LACTATION

TECHNOTE 11

Monitor bulk milk SCC

Bulk milk somatic cell count (BMSCC) refers to the concentration of cells (expressed as cells/mL) present in the vat or bulk milk. This is used:

- At the farm level – to assess milk quality status, and alert farmers to mastitis problems.
- By dairy processing companies – to determine payments or penalties to suppliers, decide how the supply will be processed, and market particular products.
- Nationally – to report on milk quality for industry benchmarking and marketing purposes.

BMSCC are conducted on samples collected when milk is pumped from the vat. A 'drip sample', taken throughout the transfer of milk from the vat to the tanker, is collected by the tanker driver and delivered to the company for testing.

Tests are performed on the milk sample at an independent testing laboratory using machines such as Fossomatics that count animal (somatic) cell nuclei stained with a fluorescent dye. This is not a measure of the number of bacteria present.

To ensure machines are measuring cell counts accurately, laboratories in New Zealand use internationally recognized reference standards.

BMSCCs are quoted as an actual test result for a particular sample, and can be summarised in forms such as arithmetic, geometric or rolling means. From 1 January 1998 the European Union required that milk from individual farms had BMSCC less than 400,000 cells/mL. Counts above this level are regarded as unfit for human consumption (European Union Directive 92/46/EC). Many dairy companies in the world have adopted this standard as a benchmark in their own quality schemes for competitive international trade in dairy products (Hubble 1997).

The European standard is based on a rolling three-month geometric mean, where herds are tested at least once a month. This method minimises the effects of extreme results and reduces the effect of seasonal variation. Recommendations for summarising and reporting national cell counts have

Confidence – High

BMSCCs give a general indication of the level of mastitis in dairy herds and are an integral part of quality assurance programmes operated by all dairy companies in New Zealand.

Research Priority – Medium

The relationship between BMSCC and prevalence of infection in a herd is likely to have changed as *Strep. uberis* becomes the predominant major pathogens in NZ herds over the past 20 years.

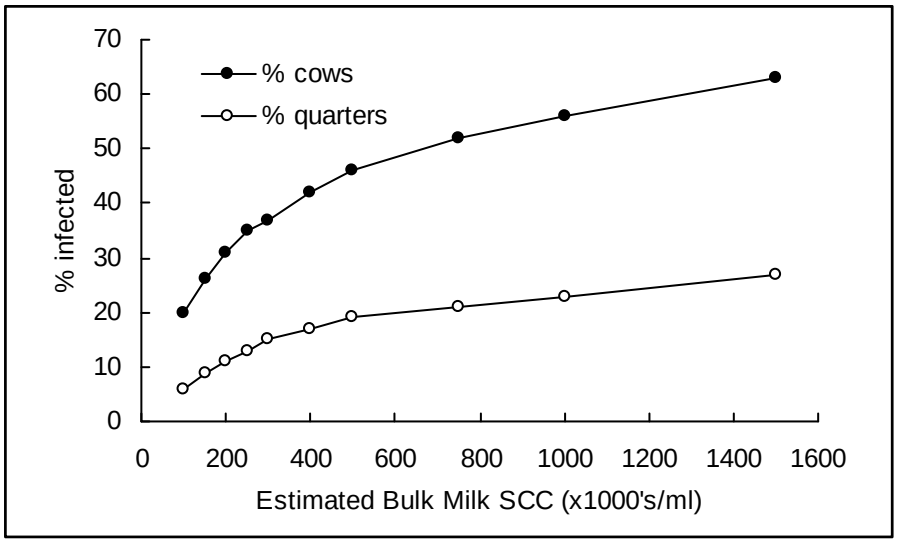
been published (International Dairy Federation 1996) because many countries use different methods to summarise BMSCC.

In the mid 1990's, the value of per-consignment testing of BMSCC for suppliers became apparent when the New Zealand Dairy Group, which collected milk from about 40% of NZ dairy suppliers introduced per-consignment or "daily" testing of the bulk milk (Lacy-Hulbert 1998). Daily testing, compared to once every 10 days, led to an 18% drop in the company's average BMSCC during the first season.

Estimating the level of mastitis in a herd using BMSCC

Estimates of BMSCC have been correlated with the prevalence of mastitis in the herd (Figure1; Holdaway *et al* 1996). This NZ study provided an early rule of thumb, that for every 100,000 cells/mL, there were approximately 10% of cows infected with a major pathogen.

Figure 1. Percent of cows and quarters infected compared with the bulk milk SCC, from Holdaway (1996).



On closer examination, it is likely that this rule of thumb is an underestimate at the lower BMSCC levels we see now. A more accurate rule of thumb for herds might be that approximately 15% of cows are infected for every 100,000 cells/mL, at least for herds with a BMSCC of 300,000 cells/mL or less (Table 1).

Table 1. Relation between bulk milk SCC and proportion of cows likely to be harbouring a major pathogen infection.

Bulk milk SCC (cells/mL)	Proportion of cows infected with a major pathogen	Proportion of cows per 100,000 cells/mL
100,000	20%	20%
200,000	30%	15%
300,000	36%	12%
400,000	40%	10%

The relationship between BMSCC and the prevalence of mastitis in herds depends on:

- the rate that somatic cells are passed into the milk; and
- how vigilant milkers are in detecting clinical mastitis and diverting their milk from the vat – as these cows contribute much higher numbers of cells than subclinical cases. (A single cow with a very high cell count can raise the average for the whole herd.)

The rate that somatic cells are passed into the milk is affected by the:

- type of bacteria causing the mastitis e.g. *Staph. aureus* infections in herds causes high BMSCC (Barkema *et al* 1998);
- stage of lactation and production level of the cows;
- time of milking and milking interval; and
- how long the cows have had mastitis.

Other methods, such as individual cow somatic cell counts (ICSCC) collected through herd testing, should be used to more accurately determine the prevalence of mastitis infection in herds.

11.1

Check bulk milk SCC using up to date data.

In NZ BMSCC are performed on vat milk samples on a per-consignment basis, and the BMSCC data is usually available within 24 h of a tanker pickup, by internet, email or text. Tanker dockets are delivered at the next pick-up. This is frequent enough to be a valuable and timely tool for monitoring trends in the current mastitis status of herds.

Technote 12 compares BMSCC with counts based on a herd average ICSCC.

Herds with BMSCC below 150,000 cells/mL have excellent mastitis control. A sudden increase in BMSCC, of 50,000 cells/mL or more may indicate one or more missed clinical cases (see section 11.3).

Assessment of a series of BMSCC, by graphing BMSCC against the date, is more useful than trying to interpret daily fluctuations in BMSCC. The onset of new infections in individual cows or variations in cell output of cows with existing infections can cause fluctuations in BMSCC (Figure 2).

Consequently the causes of BMSCC increases are more difficult to interpret in herds where there is a high level of existing infection and high SCC herds have greater daily variation than those with low SCC.

A series of BMSCC data should be assessed for:

- a trend of increasing BMSCC over time;
- counts above crisis or warning levels; and
- changes in the factory ranking of the herd.

If a supplier grades and incurs demerit points, between 5% and 100% of the milk payment can be lost, depending on the period and severity of grading. If the situation continues, causing the rolling geometric mean to go over 400,000 cells/mL, the dairy company may choose to reject milk from supply.

The simple graph (Figure 2) shows:

A. A 'high flier' (one single very high value) in October. **Action** – Look for undetected clinicals in the milking herd.
B. An increasing trend in BMSCC between October and March. **Action** – Seek advice to more proactively prevent contagious mastitis on-farm.
C. Critical BMSCC levels increasing. March BMSCC is approaching the penalty threshold of 400,000 cells/mL. **Action** – Remove high SCC cows from supply and seek advice to improve mastitis management.

Figure 2. Graphing bulk milk SCC by date for review and interpretation.

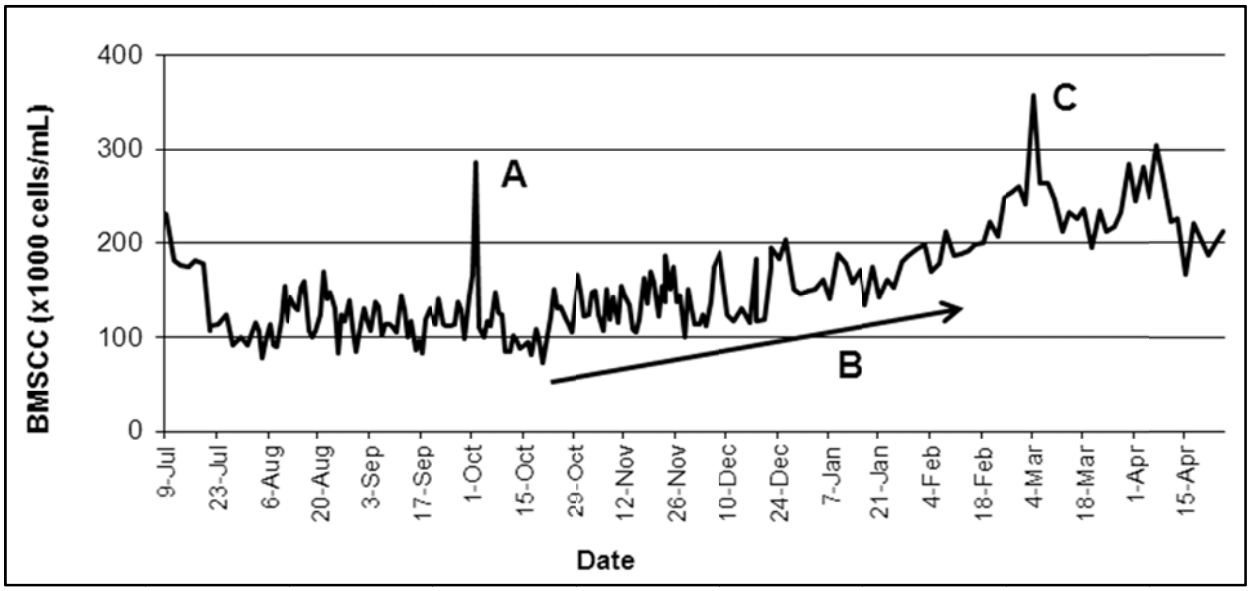
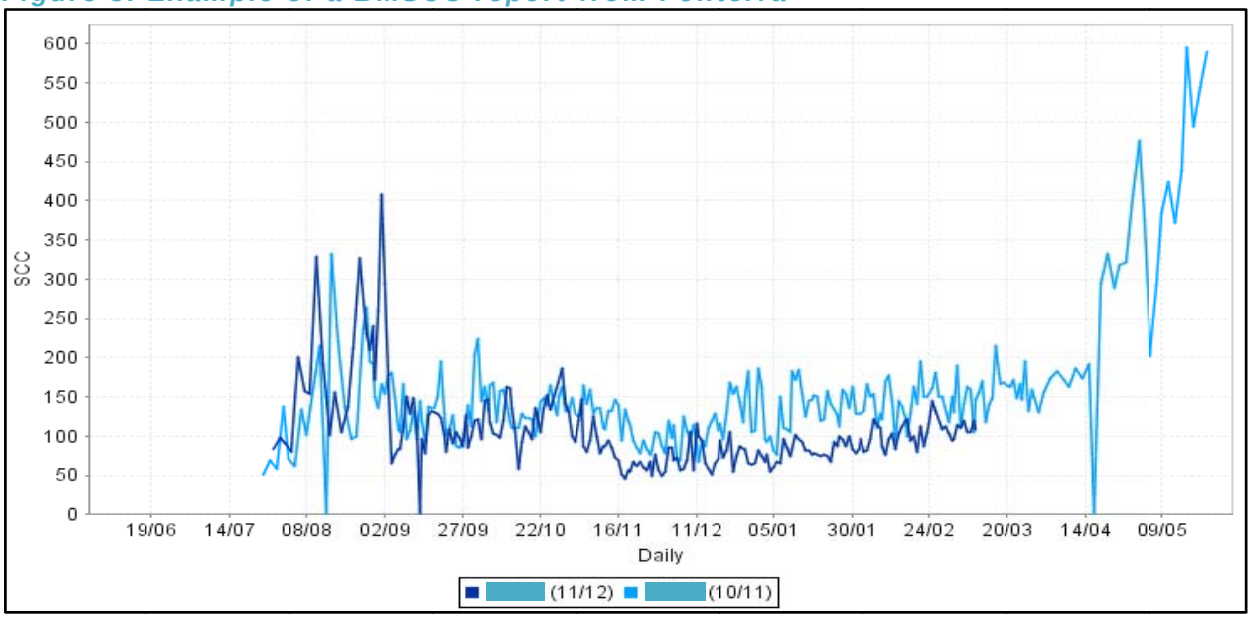


Figure 3 shows an example of a supplier's BMSCC where the 400,000 cells/mL penalty level is exceeded, on occasion, in spring, and repeatedly during the last month of the 2010/11 season. Also, year to year changes in BMSCC performance can be easily checked when the data is graphed in this way.

Figure 3. Example of a BMSCC report from Fonterra



Some researchers and advisers have used more sophisticated graphing systems. Dohoo and Meek (1982) found a fairly robust relationship between a 3-6 monthly rolling average BMSCC and the infection rate of quarters in a herd.

Using this method, they were able to classify herds with low (<10%), medium (10-25%) or high (>25%) quarter infection rates with an 80% accuracy.

BMSCCs are not a particularly sensitive indicator of low to moderate rates of mastitis spread – analysis of herd ICSCCs are more useful in this situation.

11.2

Consult your advisor if consistently above trigger or close to grading.

A high BMSCC indicates a mastitis problem worthy of further investigation. SmartSAMM recommends mastitis investigations in herds that have:

- One or more BMSCCs are above the penalty threshold
- Two or more BMSCC warnings are received
- Spikes in BMSCC are regular
- BMSCC trend upwards is steeper than your target curve
- BMSCC monthly averages are “off target” for past 3 months

Technote 12.3 describes using ICSCC to detect spread of infection in herds.

Professional intervention is also likely to be indicated in other circumstances, for example:

- if a gradual rise shows an increase of 20% or more over three months; or
- intermittent spikes in BMSCC over a farm-defined threshold.

Technotes 12 and 13 describe how advisers may respond to warning levels.

11.3

Check for clinical cases or exclude cows from supply.

In herds with BMSCCs below 200,000 cells/mL, a sudden increase of 50,000 cells/mL or more may indicate that a clinical case has been missed. For example:

- 150 cows at 200,000 cells/mL and 20 litres = 200,000 cells/mL in the vat.
- 149 cows at 200,000 cells/ mL + 1 cow at 5,000,000 cells/mL, all at 20 litres = 232,000 cells/mL in the vat.

Technote 4.1 describes physical examination of the udder to detect clinical mastitis.

Technote 5.2 describes foremilk stripping to detect clinical mastitis.

This will only be obvious in herds with low cell counts as those with higher BMSCCs have much more fluctuation on a day-to-day basis because there are so many infected quarters.

Technote 12.1 shows how to estimate the impact of high cell count cows on the BMSCC.

Acknowledgements

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Key papers

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