Interpretating Bulk Tank Somatic Cell Counts

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During the past few years veterinarians have begun to appreciate some of the benefits in monitoring bulk tank somatic cell counts (BTSCC). Although it is a measure of milk quality and not udder inflammation, the BTSCC does provide an estimate of the herd udder health. Because there is little confusion as to where cells constituting the BTSCC originate, changes in BTSCC can be more directly attributable to changes in udder inflammation than can be changes in bulk tank bacteria counts. Moderate correlations between BTSCC and quarter infection rates provide further support for the use of BTSCC as a proxy for herd udder health (Dohoo and Meek, 1982). The BTSCC can also be used to estimate losses in production associated with udder inflammation. BTSCC of 500,000 cells/ml has been estimated to represent at least 5 percent reduction in milk production, whereas counts exceeding 1,500,000 are believed to be associated with a 25 percent loss (Eberhart et al, 1982). The sampling and measuring for BTSCC is easy and inexpensive, which makes it a very desirable measurable outcome for surveillance. Consequently, the BTSCC is being used more and more frequently by practitioners as part of udder health surveillance directed toward identification of changes in the risk of udder infection with the objective to quickly intervene when necessary.

There are some difficulties in interpreting BTSCC, however, as shown by results of studies that found only 30% of the variation in BTSCC to be associated with quarter infection rate. Firstly, tank milk is often sampled inconsistently and infrequently which negates much of the potential information inherent in historical banks and in prospectively obtained data. Secondly, although timeliness and logistics of sample collection are important, appropriate interpretation of BTSCC is often difficult because of the multifactorial nature of BTSCC variation. Issues of interpretation relate to such questions as: What level of BTSCC represents good udder health? How should variation among consecutive BTSCC be interpreted? and How much variation should be expected? One of the reasons these questions are difficult to answer is the BTSCC is a function of the percent of quarters infected, of the severity of the infections and of the duration of the infection.

There are several factors other than quarter infection that should be considered when attempting to interpret changes in BTSCC. Among these are forces of population dynamics, such as age of lactating females and the average days in milk, that can act to increase or decrease BTSCC, and which are discussed more below. Before attempting interpretation of BTSCC fluctuations, however, it is helpful to have an optimum value of BTSCC in mind. Several investigators have reported that a BTSCC of 200,000-250,000 represents good udder health (Andrews et al, 1983; Dohoo and Meek, 1982). Our view is that a BTSCC of 100,000-200,000 represents good udder health and levels below 100,000 represent excellent udder health. This interpretation is based in part on results of one of our studies which found that individual-cow milk production is adversely affected when counts rise above 100,000 cells/ml. Even with a BTSCC of 100,000, there will often be a large proportion of cows with counts in excess of 100,000 cells/ml. We have found that goals of 100,000 to 150,000 cells/ml are reasonable and achievable.

One of the most difficult problems facing us has been the interpretation of fluctuations in BTSCC over time. Given the many sources of variation in BTSCC, it is often frustrating trying to determine if udder health is changing or if other factors have interacted in a way to significantly alter BTSCC. We have observed weekly BTSCC variation to range from 0 percent to 100 percent [(difference between two BTSCC) ÷ (first BTSCC)]. Although admittedly empirical, our alarm level is about 30 percent for variation between two consecutive weekly BTSCC. We attempt to improve confidence in interpreting changing BTSCC by examining the trends, specifically regressions or moving averages of BTSCC over time, to determine if there are significant changes.

Methods of sampling should be examined periodically and routinely to determine if they contribute to variation in BTSCC. There are several sources of sampling error that should be considered when sampling the tank. The sample should be taken from a tank containing milk from all cows milked an equal number of times. Samples from a tank which did not contain milk from strippers or fresh cows would have a different cell count than if they were from a tank containing milk from all cows. Samples taken from a valve may differ in count from those taken from the top of a tank. Similarly, samples taken before milk is mixed will differ in cell count from those taken after mixing. In order to interpret BTSCC within or among herds, sampling should be performed using standard procedures, and preferably using replicates. Using the mean value of duplicate or triplicate BTSCC will improve confidence that changes observed in BTSCC are real and not related to sampling error.

The machine that counts cells is another important source of error. Coulter counters usually produce higher counts than do Fossomatic counters. The variability in counts generally is greater using a Coulter than a Fossomatic, however, for low SCC (<500,000), Coulter counts are usually less variable than those from a Fossomatic. Much of the variability can be related to the machine operator who is responsible for appropriate calibration and standardization. Inaccurate standards, inappropriate calibrations and changes in machine operators can produce considerable variation in reported BTSCC.

It is also important to consider changes in population dynamics of the herd that could account for observed changes in BTSCC. Older herds, with a low proportion of heifers, will often have higher BTSCC than young herds. A herd with many fresh cows or a low average days-in-milk often will initially have a low BTSCC that will rise as the average days-in-milk increases. We have observed that herds with a high proportion of registered cattle usually have higher BTSCC than their commercial counterpart, possibly because registered herds have a higher proportion of old cows. Other management changes such as movements of cows can affect BTSCC by exacerbating chronic mammary infections through 'stress' and by placing the cow in a different milking schedule. The SCC will be higher in cows milked at less than 12-hour interval, as is often the case when cows are moved to a string that is milked several hours before or after the former string.

Other management changes that may affect BTSCC include alteration of feeds or feeding, milker attitudes and herd size. Any change in feed, water or feed schedules can alter milk production and, therefore, alter the concentration of cells in the milk. Herds with unchanging udder health can show increased BTSCC with an abrupt reduction in production. A milker's attitude regarding removal of clinical cows to a hospital pen can influence the BTSCC as well, especially in small herds where the representation of a high-SCC cow in the tank will raise the BTSCC more than in a large herd. Increases in BTSCC associated with relief-milkers, for example, may represent a lack of awareness or a reluctance on the part of the milker to identify and move clinical cows to the hospital pen and not necessarily on an increase in udder infection resulting from poor or differing milking technique.

Because BTSCC is simple and inexpensive to measure, it will likely continue to be an important means for estimating and monitoring changes in herd udder health. Changes should be viewed in light of factors, other than infection status, that potentially affect the measure of BTSCC. New uses and applications of BTSCC should be pursued in order to maximize the information available from this measure. Some of these include differential somatic cell counting, analogous to that performed through hematology; intensive monitoring of BTSCC using daily measures to detect subtle changes and to permit rapid intervention if indicated; string BTSCC that would monitor milking strings; use of rolling averages that would dampen some of the variability and permit early visualization of trends and forecasting of seasonal changes. These applications may be enhanced by the uses of individual-cow SCC, which may offer additional information to evaluate herd udder health (Thurmond, 1986, Hueston and Heider, 1986).

References

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