A global organization for mastitis control and milk quality

The Value and Use of Dairy Herd Improvement Somatic Cell Count

Mastitis is the most costly dairy cattle disease. In herds without an effective mastitis control program, approximately 40 percent of cows are infected in an average of two quarters. It has been estimated that mastitis costs about $200 per cow per year. This figure may increase unless dairy producers can achieve a reduction in prevalence of the disease.

How Much Does Mastitis Cost You?

The only way this question can be answered is to know how much mastitis is in your herd. Mastitis robs you in many ways: reduced milk production; treatment cost; discarded milk; death and premature culling; decreased genetic advancement; and reduced milk quality. Reduced milk production accounts for approximately 70% of the total loss associated with mastitis. Unfortunately, this loss is often not fully appreciated by producers. First, it occurs at the subclinical level (the quarter is infected but the milk appears normal) and second, the loss is from less milk produced, which can be difficult to recognize.

How Effective is Your Mastitis Control Program?

Despite the losses associated with subclinical mastitis, most producers continue to evaluate the effectiveness of their control programs based on the number of cows with clinical signs. Since the number of subclinical cases that eventually show up as clinical is quite variable, a producer cannot rely solely on a record of the number of clinical cases to evaluate his/her control program. Further, this record may actually be deceiving if producers expect the adoption of a proven management procedure to result in a rapid reduction in the number of clinical cases. After control procedures are implemented, their effectiveness must be evaluated over a prolonged period of time and by a more sensitive indicator than simply recording the number of clinical cases that occur.

Why Measure Somatic Cells?

Because mastitis is frequently subclinical or "hidden", a number of tests have been developed for detecting mastitis. Most tests estimate the somatic cell count (SCC) of a milk sample. The term "somatic" means "derived from the body". All milk contains white blood cells known as leukocytes which constitute the majority of somatic cells. The cell count for "normal" milk is nearly always less than 200,000 cells/ml (lower for first lactation cows). Higher counts are considered abnormal and indicate probable infection. Higher counts are also associated with decreased production.

Leukocytes accumulate at the inflamed site to combat invading bacteria. Factors such as late lactation, old age and environmental stress may cause slight elevations of SCC but such increases are inconsequential when compared to the elevation which results from infection.

How Should You Evaluate Your Herd Mastitis Control Program?

(1) BULK TANK SOMATIC CELL COUNTS (BTSCC), if conducted frequently and accurately, provide a general indication of a herd's mastitis status. Research indicates that losses

in milk production associated with elevated BTSCC are higher than previously thought.

Table 1: Losses in milk production associated with elevated BTSCC.

BTSCC (1000's/ml)	% Production Loss
200	0
500	6
1000	18
1500	29

These losses were calculated as the percentage of expected production compared to production when the BTSCC is 200,000 cells/ml. Since about 6% of quarters are infected in herds with a BTSCC of 200,000, this is still a conservative estimate of milk loss. Thus, herds with a BTSCC of greater than 500,000 cells/ml have serious losses in milk yield resulting from mastitis even though they are below the maximum SCC limit. Remember, the BTSCC reflects only the milk from those cows and quarters being put in the bulk tank. With bonus payments now prevalent and greater concern for antibiotic residues in milk, producers frequently withhold milk from problem cows from the bulk tank. Thus, relying solely on BTSCC may seriously underestimate herd infection levels and associated production losses.

Most BTSCC currently reported to producers are determined by milk plants and regulatory agencies according to requirements of the Pasteurized Milk Ordinance (PMO). While bulk tank counts may be a good indicator of a herd's general udder health status, their use will not identify problem cows nor locate factors contributing to the high counts.

(2) SOMATIC CELL COUNTS ON COMPOSITE MILK SAMPLES from each cow are available for herds on Dairy Herd Improvement (DHI) test. Electronic cell counting instruments estimate milk SCC from the same sample that is used for testing fat and protein. DHI reports available to producers will vary somewhat according to the DHI Processing Center. However, most DHI's report extensive SCC information. In addition to current SCC, many report previous SCC history for individual cows.
Herd summary data such as SCC by lactation number and stage of lactation also are frequently available.

In an effort to provide uniform SCC reporting, the DHI's have adopted a uniform scoring method originally known as the linear score and more recently as the somatic cell score (SCS). The SCS divides the SCC into ten categories from 0 through 9.
Table 2 shows how SCC is converted to SCS. Each increase of one in SCS is associated with a doubling of the cell count.

Table 2: Relationship between somatic cell score (SCS) and somatic cell count (SCC).

	SCC (1000's/ml)	
SCS	Midpoint	Range
0	12.5	0- 17
1	25	18- 34
2	50	35- 70
3	100	71- 140
4	200	141- 282
5	400	283- 565
6	800	566-1130
7	1600	1131-2262
8	3200	2263-4525

9 6400 4526-

Analysis of records from many cows indicated that as the SCS increased, milk yield decreased. Moreover, the incremental production loss of was found to be the same for each doubling of somatic cell count. For example, in cows of second lactation or greater, each doubling of cell count after 100,000 (SCS 3) resulted in an additional loss of 400 lbs. per lactation (Table 3). A SCS from an individual cow for any single month doesn't correlate well with production loss. However, using either average SCS from a cow's entire lactation or the average monthly SCS from an entire herd has been shown to be reasonably accurate in estimating losses.

Table 3. Estimated change in lactation milk yield associated with an increase in somatic cell score (SCS).

Lactation average SCS	Average SCC (1000's/ml)	Decrease in Milk Yield (lbs./305 days) Lactation 1	Lactation 2
0	12.5	---	---
1	25	---	---
2	50	---	---
3	100	200	400
4	200	400	800
5	400	600	1200
6	800	800	1600
7	1600	1000	2000

Adapted from University of Wisconsin data.

(3) SCREENING TESTS ON INDIVIDUAL QUARTER SAMPLES. The effectiveness of a control program can be evaluated by conducting the California Mastitis Test (CMT) on milk from each quarter of each cow and determining the frequency of the various reactions. To be of value as a management tool, the screening test must be conducted on a regular basis and results recorded so a history can be developed. The CMT has been used in combination with DHI somatic cell counting.

After the DHI SCS results have been received, the CMT is used to identify the

positive quarter or quarters. If desired, milk from positive quarters can then be cultured to identify which bacterial species may be involved.

How Should You Use DHI SCS Information to Evaluate Your Herd Mastitis Control Program?

A monthly summary of SCS on milk samples from each cow provides you with an evaluation of the effectiveness of the mastitis control procedures used in your herd. When combined with the results in Table 3, a realistic assessment of the amount and cost of subclinical mastitis can be made in your herd. Further, SCS allows you to measure the reduction in subclinical mastitis as management is improved.

Although no single SCS level can be used to separate infected from noninfected cows, about 80% of the cows with SCS 5 are infected in one or more quarters. As the SCS increases, the percentage of cows and quarters that are infected also increases.

A realistic goal in your herd is for more than 90% of your cows to have a SCS of less than 5. Producers with more than 25% of their cows with a SCS of 5 or greater can improve their herd mastitis control procedures in the following ways:
(a) Correct milking procedures, including milking time sanitation (emphasizing dipping all teats immediately after each milking with a product proven effective under controlled research conditions).
(b) Restore milking equipment to proper operating condition.
(c) Review other management practices such as the basis for culling, source of herd replacements, condition of lots and free stall bedding, etc.
(d) Evaluate dry cow treatment and management program. Comparing each cow's SCS before drying off and a month after calving will give you an indication of the effectiveness of the dry cow treatment used and dry cow management program.

Improvements in your mastitis control program will appear within a few months. Do not expect immediate results. Perhaps the best group of cows to monitor is first lactation cows. These cows should not have SCS above 3 since they are not affected as much as older cows by prior herd conditions. The percentage of cows in a herd with SCS greater than 3 for the first time is a good indicator of the success or failure of a control program.

Arranging SCS data in a table by days in milk, eg. 0 to 39, 40 to 99, 100 to 199, and 200+ and by lactation, eg. 1, 2, and greater than 3 for the first time a cow exceeds 3.9 SCS may help identify lapses in management that contribute to new infections in your herd. Additional techniques that have been useful include making a table of monthly weighted average SCS for the herd for a 24 month period. Include, by month, in this table the number of cows with SCS greater than 3 for the first time, SCS 5 and

greater, and cows removed each month. Analysis of this information should provide a seasonal evaluation that may identify mastitis problems in a given herd. SCS is also very helpful in identifying those few cows that contribute the major portion of the total somatic cell count in the bulk tank. Often, withholding milk from this relatively small number of cows is enough to reduce the BTSCC enough to qualify for bonuses.

What Should You Do With High SCC Cows?

The SCC program pinpoints problem cows. Unfortunately, even after problem cows are identified, management options for these cows are limited.

(1) SELECTING COWS FOR CULTURE. The major reason for elevation in SCS is intramammary infection. Monthly individual cow DHI-SCS are good indicators of infections caused by the major contagious pathogens, Streptococcus agalactiae and Staphylococcus aureus. This is because these infections are usually of long duration. Conversely, infections caused by the environmental pathogens (e.g., coliforms and environmental streptococci) are often of shorter duration. Thus, infections by environmental organisms may go unnoticed by a test administered only once each month. Although elevated SCS is an indicator of probable intramammary infection, a distinction between contagious and environmental mastitis cannot be made on the basis of SCS alone. This distinction must be made by microbiological culture of milk. Determining whether problems are contagious or environmental is necessary to enable a producer to make decisions regarding a herd's mastitis control program.

An exact SCS threshold which always permits separation of infected from noninfected cows does not exist. For initial herd screening purposes, selecting cows with a SCS of 5 or greater for milk culture has been suggested. Even under the best conditions, producers should be aware that some cows with SCS of 5 or greater will be culture- negative while some with scores of less than 5 will be culture-positive. Two techniques which may be helpful in reducing errors associated with culture include:

(a) To avoid dilution errors which may result from noninfected quarters, only culture the milk from the high somatic cell count quarters of cows with an SCS of 5 or greater. The California Mastitis Test (CMT) may be used on cows with elevated SCS to determine which quarters are positive. Even with this technique, time lag after cell count determination or low numbers of bacteria in the milk may lead to negative culture results.

(b) Avoid contaminating milk samples. Many mastitis-causing organisms are normally present in the cow's environment. Confusion results when these organisms contaminate a milk sample taken for culture. Before sampling, producers should discuss strategies and techniques with their herd veterinarian.

(2) LACTATION TREATMENT. Some producers enroll in the SCC program expecting to use SCC as a basis for treating individual cows. However, research has shown that when cows with a SCS exceeding 5 were treated there was very little effect on milk production during the remainder of that lactation. Much additional research is needed before we can clearly determine conditions (age, pregnancy status, stage of lactation, type of bacteria, etc.) where therapy during lactation could be economical.

Producers in danger of losing their market because of high BTSCC may find it necessary to treat cows with high SCS during lactation. The last SCS, milk culture results, milk production, stage of lactation, and age should be considered by the veterinarian and producer when selecting cows for treatment. Early drying off and dry treatment should be used for cows in late lactation. Milk from cows with the highest SCS in early to mid-lactation can be withheld from the bulk tank. Using this method, withholding milk from only a few cows can lower the BTSCC by as much as 50% or more. Some DHI processing centers provide SCC contribution to the bulk tank for high SCC cows in the herd. This list is a weighted average based on milk production and SCC and can be used to target cows for culture, treatment, or withholding from the bulk tank. Often this will qualify the farm for quality premium payments

The number of times a cow is SCS 5 or greater in a lactation can indicate chronic problem cows requiring special attention. High SCS in early lactation, followed by a decrease later in lactation may indicate problems with dry cow management, maternity pens, or dry cow therapy (often poor treatment technique). SCS that generally rise throughout lactation are usually associated with cows infected by contagious pathogens and may indicate problems with milking hygiene, milking equipment, milking practices, or housing of the milking herd.

(3) DRY COW TREATMENT. The general recommendation is that all quarters of all cows be treated with an intramammary antibiotic preparation at drying off. Dry treatment has a higher cure rate than lactation treatment, eliminating existing infections and preventing new infections during the early dry period. FDA-approved commercially prepared products in single-dose containers should be used.

If a producer decides to use selective dry cow therapy, SCS results can be used as a guide. It should be noted however, that a selection procedure that results in dry treating all cows that had an elevated SCC (400,000 cell/ml or greater) at any time during lactation will still fail to reach 20 to 50% of the infected quarters. In addition, quarters not treated at drying off are more likely than treated quarters to become infected during the early dry period.

(4) CULLING. Culling is often the most practical means for eliminating chronically infected cows. There is little justification for keeping cows that have consistently high SCS, sporadic flare-ups, and infections that persist in spite of dry cow treatment. These cows may be reservoirs of infection which may spread to other cows during the milking process.

(5) MILKING ORDER. Consider managing cows with high SCS as you would cows with clinical mastitis. Milk these cows last to decrease the spread of infection to uninfected cows during the milking process. In many herds this may not be practical. An alternative method is to identify cows with high SCS by a leg band and milk these cows with a separate milking unit.

Summary

The DHI somatic cell count program is a valuable tool for monitoring and evaluating a herd mastitis control program. This program can be used to identify problem cows that have high SCS resulting from mastitis. After problem cows are identified, management options can be recommended that will lower the BTSCC and reduce mastitis losses.