



What tests, apart from bulk milk cell counts, are useful in assessing milk quality?

A number of tests are conducted on milk samples from farm vats. Vat tests that relate specifically to mastitis are bulk milk cell counts and bulk-tank milk cultures. Other tests, such as a total plate count or Bactoscan, are primarily related to milk quality issues.

Bulk-tank milk cultures

Bulk-tank milk cultures may help identify organisms present in the vat and provide information on the cleanliness of milk harvesting techniques and equipment, and the adequacy of milk cooling. Dairy advisers sometimes submit vat samples to laboratories as part of mastitis investigations.

To obtain samples that are representative, the vat must be well mixed by turning on the agitator 10 minutes before sampling and samples taken from both the top and bottom of the tank (Mackie 1997). The methods used to collect and store samples are critical to prevent overgrowth with micro-organisms, and appropriate arrangements must be made to ensure samples are maintained at refrigeration temperatures. It is not advisable to make diagnostic decisions based on a single test – a series of at least three is recommended.

The procedures for culture of vat samples for bacteria originating from within the udder has been developed and refined in the United States over the past 15-20 years (Guterbock and Blackmer 1984), but few formal analyses of its usefulness as a diagnostic test for mastitis have been conducted. Vat culture is reported to have a low sensitivity for the major mastitis pathogens. Although herds infected with *Strep agalactiae* are expected to have high numbers of bacteria in milk, Godkin and Leslie (1990) found they were only detected reliably by repeated cultures. This experience has also been observed in the field in Australia.

Further studies are required to identify methods to increase the sensitivity of this screening test, including establishing appropriate sampling regimens on farm, and selective media and inocula sizes in laboratories. Although it is tempting to use bulk-tank milk to identify potential pathogens, isolated organisms do not necessarily originate from mastitic cows. For example *Strep uberis* is ubiquitous in the environment and able to multiply in raw milk cooled below 10°C, so isolation from the vat does not necessarily indicate infected quarters. More direct links between the bacteria isolated from vat milk samples and the cause of mastitis can be established by sampling individual cows.

[Technote 4.3 discusses milk cultures from individual cows.](#)

Total plate count

Total plate counts provide accurate counts of bacteria in vat milk. The presence of bacteria is established by incubating a diluted sample of vat milk on agar plates (with special growth media) for 72 hours at 30°C. The bacterial that grow are counted and the total number in the original sample is estimated according to the dilution factor used.

Counts may be high if:

- there are problems with washing equipment or refrigeration of the milk; and
- wet or dirty cows are milked, with bacteria from the cows' skin and hair washing into the milk.

Although mastitis can cause an increase in total plate counts, this situation is not common. High total plate counts are occasionally seen in herds with *Strep agalactiae* infections.

Bactoscan

The Bactoscan has largely replaced total plate counts because the number of living bacteria in a milk sample can be estimated in five minutes (rather than the three days required for cultures). The Bactoscan machine counts bacteria with the aid of a fluorescent dye. These machines are subject to regular documented calibrations to ensure their accuracy.

Thermoduric count

Thermoduric counts are the number of bacteria per millilitre of milk that survive laboratory heat treatment. High thermoduric counts indicate poor equipment cleaning and sanitation problems.

Milk samples are held at 62.8°C for 30 minutes, cooled for 10 minutes, then incubated for 72 hours at 30°C. The equivalent diagnostic test in the United States is the Laboratory Pasteurised Count (LPC), where samples are incubated for 48 hours at slightly higher temperature (32°C).

Using multiple tests to troubleshoot milk quality problems with high bacterial counts

High bacterial counts can arise from organisms passed in the milk or from bacteria contaminating equipment. Problems of milk quality due to high bacterial counts can be investigated using a combination of tests such as total plate counts, thermoduric counts and coliform counts (where coliforms specifically are estimated). The approach is to take milk samples from the bulk tank at different times during milking and from different locations in the milking plant. This helps to differentiate high bacterial counts arising from problems of pre-milking hygiene, equipment cleaning and sanitation, and incubation of bacteria in the milk handling system from mastitis pathogens (Reinemann et al 1997).

Guide to troubleshooting milk quality (Mein 1999)

Test	Examples of milk quality categories			Interpretation
	Excellent	Adequate	Warning or penalty	
BMCC (cells/mL)	<200,000	200,000 – 400,000	>400,000	Mastitis may be a cause of high bacteria counts if both the BMCC and Bactoscan readings/ total plate counts are high.
Bactoscan band (estimated bacteria/mL)	<80,000	–	≥80,000	
Total plate count (colony forming units/mL)	<10,000	10,000 – 20,000	>20,000	
Thermoduric (count/mL)	<1,500	1,500 – 3,000	>3,000	Elevated thermoduric counts generally result from equipment cleaning and sanitation problems.
Coliform (count/mL)	<100 (low)	100 – 500 (medium)	>1,000 (high)	Medium elevations in coliform counts generally result from inadequate milking hygiene (cups on wet teats, manure on cups, etc). High elevations often result from incubation in the milking system during long milking shifts (e.g. bacterial growth on milk filters).

Key papers

- Godkin MA, Leslie KE. Culture of bulk tank milk as a mastitis screening test: a brief review. *Can Vet J* 1993;34:601-605.
- Guterbock WM, Blackmer PE. Veterinary interpretation of bulk-tank milk. In: *Veterinary Clinics of North America Large Animal Practice* 1984;6:257-268.
- Mackie J. Bulk tank milk analysis: its role in troubleshooting mastitis and bacterial contamination of milk. In: *Proceedings of the Australian Association of Cattle Veterinarians* 1997:49-56.
- Mein GA. Trouble-shooting high bacteria counts in farm milk: Part 1a Routine milk quality analysis. In: *Post Graduate Foundation in Veterinary Science Proceedings 321, Machine milking, mastitis and milk quality course notes, University of Sydney* 1999:356.
- Reinemann DJ, Mein GA, Bray DR, Reid D, Britt JS. Troubleshooting high bacteria counts in farm milk. In: *Proceedings of the 36th National Mastitis Council Annual Meeting, Albuquerque, New Mexico, 1997:65-79.*

