climbed from an average of 150-200 thousand to routinely around 350 thousand. There was a significant increase in the number of clinical mastitis cases. Consequently, the herd management became interested in a strategy to bring this problem under better control. Milker training sessions resulted in better compliance with pre-milking hygiene and udder preparation, but the SCC and clinical incidence of mastitis did not improve over a 6 month period. At that point, the willingness of one co-herdsperson to do culturing resulted in implementation of an on farm culturing program for clinical cases. Over time, this herdsperson's proficiency with culturing and interpretation of samples improved dramatically, along with her ability to decide on which therapeutic protocol would have the best outcome based on the organism recovered/not recovered. In addition, efforts to reduce environmental exposure to mastitis pathogens received a much higher priority, since the majority of recovered organisms were environmental Gram-negatives. Improvements were made in freestall comfort, such as newer, more comfortable mattress surface materials, better adjusted neck rails, and a switch to kiln-dried sawdust to cover the mattresses. Pre and post-milking teat spraying was replaced with pre and post-teat dipping. In the past 6 months, the herd SCC has returned to near its previous more normal levels (Figure 1). The number of intramammary infusion tubes being used has been cut approximately in half. No single change can be attributed to this improvement, however, in the aggregate these efforts have resulted in a far more satisfactory herd SCC level and a greatly increased awareness, on the part of all of the employees at this dairy, of the many details that help to serve as a focal point in the effort to ensure overall high quality milk production.

Of note is this herd's experience with a recently introduced intramammary infusion tube, with a label claim for treatment of E. coli intramammary infection. Use of this infusion tube has met with some frustration on the part of this producer because of poor clinical results. The expectation of a positive response to intramammary infusion therapy for Gram-negative E. coli

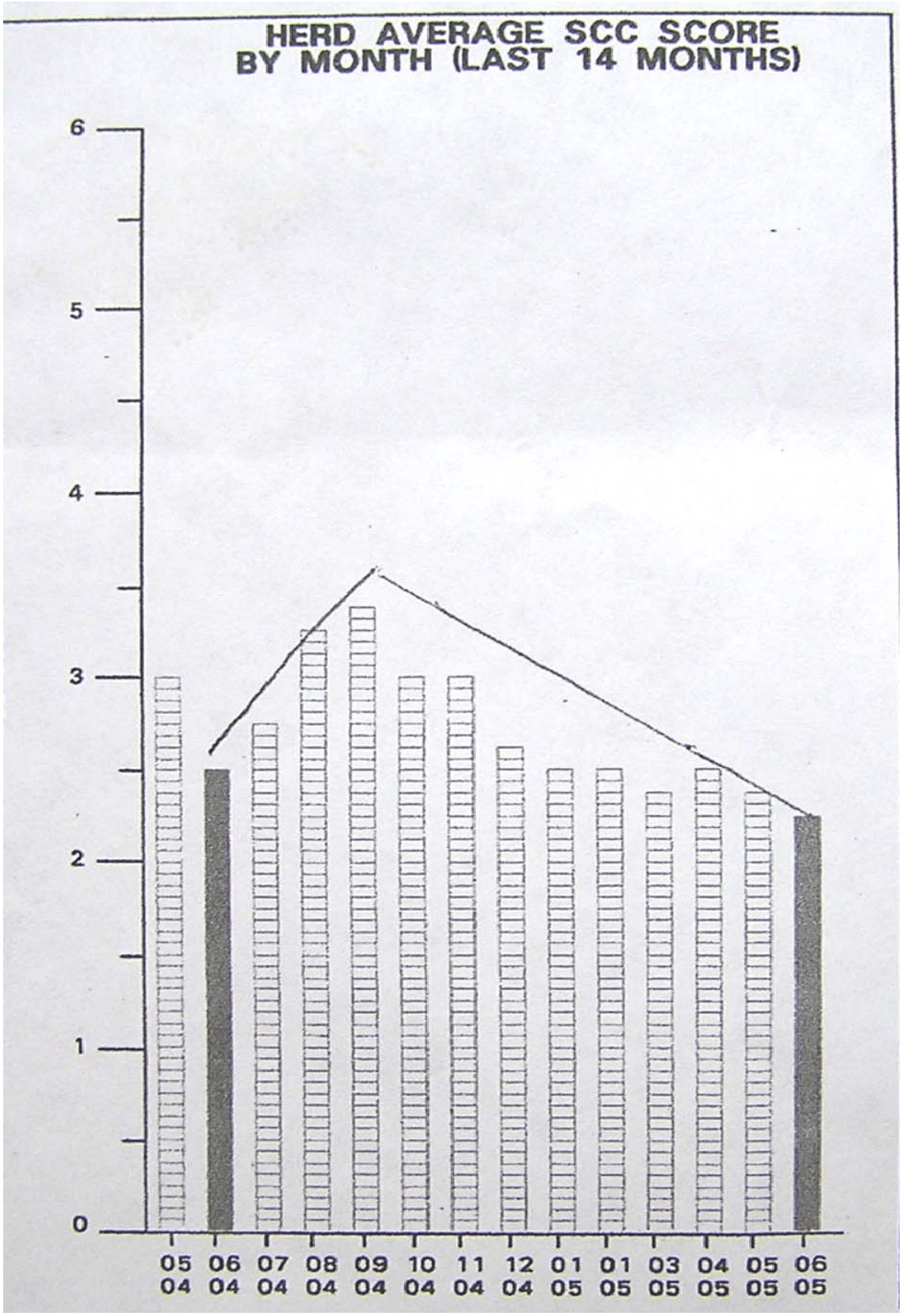
has simply not been met. An explanation of this might be that organisms cultured on the Gram-negative agar plate were not E. coli, for which the product bases its label claim. This herd, as previously mentioned, uses sawdust on top of the mattresses, and at times, it has not been possible to obtain kiln-dried sawdust, rather, only 'green' sawdust. Gram-negative organisms have been frequently associated with this type of bedding material. (3) When the clinical results of intramammary infections showed a poor response to the labeled therapy (1 treatment in an affected quarter repeated at 24 hours or once daily for 8 days), the efforts at reducing clinical infections in this herd were redirected at eliminating environmental exposure to Gram-negative organisms. New kiln-dried sawdust in the stalls replaced the 'green' sawdust, and more attention was paid to better stall maintenance and sanitation. The salient point here is that on farm culturing alerted them that they were dealing with a Gram-negative organism. Recording and timely review of their treatment therapy clearly illustrated that intramannary infusions were not correcting their Gram-negative mastitis problems. Therefore, they looked at other aspects of their facilities management to eliminate exposure to environmental Gram-negative organisms. Once these changes were made, the incidence of clinical mastitis was sharply reduced. Personnel on this dairy recognize that there was not a better "cure" for mastitis, but their efforts in control and prevention yielded long term benefits in less discarded milk, lowered treatment costs, and improved milk quality.

In our practice, I have not been able to convince all dairies of the value of on farm milk culturing. In each instance where failure has occurred, individuals with similar agricultural and educational backgrounds to our successful on farm culturing dairies, were selected to perform culturing duties. Initially, there was good compliance with the procedures, but as time progressed, neither they nor the herd management perceived any tangible benefit to their efforts. Culturing was time consuming, and their work schedule was already quite full of other duties. Despite encouragement and enthusiasm from me at each and every herd visit, the program quickly fell into disuse. No amount of brow beating or cajoling on my behalf was successful at reinstituting the culturing program. Their incubators lie unplugged and stored on cabinet shelves gathering dust. In defense of their decision, they already had reasonable milk quality and they did not feel 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. Hope springs eternal.

Summary

On farm milk culturing in large dairies 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 organisms, and for 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.

Figure 1


HERD AVERAGE SCC SCORE
BY MONTH (LAST 14 MONTHS)
6
5
4
3
2
1
0
05 04
06 04
07 04
08 04
09 04
10 04
11 04
12 04
01 05
01 05
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