Mastitis control makes cents.....

Mastitis can result in significant losses on any farm, but Irish farmers and industry are working together to tackle this problem. When mastitis is prevalent it can significantly reduce farm profits. Mastitis can be a persistent disease in dairy cattle, potentially affecting many herds. Recent Teagasc research shows that farmers stand to improve net farm profit by at least 1 cent per litre by improving mastitis control.

Mastitis reduces milk yield and leads to poor quality milk. Together, these factors erode the milk income received by farmers and processors. In addition, antibiotic therapy used to overcome udder disease adds to dairy farmers' costs and stress.

2011 Teagasc research shows that the SCC of the herd has an effect on net farm profit. As an example, 94 cows on a 40 ha farm:

SCC range cells/mL	Net Farm Profit
100,000 - 200,000	€24,954
200,001 - 300,000	€18,369
> 400,000	€11,055

FBD Trust

FBD insurance group made a financial contribution to the printing and distribution of the CellCheck Farm Guidelines for Mastitis Control. In addition to providing competitive farm insurance, by supporting CellCheck, FBD is contributing to helping farmers manage on-farm costs of mastitis.

The FBD Trust was established in 1975 to provide funding for education, research and other initiatives which would advance the interests of farmers and agriculture in Ireland generally. While the company's remit has expanded considerably in the intervening years, the company remains primarily focused on identifying and funding projects which will be of benefit to Irish farming.

What is CellCheck?

CellCheck is the national mastitis control programme, coordinated and facilitated by Animal Health Ireland. It is being developed and delivered in partnership with industry bodies representing farmers, processors, service providers and government. We don't need to reinvent the wheel when it comes to mastitis control; we do, however, need to make sure that all the wheels run smoothly and in the same direction. This is where CellCheck has a role to play.

Recent Irish research indicates that mastitis is a substantial cost for Irish dairy farmers and the overall losses run into tens of millions of Euro each year. With an effective programme, individual farmers can improve net profitability by at least 1 cent per litre by improving mastitis control.

When calculating the true cost of mastitis to both farmers and the processing industry, it is easy to include the obvious ones, but the hidden costs have to be considered too. There are costs associated with processing high SCC milk as well as on-farm costs. The table below illustrates the costs borne by farmers and processors.

Farm Costs	Processor Costs
Production losses	Lower product yield
Increased culling	Reduced quality
Higher treatment costs	Reduced shelf life
Discarded milk	Reduced market access
Penalties/lost bonuses	
Stress	
Time & labour	

When it comes to evaluating the cost of mastitis, perceptions can differ markedly from reality, as illustrated by Figure 1.

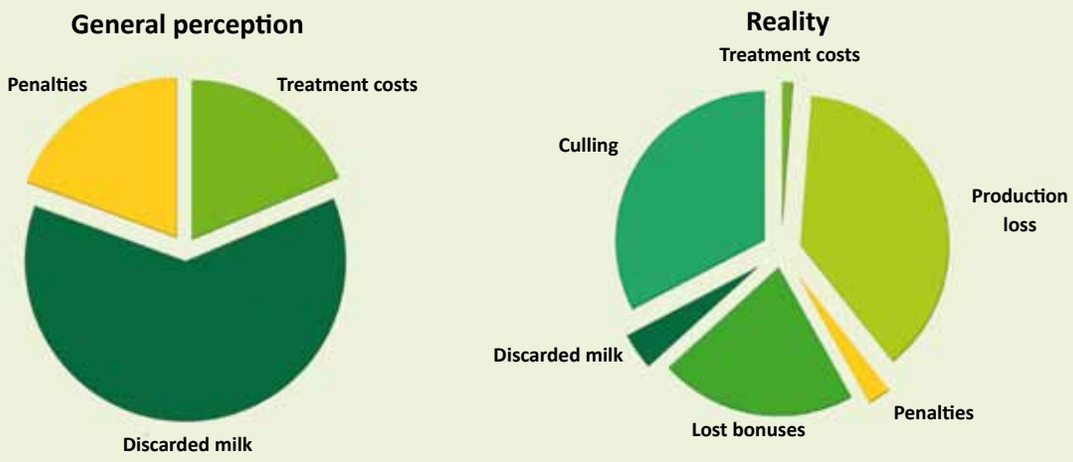


Figure 1: Sources of on-farm mastitis costs: perception versus reality (O'Grady, lecture notes 2007).

The objectives of CellCheck are:

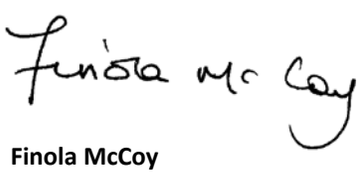
- **Setting goals**
- **Building awareness**
- **Establishing best practice**
- **Building capacity**
- **Evaluating change**

CellCheck is creating the environment and the opportunity for the dairy industry to identify and agree on common industry goals. On the path to achieving these goals, CellCheck will provide agreed, clear and consistent guidelines around mastitis control. In partnership with industry bodies, it will assist in the development of training to increase capacity, both at farm level and among service providers. The CellCheck programme will incorporate a process of continual evaluation, to ensure that it is achieving the outcomes required by dairy farmers and the industry.

The development of CellCheck has been based on learnings from Irish and international research and experience. In particular, *Countdown Downunder*, the Australian mastitis control programme, has been an important model for the development of CellCheck. Countdown Downunder was developed by Dairy Australia, using funds generated through Australian farmer levies and has been running since 1998. Dairy Australia has generously allowed us to adapt their programme and technical resources for the benefit of dairy farmers in Ireland.

As a farmer, why is mastitis control important to you?

National and international buyers of our milk products are demanding ever-increasing standards. By maintaining and improving the quality of milk they produce, Irish dairy farmers will ensure that their produce meets and exceeds these standards, while at the same time increasing the profitability of their enterprises through increased production, higher payments for quality milk, and reduced treatment and culling costs. Fewer clinical cases of mastitis means there is also less frustration for farmers and less risk of antibiotic contamination of milk or meat products.



Finola McCoy
CellCheck Programme Manager
Teagasc/AHI

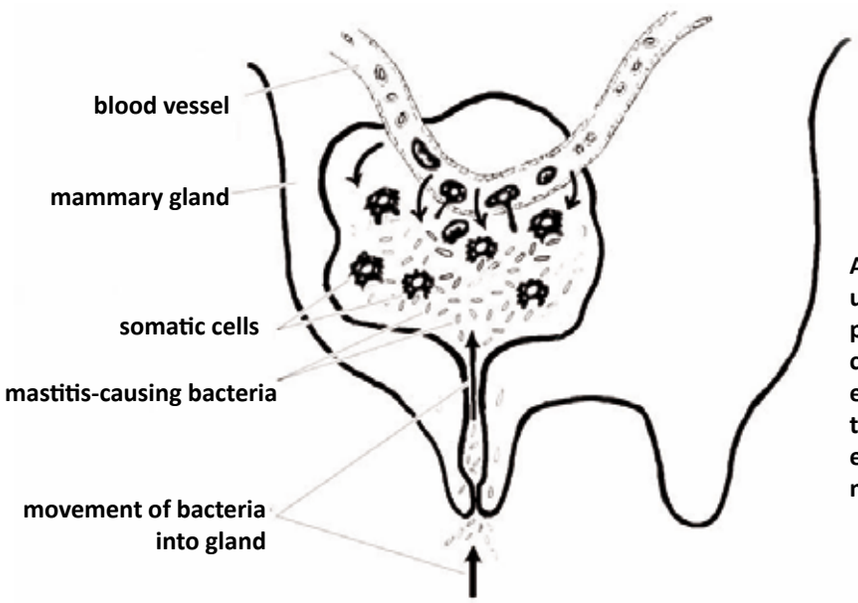
What is mastitis?

Mastitis is inflammation of the mammary gland. In cows, it is usually caused by bacteria which have entered the teat canal and moved to the udder. The bacteria multiply and cause a mastitis infection which results in an inflamed udder. The cow's immune response to this infection results in a localised influx of inflammatory cells, seen as an increase in the somatic cell count (SCC) of the milk in that quarter.

Where do the mastitis-causing bacteria come from?

The two main sources of bacteria are:

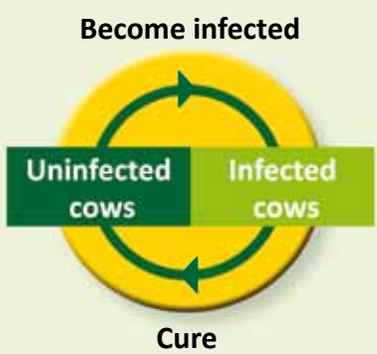
- other cows, which spread bacteria which cause **contagious mastitis,** and
- the environment, which harbours bacteria which cause **environmental mastitis.**



A cross section of the udder, highlighting the presence of mastitis-causing bacteria entering through the teat canal and establishing within the mammary gland.

Mastitis in a Herd

The mastitis status of the herd changes continuously, depending on the rate at which uninfected cows become infected and infected cows are cured. The rate at which these changes in status occur is affected by a wide variety of on-farm management factors.



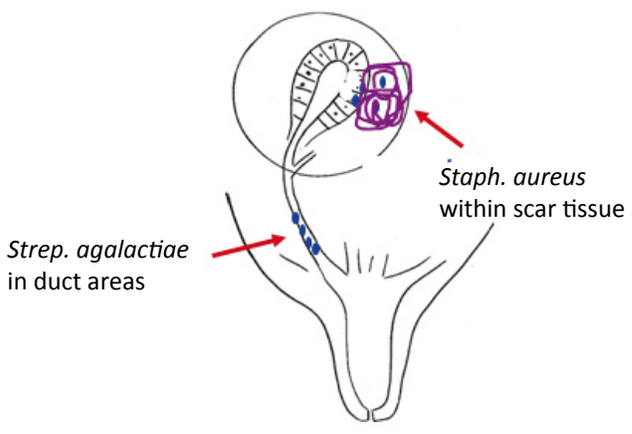
Contagious Mastitis

Bacteria which cause contagious mastitis generally live inside udders of infected cows, or on the teat skin.

Two of the main bacteria causing contagious mastitis are *Staph. aureus* and *Strep. agalactiae*. Transmission of these bacteria between cows and quarters usually happens at milking time by contact with infected milk. This spread can occur by milk on milkers' hands or liners, by cross flow of milk between clusters and from splashes or aerosols of milk during stripping.

- *Staph. aureus* can invade udder tissue and live inside cells. They often form pockets of infection (microabscesses) that are protected from intramammary antibiotics by scar tissue.
- Other bacteria such as *Strep. agalactiae* tend to locate in duct areas of the udder where antibiotics can gain access and thus are effective.

***Staphs.* and *Streps.* in the udder**



Contagious Mastitis	
Source	**Inside udder or on teat skin**
How spread	**Infected milk**
When spread	**Milking time**
Bacteria involved	***Staph. aureus*** ***Strep. agalactiae*** ***Strep. uberis***
Comments	***Staph. aureus* - is a major cause of mastitis in Ireland. They are difficult to cure, especially during lactation, so prevention is essential.** ***Strep. agalactiae* - is very sensitive to penicillin, so treatment has a relatively high cure rate.** ***Strep. uberis* - are generally environmental bacteria but can spread from cow to cow at milking.**

Environmental Mastitis

Bacteria which cause environmental mastitis are widespread in a cow's surroundings - soil, manure, bedding, calving pads and water, or on body sites of the cow other than the mammary gland. Housed cows are generally at greater risk than grazing cows.

The main bacteria are *Strep. uberis* and *E. coli*. A number of bacteria like *E. coli* are often grouped together and called *coliforms*. These bacteria are not particularly well suited to life in the lactating udder, and infections often do not persist. *Strep. uberis* can however sometimes persist, and may also spread at milking.

Most environmental mastitis cases are seen in the period immediately before calving, through to a few weeks after calving, when the cows are very susceptible to infection because their natural defence mechanisms are low. Poor housing facilities contribute significantly to environmental mastitis.

High numbers of environmental mastitis bacteria may contaminate teats, especially if udders are wet and exposed to mud and manure.

Environmental Mastitis	
Source	**The cow's environment e.g. manure, soil.**
How spread	**Contamination from infected environment, especially at risk when teat canals are open i.e. after milking. Can be introduced with intramammary tubes if teat ends are not sterile when treatment occurs.**
When spread	**Mainly at drying-off and around calving time - most cases seen at calving or early lactation.**
Bacteria involved	***Strep. uberis*** ***E. coli* and other coliforms** ***Strep. dysgalactiae***
Comments	**Often causes very severe or acute clinical mastitis.** ***Strep. uberis* - usually responds to treatment, but can be difficult to cure. Often associated with straw bedding.** ***E. coli* and other coliforms - do much of their damage through toxins released after the bacteria die. Do not usually persist in lactating udders.**

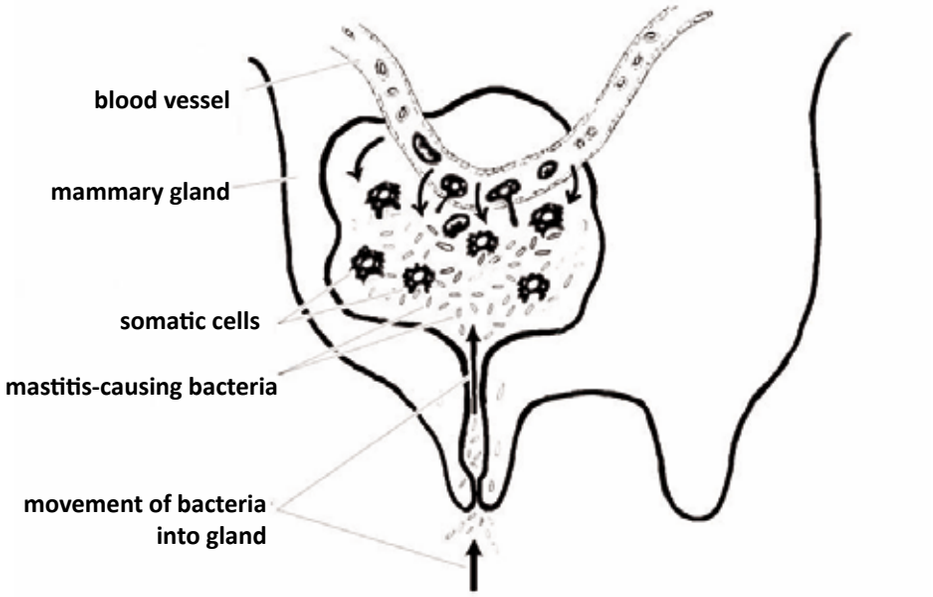
What are the forms of mastitis?

The forms and signs of mastitis vary depending on the bacteria causing the infection and the immune response of the cow towards the bacteria.

Most cases of environmental mastitis are clinical (in all forms) but subclinical cases do occur too. Cases of mastitis caused by *Staph. aureus* can be seen in all the various forms of mastitis.

Form of mastitis	Cow	Udder	Milk
Severe clinical mastitis (peracute mastitis)	**Extremely ill and depressed, may die**	**May become gangrenous (black mastitis)**	**May initially look normal although the cow is obviously sick, but soon becomes abnormal, often watery and blood stained**
Acute clinical mastitis	**May or may not be sick**	**Hot swollen and painful**	**Abnormal and can be discoloured and contains clots and/ or blood**
Clinical mastitis	**No observable changes**	**Shows little change**	**Clots are clearly seen**
Mild clinical mastitis	**No observable changes**	**Shows no abnormalities**	**A few clots or flakes occur**
Chronic mastitis	**No observable changes**	**Lumps may be felt**	**Mild changes, such as wateriness**
Subclinical mastitis	**No observable changes**	**No observable changes**	**No observable changes but significant changes in milk SCC**

Cells in milk



Cross section of the udder showing the influx of somatic cells in response to the presence of bacteria in the mammary gland.

When bacteria enter the udder, the cow responds by sending large numbers of white blood cells to the mammary gland and into the milk. The white blood cells surround and destroy bacteria. They are one of the most important defence mechanisms the cow has to fight udder infection. There are also a small number (about 2%) of cells shed into milk from the udder tissue. All these cells are from the cow's body - they are not bacterial cells, and are referred to as 'somatic' cells. The number of somatic cells does not increase after the milk leaves the cow no matter how poor the filtration or cooling.

The concentration of all body cells in milk is called its somatic cell count (SCC).

You can measure either:

1. the individual cow somatic cell count (individual cow SCC), usually taken at a milk recording, or
2. the bulk tank somatic cell count (bulk tank SCC).

A sample of milk taken from all four quarters of a cow shows the concentration of cow somatic cells. The concentration of cells in milk varies throughout a milking, so the sample used to measure individual cow SCC should be collected throughout the milking. Samples for bulk tank SCC should be collected via the drip sampler which is taken when the bulk tank is being emptied. This ensures that the milk sample is well mixed.

The concentration also varies between morning and evening milkings, especially with unequal milking intervals. Evening milkings tend to be higher.

Total Bacterial Counts (TBCs), which are sometimes referred to as Total Plate Counts (TPCs) assess the number of bacteria, not cells, in milk.

The individual cow SCC is an indirect way of estimating the likelihood of mastitis in a cow.

Uninfected cows generally have SCC levels of below 100,000 cells/mL. A rise in SCC above 200,000 cells/mL generally indicates that an infection has occurred. Different infecting bacteria may cause different SCC patterns. Subclinical cases of *Staph. aureus* may have cell counts that rise and fall, showing an irregular pattern during lactation. SCC in cows with *E. coli* tends to rise rapidly and then drops over a short period of time.

Stress may increase SCC levels slightly in cows, but the greatest increases are seen in infected cows. Elevated individual cow SCC levels which are not associated with infection may occur for up to 20 days after calving.

Elevated SCC levels may also occur in late lactation when milk volume is low and cells are 'concentrated'. However, in uninfected quarters this elevation is minimal.

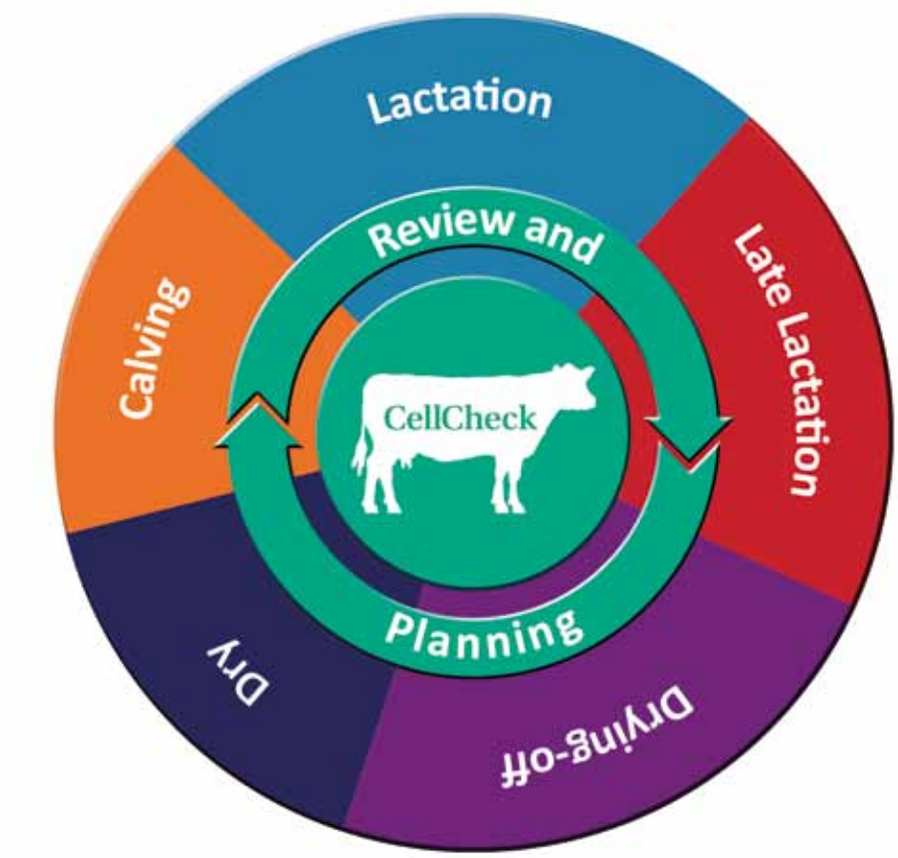
Bulk tank SCC is a function of the percentage of quarters infected by major pathogens in a dairy herd. As an approximate guide, each 100,000 cells/mL indicates about 10% of cows are infected.

A series of bulk tank SCC should be assessed to see both the level and the trend for a herd. In herds with bulk tank SCC below 200,000 cells/mL, a sudden increase (of 10% or more) may indicate that a clinical case has been missed.

Guides on bulk tank SCC levels (cells/mL)	
< 150,000 cells/mL	**Excellent mastitis and SCC control**
150,001 - 200,000 cells/mL	**Good control of mastitis and SCC**
200,001 - 400,000 cells/mL	**Unstable control of mastitis and SCC review mastitis control**
> 400,000 cells/mL	**Indicates little/no control of mastitis in the herd and urgent action is needed - seek help**

How to use this book

The **CellCheck Farm Guidelines for Mastitis Control** are intended to be a guide to effective mastitis control. The book is divided into five key stages of the cow's lactation cycle. Each section explains what the challenges are at this time and provides simple recommendations where your farm management can impact on mastitis.



Underpinning this is the need to **Monitor, Review** and **Plan** for each segment of the lactation cycle.

Linked to each of the sections above, there are additional **Management Notes** on practices and procedures that are relevant across different periods of the lactation cycle. These can be found at the back of the book and cover areas such as milk culturing, intramammary tube administration and housing.

While all the information in the book should be of interest to you, it's not envisaged that you will sit down and read it from cover to cover in one go! By reading the section on **Monitoring Mastitis** you will be able to identify which sections are most relevant to you and your problems.

Monitoring Mastitis

Knowing how your herd is performing is the first step to getting mastitis under control and to help keep it there. This section of the book will cover simple ways in which you can monitor what's going on with mastitis in your herd, by assessing your herd's performance in each of the key stages of the lactation cycle. If you find your herd is not performing well in certain areas, you should then take a look at the relevant section of this book to get more information on that area.

How to monitor

To monitor performance you need records - you can't manage if you don't measure. At a minimum, in order to "Keep your finger on the pulse" of your herd's performance, you need to use two types of records:

- somatic cell count (SCC) records
- clinical case/treatment records.

There are several other records that are also very import to gather. These focus on monitoring particular problem areas and so are covered in more detail within the relevant sections of this book.

Milking machine test reports & maintenance records	**See Guideline 6**
Teat disinfectant usage	**See Guideline 7**
Teat health scores	**See Guideline 9**
Milk culture results	**See Management Note A and 'What is Mastitis'**

How do I get the records I need?

Before you can analyse your herd's performance you'll need to put a plan in place to gather the records you need.

Gathering somatic cell count (SCC) records

SCC records are most commonly gathered at either a herd level or at individual cow level. You can get herd level records either from processor bulk tank collections or from milk recording. Milk recording also provides individual cow SCC.

Herd level records can provide a very broad view of how the herd is performing with respect to SCC. However to monitor mastitis effectively, individual cow SCC records are essential. These will provide information on the number of infected cows and the spread of mastitis within your herd. It can also provide information on the effectiveness of mastitis control over the dry period.

Clinical case/treatment records

In order to know if the occurrence of clinical mastitis in your herd is high or not, you need to record it. Just looking at the high SCC cows on your milk recording alone might mean you'll be missing the cases that occur between milk recordings. These records need to be gathered by you. You can either record these cases on the chart provided or enter them online at **www.icbf.com**

CellCheck AnimalHealthIreland.ie

Mastitis Recording Chart

HerdPlus Profit through Science

Cow ID	Date	Quarter Affected	Drug Treatment	Num of Tubes	Comments
E.G. 93	19/05/11	LB	Drug xyz	1 1 1	Clots - Cow sick & back in milk

To get the most information you should record all cases of clinical mastitis, not just the treated ones. As a minimum you'll need to record the date and cow number. However, for just a little more effort, recording the quarter(s) affected, the treatment given and the response will give you the most accurate information.

Refer to Management Note G: Records to keep on clinical cases of mastitis.

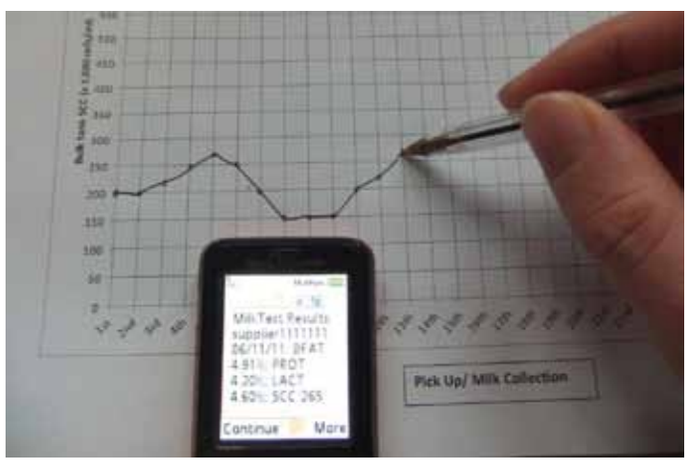
Receiving milk results by sms allows speedy monitoring of SCC.

Analysing your records to get the information you need

As you gather these records, you can use them to understand how your herd is performing.

CellCheck has developed a recording sheet to put in the dairy so that you can record bulk tank collection SCC records as you receive them, and visualise the changes in SCC over time.

CellCheck, in conjunction with ICBF, is also developing the **CellCheck Farm Summary report.** This will be available to all milk recording herds and will provide a summary analysis of all the key SCC measures and clinical mastitis cases recorded.



Plot your pick-up SCC on a graph to notice trends quickly.

What targets should I be aiming for?

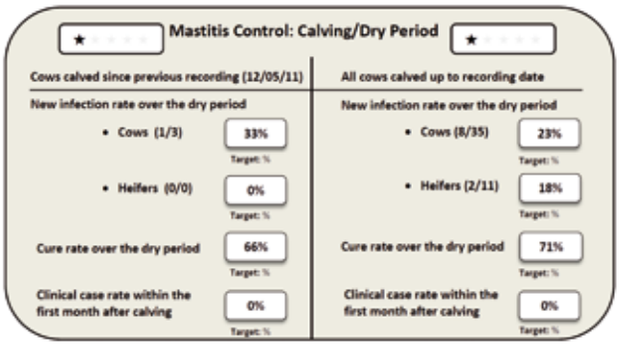
To effectively monitor mastitis CellCheck recommends monthly milk recording. This is because monthly milk recording provides the most accurate measures of performance. All national and international targets and standards for mastitis control are developed to assess monthly milk recorded herds. Achieving these targets indicates good control of mastitis and minimal associated economic loss.

As well as targets, the **CellCheck Farm Summary** report will also provide a simple star rating allowing you to benchmark your performance.

Also, within each of the sections of this book there are suggested targets for intervention, when you should seek professional advice.

1. Monitoring mastitis at calving

Clinical cases/treatment records



Example of CellCheck Farm Summary report extract.

Monitoring clinical case rate in the first month after calving will measure the effectiveness of mastitis prevention around calving. It will also give you some insights to mastitis prevention over the dry period, as many clinical cases soon after calving can originate over the dry period. The **CellCheck Farm Summary** report will help you to keep track of both the recent trends in clinical mastitis, and the long term herd average for this lactation.

2. Monitoring mastitis control over the dry period

Culling rate for mastitis

Culling for mastitis is an important part of a mastitis control programme. As culling rates vary depending on farm management, it isn't possible to give a target culling rate. If mastitis is the main reason why you cull cows or alternatively if you never cull cows for mastitis, then either of these should provide warning signs that there could be a problem with mastitis control on your farm. Discussing and reviewing your culling decisions with a CellCheck Advisor will help you to assess if you're making the most appropriate culling decisions.

Dry period SCC dynamics

By analysis of individual cow SCC you can monitor dry period cure rates (i.e. cows with high SCC at dry-off, followed by low SCC after calving). A low cure rate over the dry period may be as a result of either not curing previous infections, or it may be that infections were cured but cows also picked up a new infection.

You can also see how effective you've been in preventing new infections (i.e. cows with low SCC at drying-off (or heifers) maintaining a low SCC after calving). Only cows with SCC records within the first month of calving can be reliably assessed using this analysis.

Target clinical case rate within the first month of calving is <5% of cows calved.

If your herd has exceeded this target, or if any cows have died as a result of clinical mastitis then intervention is required.

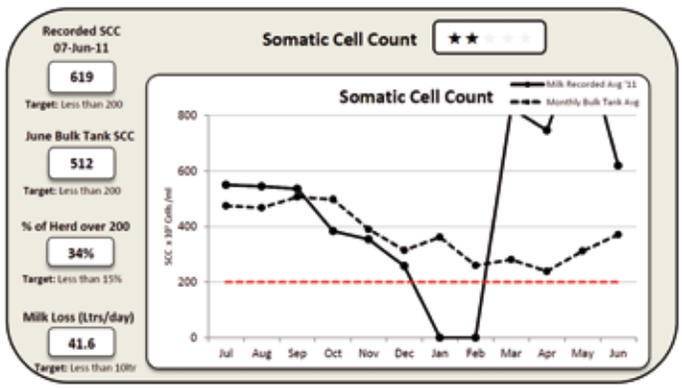
See Guidelines 1 - 4 and 16 - 20 for more information and consult with your CellCheck Advisor.

Guidelines 16 - 20 provides advice on preventing new infections over the dry period.

3. Monitoring mastitis control during lactation

Monitoring mastitis during lactation focuses on assessing changes in the herd SCC, the amount of infected cows, the number of cows chronically infected, and the number of new clinical and subclinical cases of mastitis.

Herd level SCC



Example of CellCheck Farm Summary report extract.

Herd level SCC will give you a good overview of the udder health on the farm. Infected cows will increase the overall herd SCC. You can monitor your herd's SCC by plotting out your bulk tank SCC recordings, or your herd SCC from your milk recording reports.

In a herd where mastitis is under control the SCC should be below 200, 000 cells/mL. A herd with a SCC greater than 200,000 cells/mL will have a problem with mastitis and, as a result, will be suffering significant economic losses.

If your herd's SCC is over 200,000 cells/mL refer to Guidelines 5-15, and Management Notes A & M for more information and potential solutions. If your herd's SCC remains over 200,000 cells/mL then further intervention is required.

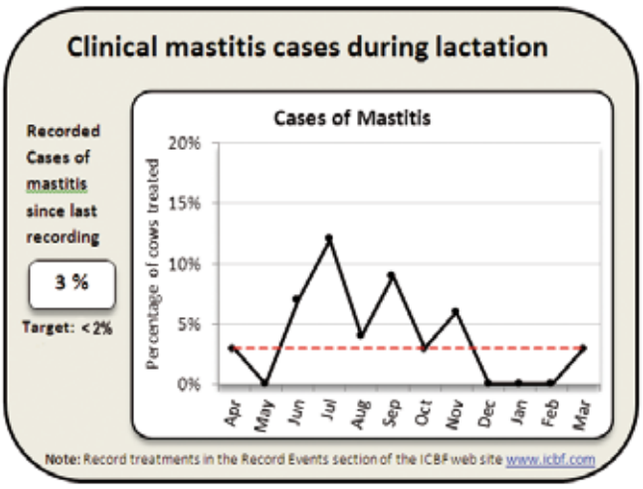
If your herd's SCC is over 400,000 cells/mL then you have a drastic problem and immediate action is required!

Whether dealing with drastic or persistent problem you should seek professional advice from your local CellCheck advisory team. They will help you to decide on an appropriate control plan.

Be careful when using pick-up records alone as this may give you a false sense of security, especially if you are leaving out a lot of cows with high SCC and clinical mastitis from the bulk tank.

If exceeding targets in this area, see Guidelines 5 - 15 for more information.

Clinical cases/treatment records



Example of a CellCheck Farm Summary report extract.

Target clinical case rate during lactation is <2% of cows per month.

If your herd has exceeded this target, or if any cows have died as a result of clinical mastitis then intervention is required.

Monitoring clinical case rate during lactation will measure the effectiveness of mastitis control throughout the year. The **CellCheck Farm Summary** report will also allow you to assess trends in recent clinical mastitis rates for this lactation.

See Guidelines 5 - 15 for more information and consult with your CellCheck Advisor.

Individual Cow SCC dynamics

Using your milk recording results to analyse individual cow SCC, you can monitor how well you are preventing the spread of mastitis i.e. cows with a low SCC at the previous milk recording and maintaining a low SCC throughout the current recording.

See Guidelines 5 - 15 and Management Note M for advice on preventing new infections during lactation.

You can also assess the proportion of the herd chronically infected i.e. cows with a high SCC for the last two recordings.

CellCheck Advisors

Finally use your CellCheck advisors well. They have been trained in mastitis investigations and have been encouraged to engage with other service providers on your farm in order to ensure you get the best solutions. Arrange a time when they come on-farm together to address your issues, draw up an appropriate plan, including follow up. You'll get more out of a joined up team approach than tackling mastitis control in isolation.

Notes