



# What cow-side tests are useful in detecting mastitis?

Tests used in the dairy shed to detect subclinical mastitis in cows include the Rapid Mastitis Test and measuring the electrical conductivity or pH of milk samples.

Technote 4.3 discusses the use of milk cultures to detect cows with mastitis.

### The Rapid Mastitis Test

The Rapid Mastitis Test (or Californian Mastitis Test) is a cow-side test that detects subclinical mastitis in individual quarters by the presence of cells in milk samples. A small amount of milk from each quarter is squirted into a dish at milking and an equal amount of detergent reagent is added. The solution is swirled to mix it, and the amount of gel reaction is assessed.

It is critical to differentiate trace reactions from test negative samples to identify cows with subclinical mastitis. Experience is required to obtain accurate readings of trace reactions as the slime layer may not be obvious in some samples.

### Gel reaction scores in the Rapid Mastitis Test

Score	Visible change	Approximate cell count (cells/mL)
Negative	Fluid mixture	< 200,000
Trace	Slight slime formation most noticeable when the mixture is gently swirled in the dish	150,000 – 500,000
1+, 2+ or 3+	Distinct slime formation which coats the side of the container when the mixture is swirled	>400,000

Commercial Rapid Mastitis test kits, such as Mastest, from DLC Australia Pty Ltd, are available from veterinarians and dairy product suppliers.

## Electrical conductivity of milk

Normal milk contains a small amount of salt that allows an electric current to pass through it. In damaged udder tissue, more salt leaks into the milk and the electrical conductivity of milk increases. Changes in electrical conductivity in inflamed mammary glands may precede visible changes in milk, and assist early identification of subclinical and clinical cases of mastitis. Evaluations of conductivity tests to diagnose intramammary infection have given widely varying results, and are summarised in a comprehensive review by the International Dairy Federation (Hamann and Zecconi 1995).

There are two different approaches to measuring conductivity:

- hand-held, portable instruments used for occasional strategic cow-side testing; and
- in-line units that provide conductivity measurements throughout each milking (e.g. units with conductivity electrodes implanted in the cluster and coupled to a computer).

Although the proportion of herds in Australia that take in-line conductivity measures at each milking is very low, it is likely that the use of this diagnostic system will increase in the future, especially in large herds.

There are several hand-held meters on the Australian market. It is important to assess foremilk at the start of the milking process (Woolford et al 1998), and testing this milk immediately after it is removed from the udder reduces variations in readings due to changes in temperature of the sample.

The accuracy of conductivity meters varies with the type of pathogen causing the mastitis and the duration and extent of tissue damage. There is substantial overlap between the conductivities of milk from normal and mastitic quarters and a lot of variation in the natural conductivity during milking for individual cows and between cows (Hillerton and Walton 1991, Milner et al 1996). The ability of meters to discriminate between normal and infected quarters depends on consistent collecting and testing techniques, the availability of base-line data for cows, and the method of interpretation of results.

To find a quarter with damaged tissue, it is best to compare between quarters in the same cow at the same time rather than look for a particular absolute conductivity level. (An assumption is made that the quarter with the lowest value has 'normal' tissue, which is not always the case.) Before interpreting the result of a hand-held device it is important to check whether the display reports electrical conductivity or electrical resistance – the two measures are inversely related with resistance decreasing as conductivity increases.

Selecting an optimal threshold to classify cows as infected can vary between herds and is influenced by the prevalence of mastitis in the herd and the relative cost of misdiagnosis (Mansell 1998, Sheldrake et al 1983). Even under ideal conditions conductivity meters are only considered as an aid to mastitis diagnosis.

Tips from New Zealand's Dairying Research Corporation for using conductivity meters are:

- Use only the first foremilk for measurement.
- Carry out measurements at cow-side, particularly if the meter does not have temperature compensation.
- Do not compare readings between cows.
- Restrict comparisons to measures of quarters on the same cow.
- For a cow, a quarter with a reading more than 15% higher than the lowest reading for that cow is very likely to be infected.
- Do not use the meter to measure vat milk – the result will be meaningless.
- Conductivity meters can be used during the colostrum period, but there will be errors in readings if calves are suckling.

## pH of milk

Another simple diagnostic test based on changes in milk ion concentrations is pH measurement. In inflamed quarters, bicarbonate ions entering the milk from the bloodstream can cause increases in the pH (from a normal level of 6.6) to levels of 6.9 or higher and this is detectable by indicator dyes or conventional electrode procedures. In isolation, changes in pH are considered a poor test. Indicators have been combined with Rapid Mastitis Test reagents so that they demonstrate a colour change due to change in ion concentration as well as gel formation from elevations in somatic cell counts.

## Key papers

- Hamann J, Zecconi A. Evaluation of the electrical conductivity of milk as a mastitis indicator. In: Proposal to the International Dairy Federation, subgroup A2D, Machine milking and mastitis, third draft, October 1995.
- Hillerton JE, Walton AW. Identification of subclinical mastitis with a hand-held electrical conductivity meter. *Vet Rec* 1991;128:513-515.
- Mansell PD. The use of hand-held "mastitis detectors" in the diagnosis of subclinical mastitis. In: Proceedings of the XX World Association of Buiatrics Congress, Sydney, 1998:285-289.
- Milner P, Page KL, Walton AW, Hillerton JE. Detection of clinical mastitis by changes in electrical conductivity of foremilk before visible changes in milk. *J Dairy Sci* 1996;79:83-86.
- Sheldrake RF, McGregor GD, Hoare RJT. Somatic cell count, electrical conductivity and serum albumin concentration for detecting bovine mastitis. *J Dairy Sci* 1983;66:548-555.
- Woolford MW, Williamson JH, Henderson HV. Changes in electrical conductivity and somatic cell count between milk fractions from quarters subclinically infected with particular mastitis pathogens. *J Dairy Sci* 1998;65:187-198.

