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Using the California Mastitis Test

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One of the best ways to detect mastitis is to use the California Mastitis Test (CMT). A four-compartment paddle and the CMT reagent are the only supplies you need to conduct the test.

Conducting the CMT is simple, but before interpreting the results, you need to know what the test measures.

Test for invisible mastitis

Milk that is watery, thick or ropy means an active case of mastitis has progressed far enough to be recognizable. This is clinical mastitis.

However, such clinical cases make up only about 20 percent of the mastitis in dairy herds. Infected quarters usually produce normal appearing milk. Infections may continue for weeks before you notice abnormal milk or soreness of the udder. Researchers have made many attempts to devise a test for this "invisible" mastitis. So far, the CMT is the most satisfactory test for cowside use.

Abnormal milk and infection

The animal body defends itself against injury and infection. When infection occurs, white blood cells, or leukocytes, gather to engulf bacteria and stop the spread of infection. If an injury is sterile, few leukocytes are present; but if infection sets in, the white blood cells congregate in great numbers.

High leukocyte counts in milk strongly indicate mastitis-causing bacteria are present. The CMT reagent, when added to milk, reacts with a part of the leukocytes, forming a gel. The greater the mastitis infection, the more leukocytes present and the more gel-like substance that forms. Table 1 shows how the leukocyte count in milk influences the appearance of the test and affects the CMT score.

Table 1
The CMT score in foremilk.

Leukocyte count per milliliter	Test appearance	CMT score
Below 200,000	Mixture liquid, no precipitate	negative
150,000 to 500,000	Slight precipitate, tends to disappear with paddle movement	T
400,000 to 1,500,000	Distinct precipitate but does not gel with paddle movement	1
800,000 to 5,000,000	Distinct gel formation	2
Over 5,000,000	Strong gel formation that tends to adhere to paddle. Forms distinct central peak	3

Use the first stream or two of milk from a quarter for the test. Milk drawn later will have fewer leukocytes. Leukocytes, however, will increase as milk flow slows and will be highest in residual milk taken between milkings.

The California Mastitis Test, then, is a measure of the inflammation within a quarter and can be scored on the basis of degree of gel formation.

The purple color that results from the test is generally more intense in samples from infected quarters. This is because such samples have a basic or alkaline pH. The deep purple color indicates abnormal composition of milk. It means the mammary gland is infected.

CMT in milk barn

The CMT is best used on fresh milk in the milking barn. It is simple, quickly performed and inexpensive.

CMT and DHI SCC

Dairy Herd Improvement (DHI) associations offer monthly somatic cell count (SCC) services to dairy producers. These counts are made on combined milk of all quarters of individual cows. This service provides monthly records.

The CMT is used to identify inflamed quarters of cows positive to DHI SCC tests.

Profitable use of CMT

Whether you use the DHI program or individual monthly CMT tests as the basis of your records, you need records of CMT reactions of inflamed quarters.

When you test all lactating animals monthly and keep records, you can expect the following benefits:

- Early detection of inflammation so that:
- Laboratory testing can be done on inflamed quarters
- Treatment can be made promptly and effectively
- Udder damage can be minimized
- Milk losses can be reduced.
 - Ability to base milking order on test results. This helps prevent the spread of infection.
 - Indication of when treatment may be needed and whether treatment has been effective.
 - Indication of when to dispose of an animal.
 - Better service from the veterinarian, because the history of udder health is available.
 - Less cost for laboratory testing, because only inflamed quarters need to be tested.

Test is simple

The procedure for conducting the CMT is simple. Draw foremilk from each quarter into separate cups of a four-cup plastic paddle. Tilt the paddle to equalize milk quantities in the cups at about 1/2 teaspoon each. Add 1/2 teaspoon of test reagent to each cup. Make sure you use reagent produced under license to ensure standardized concentration.

Rotate the paddle to mix, and observe changes in color and gel formation within 10 to 15 seconds after mixing. Milk from a normal quarter remains liquid and flows freely. In a moderate reaction, the gel that forms is fragile and breaks into small masses or clumps. Milk samples that react strongly form a gelatinous mass that clings together as the paddle is rotated.

Interpret CMT results

Experience and practice are necessary for accurate scoring of the test. But repeated testing and careful study of accurate records give good management information.

Limitations of the test are important. Not all inflammation is caused by bacteria. However, reactions to the CMT are usually weak when caused by injury. Several types of bacteria may infect the udder, and the CMT does not identify the type. Laboratory cultural tests must be used for this purpose.

Some mastitis does not respond to treatment. The CMT does not indicate whether treatment will be effective. The amount of inflammation, and consequently the CMT score, may change moderately from day to day even though the infecting organism remains within the quarter. Therefore, repeated testing and accurate record keeping are important.

Don't use the CMT before the third day after calving or to test milk from cows being dried off. Leukocyte counts are relatively high during these periods.

Irritation from malfunctioning or improperly operated milking machines may cause low-scoring CMT reactions to occur in large numbers. This warns you to improve your milking procedures or that the vacuum pump, pulsator or some other part of the milker is not operating properly. If irritation continues, infectious mastitis may result.

Laboratory culture tests at the Missouri Experiment Station demonstrate that as severity of reaction to the CMT increases, probability of infectious mastitis increases (Table 2).

Table 2

Percentage of quarters infected and CMT score.

CMT score	Description	Percent infected
No reaction	Negative	25
T	Trace	50
1	Weak positive	75
2	Distinct positive	90
3	Strong positive	95-100

Note that even among quarters not reacting, as many as 25 percent may be shedding mastitis-causing bacteria, at least in small numbers.

In herds that have had excellent mastitis control for several years, from 5 to 20 percent of the total quarters of the herd may react at a given time. However, no more than 1 to 10 percent of these would be strong reactions.

In a grossly infected herd, as many as 60 to 75 percent or more of the total quarters will react at some time during the year. The percentage of strong reactors will generally range from 25 to 40 percent.

Dairy producers whose methods and measures of preventing mastitis are average can expect 15 to 20 percent of the quarters tested to give strong reactions.

As the dairy animal ages, the number of quarters reacting can be expected to increase. On the average, when you test 2-year-old cows, you can expect one strong reaction for about every 10 quarters examined. But when you test 5- and 6-year-old cows, you can expect one out of every four quarters to react strongly.

Established chronic cases of mastitis produce uniform CMT reactions throughout the lactation. Atrophied quarters, those made smaller by long-term infection, produce strong CMT reactions consistently. In general, atrophied and fibrotic (hard) quarters are most difficult to rid of infection.

Factors other than infection that tend to increase leukocyte numbers and to increase CMT reactions include:

- Positive reaction one to two weeks following treatment.
- Very early (colostrum) and late lactation.
- Teat end injury.
- Fluctuating and irregular milking vacuum.
- Injury to the udder.
- Periods of estrus.
- Abnormal health of cow such as foot rot or uterine infection.

Related MU Extension publications

- WQ323, Mechanical Solid/Liquid Separation for Dairy Waste
<http://extension.missouri.edu/p/WQ323>

Order publications online at <http://extension.missouri.edu/explore/shop/> or call toll-free 800-292-0969.



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