Milk testing – the route to effective on farm mastitis management

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Milk testing is essential in a developed dairy market. It is the tool to determine milk quality. Defining milk component standards like fat and protein levels and bacterial counts allows homogeneity and thus results in a system that guarantees the maintenance of the high quality demanded by today's customers.

Milk testing is also a necessary step for mastitis control: with data at herd, animal and quarter levels you know the situation on your farm, you have a detailed picture and you can take appropriate remedial action.

Today, in Europe, many tools already exist and these produce a lot of data. On the other hand, old, simple and cheap tests have been forgotten, for instance the CMT test.

The main milk testing methods will be described in this article and we will then detail when, why and how often each test should be used. A combination of different tests is useful for farmers as their correct use in a precise routine leads to first class information for mastitis control. In addition, more profitable preventive mastitis management can then be implemented!

Milk tests

Different systems are available to monitor mastitis at farm level, ranging from the most basic to laboratory tests. Several articles have described the most common tests that are available.

The purpose of this article is not to describe in detail the methods, but to consider the parameters to take into account to select milk tests as part of a mastitis management program.

Major tests related to the detection of mastitis are:

- **Visual observation of milk.** Changes to the colour and consistency of milk are the basics of milk testing. This simple, fast and cost effective test should be undertaken prior to each milking. The detection of flocs and/or the modification of colour is associated with clinical mastitis. It is the preferred way to detect clinical mastitis. This test is performed with a forestrip cup (specific cup with black fond to facilitate the detection of signs of clinical mastitis).
- **Electrical conductivity** (EC) is the measure of the resistance of the milk to an electric current. It is based on the concentration of ions (mainly anions Cl^- and cations Na^+ and K^+). Intramammary infection is correlated to increase of EC due to cell destruction and leakage of ions. The detection of cows with clinical mastitis is about 80%, and specificity is around 75% (healthy cows recognised as healthy). One important and quite limiting factor is that EC is cow (even quarter) specific, which means that there is no strict threshold for any cow, but these vary from cow to cow. Thus, routine measurements and records are essential to interpret the EC and detect mastitis.
- **Other tests** based on milk composition are also available (for example Lactate dehydrogenase increase, correlated to increase of immune response; or lactose decrease related to bacteria presence. More data should be collected and be interpreted to evaluate if an extension of the use of these parameters will optimise mastitis detection and control.
- **SCC** (Somatic Cell Count). This is produced by immune system cells arriving from the blood into the udder when intramammary modification (mainly infection) occurs and is the reference parameter for detecting subclinical mastitis. SCC measurement can be done on the farm (semi-quantitative test based on CMT method) or in the laboratory (Fossometric system measure is the reference in Europe).

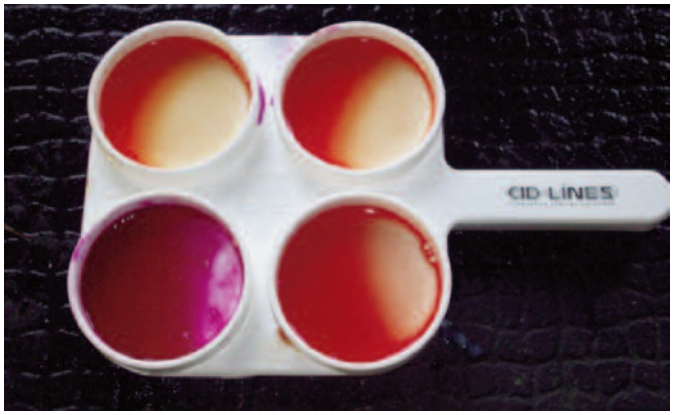
Milk measurements related to control and cure of existing mastitis include:

- **Detection of pathogens.** This can be done with two main methods: **culture** (allowing bacterial growth in the laboratory and recognition of specific micro-organisms) and **PCR** (Polymerase Chain Reaction; amplification of a specific part of DNA of one or several bacteria). This last method reduces the number of 'no growth' results quite frequently obtained with culture.

It is a very exciting technology, allowing very fast and detailed results, but how useful is the information?

The idea is to know your enemy. Thus, you can react fast which is crucial for mastitis appropriate treatment and to avoid udder damage.

Adequacy of first treatment administered in cases of mastitis is improved thanks to utilisation of data from previous mastitis cases on the farm.



Detection of quarter with high somatic cell count with Kenotest (Californian Mastitis Test).

Table 1. Milk tests associated with mastitis management.

Level of test	Milk tests	Information collected
Herd	Bulk SCC	General situation, compliance to official standard of healthy milking
Herd	PCR of bulk milk	Pathogens
Cow	ISCC	Healthy/infected animal
Cow	Conductivity	Indicator of milk composition modification (mainly related to mastitis)
Quarter	CMT	Healthy/infected quarter Necessary of treatment Efficacy of treatment
Quarter	Culture	Most appropriate treatment Pathogens responsible for mastitis on the farm
Quarter	PCR	Most appropriate treatment Pathogens responsible for mastitis on the farm

Choosing the right test

Related to these tests, several parameters have to be taken into account to select a proper scheme at farm level.

- **Accuracy of the tests.** What can you conclude from the tests you have done? It is essential to establish a routine procedure for milk testing for mastitis management.
- **Specificity** is the capacity of a test

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to detect a true negative (healthy cow is classified as healthy).

- **Sensitivity** is the capacity of a test to detect a mastitis cow.

Individually and manually performed, specificity and sensitivity determination will not be described here. Cross interpretation can be useful to define whether the threshold limit is low enough, or a reference trained person might be useful.

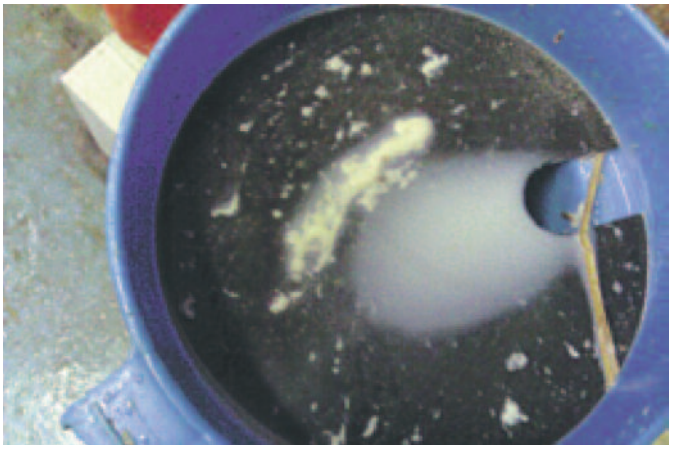
- **Electrical conductivity** is a cow specific parameter. It means that a history of the cow is necessary to confirm the link with mastitis.
- **CMT test** has a high sensitivity (around 90%), specificity is lower (70%).
- **SCC measurement** is the official measure all over the world for milk quality. Thus SCC is the very first parameter to have an official threshold and to be monitored by farmers. However, for better management results SCC should be monitored at cow level, not at herd level.

As farmers tend not to read papers or do not have access to them, there is still a great improvement that can be realised within the scope of existing routinely performed tests.

- **Detection of pathogens.** It is widely recognised that almost 40% of the samples of high somatic cell count animals result in no bacteria growth with the traditional culture methods. Is the test sensitive enough? Is the routine (sampling, delay of arrival to the laboratory) performance adequate?

The arrival of new technology on the market tends to overcome the traditional issues of milk samples culture. The new technologies seem to be highly sensitive. However, the specificity and the interpretation still have to be validated.

- **The frequency of the test** is how often they have to be undertaken in order to optimise the detection of mastitis.



Detection of clinical mastitis/milk modification with a forestrip cup.

Clinical mastitis signs can appear in a few hours, thus the forestripping has to be a daily routine. A negative result (visually normal milk is associated with no mastitis, whereas milk modification (consistency, colour and/or odour) is associated with mastitis. The exception to this is colostrum at the beginning of lactation.

EC is a daily routine. The most important factor is the cow value. In order to detect as fast as possible a modification of EC, the history of the cow is necessary in order to assess the result. A quarter based result could lead to an even faster detection of variation.

The CMT test has to be performed on a frequent basis. Everyday is usually considered highly time consuming. As milk preparation should not be longer than 90 seconds, the protocol has to be clearly defined and milkers used to perform the test. Depending on other data available on the farm, the frequency of CMT can be adapted. It can be best to focus on some animals of the herd (for instance fresh cows, and before dry period).

SCC measure can vary from morning milking to evening milking as well as at the beginning of milking or at the end. Performed in an external laboratory, individual SCCs are usually measured every month or every six weeks. The measurement taken into account is the number of high results (above 250,000 cells/ml for multiparous and 150,000 cells/ml for primiparous).

Detection of pathogens is performed in cases of mastitis (clinical or subclinical). The purpose is to obtain precise data for treatment, and to record the cause of mastitis.

The cost of the test, labour and time costs are a pre-requisite for milk testing. The price of the test can vary from no cost (visual observation) to a few euros per test. With electronic tests, milking parlour equipment and maintenance also have to be taken into account.

Proposed program

Table 2 presents a routine to optimise data collection and mastitis management on the farm. This program contains nothing new and has been widely recommended for many years.

The dairy industry tends to develop new and more sophisticated tools. Continuous monitoring is a big advantage of automatic milking and of most of the new milking parlours. Interpretation and translation into data useful for the farm/cow, which are not following the same trends. What is done with the data? To benefit from the tests, the results have to be translated into information that is useful to the farm. The faster you know and take action, the better and the greater are the chances of success in reducing economic losses due to mastitis.

However, what we see in the field is that only a few farms are performing this complete routine. For decades, mastitis has been one of the three most costly diseases on the dairy farm. Let us try to analyse why there is such a gap between recommendations and field practice.

Critical points to obtain results from milk testings are:

- Correct realisation of the tests (this implies training of the workers, time dedicated to perform the tests).
- Appropriate record of the results (creation of a system).
- Adequate interpretation of the data (time and knowledge to analyse the data).

Any working system has to use time as wisely as possible. To manage a dairy farm is a time consuming job. Many issues and activities are both urgent and important (for instance calvings, inseminations and acute diseases). Milk tests belong to another category – they are important but not urgent.

Dealing with urgent matters give immediate results. Dealing with important but not urgent activities requires patience, perseverance and discipline, but tremendous results can come from it. The policy adopted by Switzerland (see inset) is a relevant illustration.

Conclusion

From very simple tests to highly sophisticated methods, many tests are available that provide data for mastitis management. Regarding milk testing, new is not equivalent to better. Mindset and willingness to improve are key elements to succeed and increase profits on the dairy farm.

What can be recommended to a dairy farmer concerning milk testing? First, analyse the existing situation on your farm (level of clinical and subclinical mastitis). Set up your goals. Describe in detail the routine (which tests, when to realise them and who performs them). Discuss with specialists and search for testimonials from other farmers. Then, be patient – a few months are required. Be confident in the strategy you have adopted and you will reap the benefits of managing mastitis thanks to milk testing! ■

Table 2. Routine to optimise data collection and mastitis management on the farm.

Test	Information collected	When to perform
Bulk SCC	General situation, compliance to official standard of healthy milking	Once a month or every six weeks
Individual SCC	Healthy/infected animal	Once a month or every six weeks
Visual control	Healthy/infected quarter	Before each milking
CMT	Healthy/infected quarter Check efficacy of treatment	Min. once a week, ideally every two or three days Fresh cow Before dry period After administration of a treatment
Culture or PCR	Pathogen responsible for the mastitis Most appropriate treatment Overview of the pathogens responsible for mastitis on the farm	When clinical signs of mastitis and poor response to first standard treatment When chronic high SCC result

The Swiss milk quality regulation

(an example of continuous monitoring of udder health)

The Swiss ordinance for milk quality assurance at farm level (EVD, 1999) established the mandatory use of monthly CMT tests of all cows and quarters for farmers.

The results have to be documented and stored for three years. Milk from cows with a CMT of >1 on one quarter at least is rejected at the dairy and is, therefore, excluded from human consumption. The rigorous application of this CMT routine has brought Switzerland to be the country with the lowest bulk milk cell count (approximately 100,000 cells/ml) worldwide. This achievement comes along with a high compositional quality.