11 Monitor Bulk Milk Cell Counts

Bulk Milk Cell Counts (BMCC) refer to the concentration of cells (expressed as cells/mL) produced by the entire herd into the vat milk. They are used:

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

BMCCs 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 by dairy companies or at independent laboratories 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 accurately measuring cell counts, laboratories in Australia utilise an independent service that supplies cell count standards.

BMCCs are quoted as an actual test result for a particular sample, and in summarised forms such as arithmetic, geometric and rolling means. From 1 January 1998 the European Union required that milk from individual farms had BMCC 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 been published (International Dairy Federation 1996) because many countries are using different methods to summarise BMCC.

The New Zealand dairy industry has reported a reduction in its national average somatic cell count from an estimated 350,000 cells/mL to about 180,000 cells/mL over nine years (Hubble 1997). These estimates were based on arithmetic means.

Estimating the level of mastitis in a herd using BMCC

Estimates of BMCC are correlated with the prevalence of mastitis in the herd

Confidence – High

BMCCs give a general indication of the level of mastitis in dairy herds and are an integral part of the milk quality payment system for most dairy companies in Australia.

Milk quality tests, apart from BMCC, are described in the 'Vat milk tests' FAQ sheet.

(Holdaway et al 1996). A field rule of thumb is that herds with BMCC of 400,000 cells/mL have mastitis infections in 40% of cows, and herds with BMCC of 300,000 cells/mL have mastitis infections in 30% of cows (Ryan 1991). This estimate was calculated from approximately 200 year-round calving herds. It is only a rough guide, with wide confidence limits around the estimated prevalence (for example ± 10% according to Westgarth 1971).

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

- the rate that somatic cells are passed in 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. (As an extreme example, a single cow with a very high cell count might raise the average for the whole herd.)

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

- type of bacteria causing the mastitis (e.g. Strep agalactiae infections in herds cause high BMCC) (Wilson et al 1997);
- stage of lactation and production level of the cows;
- time of milking; and
- how long the cows have had mastitis.

Other methods, such as individual cow cell counts (ICCC) taken at herd recording, should be used to more accurately determine the prevalence of mastitis infection in herds.

Technote 12 compares BMCC with counts based on a herd average ICCC.

11.1 Check Bulk Milk Cell Counts whenever they arrive, to see if they have risen.

BMCCs are generally performed on vat milk samples at daily, weekly or 10-day intervals. Although there is sometimes a lag period, most BMCC reports are received by farmers frequently enough to be a valuable and timely tool for monitoring trends in the current mastitis status of herds.

Herds with BMCC below 150,000 cells/mL have excellent mastitis control. A sudden increase in BMCC may indicate one or more missed clinical cases. If the herd BMCC is usually less than 200,000 cells/mL, an increase of 10% may indicate a missed clinical case (see section 11.3).

Assessment of a series of BMCC, by graphing BMCC against the date, is more useful than trying to interpret daily fluctuations in BMCC. The onset of new infections in individual cows or variations in cell output of cows with existing infections can cause fluctuations in BMCC. Consequently the causes of BMCC increases are more difficult to interpret in herds where there is a high level of existing infection and high cell count herds have greater daily variation than those with low counts.

Example of a BMCC report from Bonlac Foods Limited

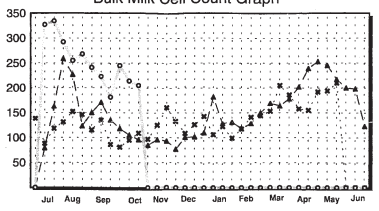
BONLAC FOODS LIMITED *Bonlac - Milk Quality Monitor*
A.C.N. 006 483 665

BONLAC FOODS

Farm No
Month October

Financial Year
1998
1999
2000

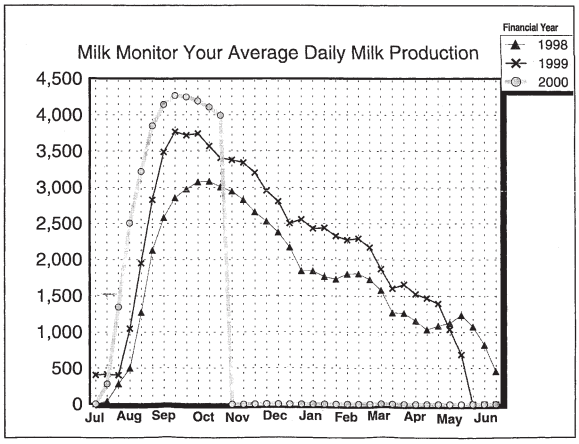
Bulk Milk Cell Count Graph



Monthly Average Cell Count Table

Month	Your Average BMCC	Factory Supplied Average BMCC
Jul	331	248
Aug	272	202
Sep	215	196
Oct	221	190
Nov		
Dec		
Jan		
Feb		
Mar		
Apr		
May		
Jun		

Milk Monitor Your Average Daily Milk Production



BONLAC FOODS LIMITED
A.C.N. 006 483 665

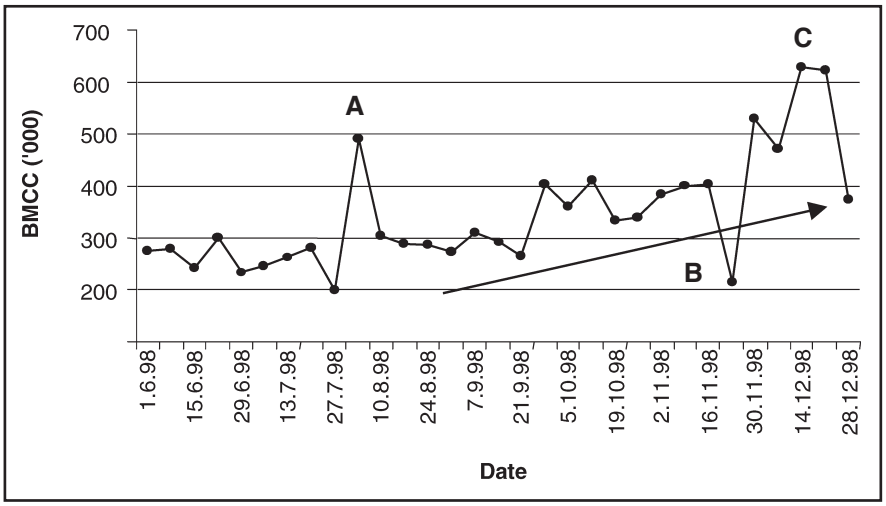
Milk Production Statement

BONLAC FOODS

Farm No
Month OCTOBER

Day	Type	Litres	Fat %	Protein %	Fat Kg's	Protein Kg's	Quality Test	Results	Band
01/10/1999	Day	4,203	3.99	3.18	167.7	133.7	BMCC	263,000	
02/10/1999	Day	4,263	4.04	3.24	172.2	138.1	BMCC	217,000	
03/10/1999	Day	3,951	3.96	3.23	156.5	127.6	BMCC	166,000	
04/10/1999	Day	4,325	4.00	3.22	173.0	139.3	BMCC	199,000	
05/10/1999	Day	4,204	3.83	3.28	161.0	137.9	BMCC	280,000	
							Bacto	63,000	1
							Therm ..	160	1
06/10/1999	Day	4,264	3.82	3.26	162.9	139.0	BMCC	265,000	
07/10/1999	Day	4,081	4.02	3.27	164.1	133.4	BMCC	339,000	
08/10/1999	Day	4,417	4.03	3.25	178.0	143.6	BMCC	312,000	
09/10/1999	Day	4,109	4.12	3.24	169.3	133.1	BMCC	240,000	
10/10/1999	Day	4,101	3.96	3.23	162.4	132.5	BMCC	173,000	
							Avg CC	245,000	1
Total		41,918	3.98	3.24	1,667.1	1,358.2	Q/P Band =		1
11/10/1999	Day	4,161	4.26	3.14	177.3	130.7	BMCC	151,000	
12/10/1999	Day	4,133	4.11	3.20	169.9	132.3	BMCC	349,000	
13/10/1999	Day	3,947	4.13	3.21	163.0	126.7	BMCC	286,000	
14/10/1999	Day	4,287	3.99	3.23	171.1	138.5	BMCC	208,000	
15/10/1999	Day	4,025	4.13	3.29	166.2	132.4	BMCC	197,000	
							Bacto	45,000	1
16/10/1999	Day	4,133	3.95	3.27	163.3	135.1	BMCC	195,000	
17/10/1999	Day	4,092	4.01	3.22	164.1	131.8	BMCC	212,000	
18/10/1999	Day	4,077	4.00	3.18	163.1	129.6	BMCC	214,000	
19/10/1999	Day	4,015	4.04	3.24	162.2	130.1	BMCC	172,000	
20/10/1999	Day	4,198	3.97	3.22	166.7	135.2	BMCC	158,000	
							Avg CC	214,000	1
Total		41,068	4.06	3.22	1,666.9	1,322.4	Q/P Band =		1
21/10/1999	Day	4,035	4.02	3.32	162.2	134.0	BMCC	202,000	
22/10/1999	Day	3,961	4.19	3.33	166.0	131.9	BMCC	235,000	
23/10/1999	Day	4,073	4.07	3.25	165.8	132.4	BMCC	- 192,000	
24/10/1999	Day	4,031	4.08	3.26	164.5	131.4	BMCC	165,000	
25/10/1999	Day	3,806	4.40	3.47	167.5	132.1	BMCC	198,000	
							Bacto	20,000	1
26/10/1999	Day	4,197	3.86	3.34	162.0	140.2	BMCC	145,000	
27/10/1999	Day	4,064	3.61	3.39	146.7	137.8	BMCC	220,000	
28/10/1999	Day	4,058	4.00	3.35	162.3	135.9	BMCC	250,000	
29/10/1999	Day	3,911	4.16	3.39	162.7	132.6	BMCC	211,000	
30/10/1999	Day	4,013	4.15	3.33	166.5	133.6	BMCC	234,000	
31/10/1999	Day	3,761	4.14	3.33	155.7	125.2	BMCC	206,000	
							Avg CC	205,000	1
Total		43,910	4.06	3.34	1,781.9	1,467.1	Q/P Band =		1
MTD	This Year	126,896	4.03	3.27	5,115.9	4,147.7			
	Last Year	110,519	3.87	3.12	4,274.7	3,449.9			
YTD	This Year	370,718	4.02	3.32	14,899.0	12,293.3			
	Last Year	293,948	3.94	3.18	11,588.6	9,340.8			

Graphing BMCC by date for analysis



A series of BMCC data should be assessed for:

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

For example, the simple plot above shows:

A A 'high flier' (one single very high value) in August.

B An increasing trend in BMCC between August and November.

C Crisis BMCC levels in December. The December level crosses the penalty threshold (to an extent where farmers may be receiving only 50% of their potential milk cheque from some companies) and is close to being rejected by companies in some states.

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 BMCC 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.

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

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

11.2 Consult with your factory field officer or veterinarian if close to, or in receipt of, Bulk Milk Cell Counts that would downgrade milk.

A high BMCC indicates a mastitis problem worthy of further investigation. The Countdown Downunder Farm Guidelines for Mastitis Control recommend mastitis investigations in herds that have:

- average bulk milk counts above 250,000 cells/mL over the past six months; or
- cell counts that are regularly above the premium payment threshold.

These warning levels serve as a guide for the point where investigation should definitely be activated. A BMCC averaging above 250,000 cells/mL for six months may include many 10-day or daily counts above 250,000 cells/mL and intervention may be warranted much earlier.

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

- if a gradual rise shows an increase of 10% or more over three months;
- there are two or more counts above the warning threshold; or
- one count is above the penalty threshold.

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

11.3 Check for clinical cases – undetected clinicals can cause Bulk Milk Cell Counts to rise.

In herds with BMCCs below 200,000 cells/mL, a sudden increase of 10% 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.

This will only be obvious in herds with low cell counts as those with higher BMCCs 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 BMCC.

Technote 5.2 discusses using foremilk stripping to detect clinical mastitis.

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

Key papers

Dohoo IR, Meek AH. Somatic cell counts in bovine milk. Can Vet J 1982;23A:119-125.

Holdaway RJ, Holmes CW, Steffert U. A comparison of indirect methods for diagnosis of subclinical intramammary infection in lactating dairy cows Part 3. Aust J Dairy Technol 1996;51:79-82.

Hubble IB. Testing and reporting raw milk quality. Aust J Dairy Technol 1997;52:102-108.

International Dairy Federation. Recommendations for presentation of mastitis related data. In: Production, hygiene and quality of milk, Commission A, Supplement, Sandton, South Africa, 1996: A-Doc 186.

Ryan D. Investigation of mastitis problem farms. In: Post Graduate Foundation in Veterinary Science Proceedings 161, Dairy medicine and production, University of Sydney, 1991:43-58.

Westgarth DR. Interpretation of bulk cell count data. In: Dodd FH, Jackson ER editors. The control of bovine mastitis. British Cattle Veterinary Association 1971:105-111.

Wilson DJ, Das HH, Gonzalez RN, Sears PM. Association between management practices, dairy herd characteristics, and somatic cell count of bulk tank milk. J Am Vet Med Assoc 1997;210:1499-1502.