Assessing somatic cell counts in your dairy herd – an essential skill

Assessing somatic cell counts (SCC) is an essential skill for both veterinarian and farmer. Measuring and interpreting cell counts trips up many a dairy farmer and veterinary advisor. In part, this is because of all the inherent inaccuracies with individual cow cell count measuring, but also the need to focus on patterns of new infection, not just identifying infected cows to treat or manage.

Adding further inaccuracies by not using an external, accredited laboratory, and a robust, regular testing protocol, such as is offered by the main milk recording organisations, just adds a further level of complexity, clouding the waters even further.

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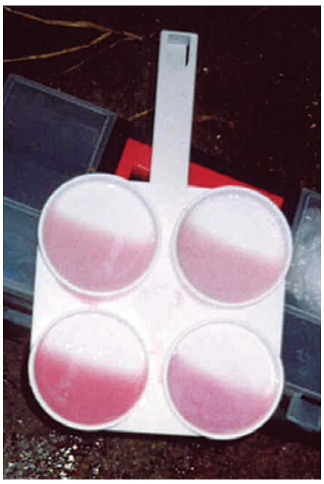
A healthy udder (Mo Kemp).

The cell count of a given quarter not only indicates when an infection is present but can also be used to assess when an infection may have cleared, particularly with Gram-positive infection.

Monthly individual SCC data are extremely useful for monitoring patterns of infection and for assessing treatment outcomes. Monthly cell counts only indicate the average cell count of four quarters, sometimes it is more beneficial to have cell counts from individual quarters. Monitoring individual SCC more regularly, even daily, may be useful in some situations but expert interpretation of the results will be needed, so as to avoid confusion.

Ideally, cell count tests should be easily performed at cow side, be quick, be cheap and reliable. When making decisions about which tests to use, consider whether you 'need' to know an actual SCC value cow-side, or do you just need to know that a quarter is infected? The investment in technology cow-side to determine a SCC value, whilst attractive, has to be weighed against a very cheap test like the CMT which still tells you the same thing – whether or not the quarter is likely to be infected. There are various means of assessing cell counts on farm – some are described below.

California Milk Test (Mo Kemp).



The California Milk Test

The most commonly used test that fulfils the criteria above is the California Milk Test (CMT).

An equal volume of detergent and milk are mixed. The resultant solution changes to a mucus-like, grainy solution if there is a raised cell count. One quarter can be compared to the other three making interpretation easy. The basis of the test is simple: the detergent splits the cells, releasing DNA which coagulates. The more cells, the more DNA, and the more coagulation. Simple, but effective, and reliable.

The CMT does not involve a colour change. This is a common misunderstanding. The dye in the CMT test solution is merely there to help make the clumping more obvious.

Limitations of this test include:

- Only very high cell counts (above about 400,000, depending on experience) will cause a visible change. Therefore, false negatives can occur.
- It is a subjective test and different operators may interpret the test differently. Ideally the same person/people should always perform the test – to ensure continuity of interpretation.

A home-made alternative

CMT fluid is costly. It is possible to perform this test using diluted domestic washing up liquid, combined with food dye:

- Mix the detergent with water, one part detergent to four parts water.
- Add 1ml food dye to 200ml of the detergent solution.
- Add an equal volume of milk and detergent solution to the CMT paddle (about 3ml of each) and look for clumping in the usual way.

Be aware that this method will not be as accurate as the CMT, as domestic detergents have varying levels of anionic surfactants, but if finances are tight then this cheap and easy method could be considered.

The Portasol SCC Milk Test

The Portasol SCC Milk Test gives a numerical reading. A test strip is dipped into the suspect milk, activator is added and within five minutes there is a colour change. The colour is compared to a chart to give an approximate cell count value. Accuracy with this test can be increased by using the test strip in a portable digital reader.

The DeLaval Cell Checker

The DeLaval Cell Checker (DCC) is more expensive, but again gives a relatively reliable numerical result, becoming more accurate the higher the cell count. It is dependent on temperature.

In general

Neither CMT, Portasol, or DCC somatic cell count testers replace laboratory cell count testing. CMT testing only indicates whether a quarter has a sub-clinical infection: it is not quantitative.

Portasol is slightly better in that it does give a 'ballpark' cell count. Neither test gives a precise accurate cell count figure.

Numeric sequential cell counts are needed to assess whether a quarter is responding to treatment; whether infection is clearing or has deteriorated.

On-farm tests are an aid to the monthly cell counts offered by NMR, CIS, QMMS or other accredited milk recording organisations. Cell counts do fluctuate, so a single test should never be relied upon.

One further limitation with cell count tests is that they do not detect the presence of bacteria. A quarter may show as CMT negative but still have bacteria present and hence infection may recur. There is another cow side dipstick test available that detects bacterial infections of the udder called UdderCheck.

This test detects an enzyme called lactate dehydrogenase, an enzyme that is elevated when bacterial infection is present. The test strip changes colour and results are compared to a colour chart. An automated version is available in the DeLaval Herd Navigator.

Sophisticated algorithms combining cell count, electrical conductivity and lactate dehydrogenase can begin to get closer to identifying infected quarters requiring treatment. Science and technology are gradually moving on, and doubtless this will be beneficial in time.

Care is needed though to interpret the increasing amount of available information.

Looking for patterns

SCCs can respond differently to specific pathogens.

- Staphylococcus aureus

Infection of the udder with S. aureus commonly causes a cyclical increase and decrease in SCC. This is because S. aureus is very effective at hiding in the udder. It is ingested by the white blood cells but is able to resist being killed by them. White cells detect infection, migrate to the udder, raise SCC and kill off a proportion of bacteria.

However, some bacteria are ingested by the white blood cells and resist being killed by them. They hide and survive within the white cells, are no longer detectable and SCC drops.

If milk is sampled for bacteriology during this period it is likely that cultures will be negative. Whilst 'hidden' within white cells, S. aureus is also able to evade being killed by antibiotics at this time, making it such a difficult pathogen to contend with.

Once the white cells die, the bacteria are released, multiply, are detectable once more, attract white cells and the SCC rises again. This process continues. Repeat milk samples for bacteriology when a case of S. aureus is suspected are therefore necessary.

Repeated samples should also be performed if a sample comes back positive. Even sophisticated laboratory tests can yield false positives and false negatives for this pathogen (up to 1 in 10 results may be misclassified even by the best tests). A cow should certainly never be culled on the basis of a single positive test result.

Arguably, a cow should not be culled even after a number of positive results, as greater than 90% of these cases can be cured with appropriate treatment during the dry period.

- Streptococcus uberis

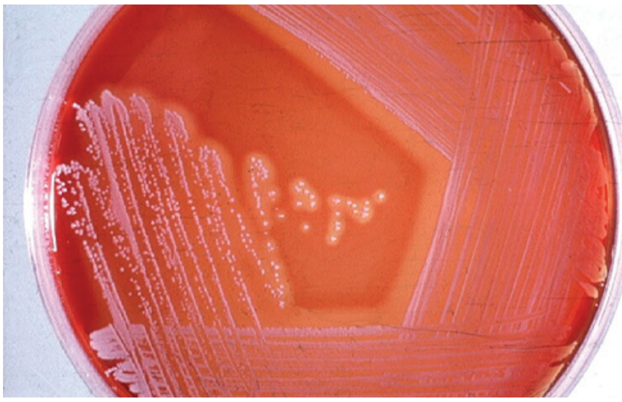
Some S. uberis strains have also been associated with persistently high SCC. This is because S. uberis is able to survive in the cow udder by breaking down milk protein, such as casein and using it for its own nutrition. This allows the bacteria to multiply rapidly and avoid the flushing out effect of milking.

S. uberis is also able to invade the epithelial cells of the udder thus avoiding destruction by the immune system. Persistence within the udder results in a persistently high SCC. It is thought that certain strains of S. uberis are better able to do this than others, which is why different S. uberis infections can appear very different from cow to cow and farm to farm.

- Escherichia coli

E. coli and other coliforms are continually challenging the cow's udder but, for the majority of the time, do not cause a problem, as the cow's immune system is able to clear them.

S. aureus plate (Mo Kemp).



An example of gangrenous mastitis (Mo Kemp).

These bacteria cannot 'stick' to the udder and so must be present in sufficient numbers to avoid being flushed out. Studies have shown that if a cow can raise her SCC within four hours then an infection will be cleared, whereas those cows that are slow to respond will succumb to mastitis.

There are sometimes concerns that a cow with a very low SCC is unable to mount an immune response quickly enough to fight infection and these findings might concur with that. However, the evidence is inconclusive and it appears to be the speed a cow can react rather than the number of white cells already present in the udder which determines her ability to respond to E. coli infections.

Cows have a downgraded immune response around the time of calving and can be more susceptible to mastitis at this time, as the neutrophils (white cells) are slower to respond to bacteria.

Stress (due to handling, transport, calving, managements issues, concurrent disease etc) can have an immunosuppressive effect. As a result of this, cows can become more susceptible to disease generally, including mastitis.

Chronic infections and chronically high SCC are unusual with infection with E. coli and other coliforms but do sometimes occur.

Typically, an E. coli infection causes a very dramatic and quick rise in SCC, followed by a decline to normal levels (below 200,000) within 7-10 days.

Therefore, SCC patterns can be used to predict which pathogens are present. Bacteriological sampling and identification of the bacteria involved will give the most accurate prediction of what the cows' SCC will do in response to infection.

Electrical conductivity

Electrical conductivity (EC) is another way to detect and measure mastitis levels in the herd. EC measurements are only useful if data is built up over a period of time. One-off measurements are not accurate.

For this reason, whilst there are hand-held devices available to measure EC they are more commonly used as an in-line computerised device, especially with robotic milking.

EC measurements are taken from every 200ml of milk from each individual quarter and the highest value at each milking is recorded. This value is checked against an average from the cow's milkings over the last 10 days and recorded as a graph. Spikes in the graph are easily seen and can then be further investigated.

Records are kept for several days and so the cow's infection history can also be checked. The in-line milk monitors are generally accurate and reliable but like all technology are prone to some faults, notably air bubbles or foam in the line.

The more modern detectors are designed to measure EC before removal of the cluster and hence avoid the introduction of air.

It is interesting to note that the spike in EC is due to mastitis causing an influx of sodium and chloride ions into the milk and a corresponding decrease in potassium and lactose.

EC measuring is a relatively new method of mastitis detection. Traditionally farmers tasted suspicious milk to check for a salty taste (in other words an increase in sodium chloride) for the detection of mastitis.

It is the author's opinion that handheld one-off EC detectors have the tendency to cause more confusion than any benefit. ■

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