UDDER HEALTH MANAGEMENT
Udder Health Management is the ninth in a series of management manuals published by Veepro Holland. Through these manuals Veepro Holland aims at providing you with useful management information. Dairy cattle worldwide have to be managed well to utilise their potential to full extent. No single booklet can cover every subject as diverse and complex as dairying. Nor will probably everyone associated with dairying agree on all points covered in one publication. But we of Veepro Holland believe the combination of this manual and other publications on the subject may broaden your knowledge about udder health and will subsequently contribute to a healthy and highly productive herd. Veepro Holland is indebted to those who contributed to this manual, particularly Dr. Ynte Hein Schukken of the Department of Herd Health Management and Reproduction of the Faculty of Veterinary Medicine, State University of Utrecht and Ms. Ing. Hinke Fiona Cnossen, formerly of the National Reference Centre for Livestock Production (IKC) at Lelystad for their constructive criticism.

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VEEPRO HOLLAND
INTRODUCTION

The dairy farmer and the dairy processing industry must constantly strive for products that are excellent in quality and flavour. Udder health of the dairy cow plays an important role in achieving this goal. Maintaining minimal standards of cleanliness on the dairy farm is essential for producing milk of good quality. Many successful dairymen worldwide believe that good quality milk starts with the dairy cow itself. If the dairy herd and the surrounding environment are clean, you are more likely to have healthier cows producing high-quality milk. Milk is regarded as an excellent source of proteins, milk sugars and minerals, in particular when milk is produced by healthy cows. Everyone handling milk should take care that the quality is not interfered with in any way.

Milk from healthy udders contains a minimum of bacteria and somatic cells. Data available from commercial dairy herds show that there is still room for milk quality improvement. In addition, cows with healthy udders have a higher milk production and therefore add to the herd’s profitability. It should be noted that cows producing milk of abnormal composition due to udder health problems will cost the dairy farmer more because of lower milk production, a lower milk price, extra labour and higher veterinary costs. So cows with healthy udders will produce milk of excellent quality and thereby will contribute substantially to the dairy farmer’s income.

In most countries, farmers are paid for the composition (milk fat and protein) and quality of the milk produced. Premiums are paid for maintaining high-quality standards and penalties are imposed if milk quality is below standard. In the Netherlands and other countries, milk of a lesser quality may even be refused by the dairy-processing industry as public health standards are high.

Bovine mastitis is the most costly disease affecting dairy cows worldwide. It is estimated that almost half of all cows in any herd have some form of udder inflammation and mastitis-free herds are extremely rare. In fact, the real cost of mastitis is surprising, since many mastitis cases are difficult to notice and therefore its effect on milk production cannot be quantified. In order to prevent production...
losses due to mastitis, it is imperative to control the disease. The dairyman’s effort can greatly contribute to protecting the dairy cows from mastitis by introducing objectives to prevent new cases or to eliminate existing ones. It is important to emphasize that several on-farm management and environmental factors must interact together to reduce the exposure of cows to mastitis organisms. Therefore, a strategy of mastitis control should involve the total dairy herd management and should not only be limited to the milking parlour itself. You will find that the cost of active control of mastitis is far lower than the cost of simply reacting to it.

The essential practices for maintaining optimal udder health and the control of mastitis are thoroughly described in this manual. The proper milking techniques themselves are discussed in more detail in the Proper Milking Management manual.

**MASTITIS OCCURRENCE**

The occurrence of mastitis can widely vary, depending on the cause and the susceptibility of the dairy cow. Mastitis is an inflammation of the udder and is caused by bacteria in nearly all cases. Pathogenic microorganisms have to invade the teat orifice and canal to infect the mammary tissue, causing inflammation of a quarter. It will immediately result in the transfer of white blood cells (leukocytes) into the milk to combat the pathogens. This will lead to higher somatic cell counts in the milk produced and, consequently, to reduced milk production. The cow’s natural defence against the penetration of bacteria is the muscle around the teat end (the teat sphincter). When this muscle closes tightly it is more difficult for bacteria to enter.

However, to permit milk to flow, the muscle around the teat orifice must be flexible. It is just during and after milking that cows are most susceptible to new infections. By using a teat dip or spray, the risk of teat canal infections becoming intramammary infections can be reduced significantly. On average, the sphincter is not fully closed for about 1 to 2 hours after milking. Any bacterium that comes in contact with the teat end during or directly after milking has little difficulty gaining access to the mammary tissue.

Teat dipping for healthier udders!

**Different forms of mastitis**

Mastitis can be subdivided into subclinical and clinical mastitis. Subclinical mastitis cannot be noticed by the dairy farmer because there are no perceptible signs of the disease. About 90% of all cases of mastitis are subclinical. In contrast, clinical mastitis is easily detected; for example, the udder tissue is warmer and less soft to the touch. Examination of at least two squirts of foremilk from each teat for abnormalities, greatly assists the milker in detecting mastitis at an early stage. Cows with mastitis should be milked last in order to avoid spreading of the infection to other cows. It goes without saying that it is important to know that subclinical and clinical mastitis are not necessarily correlated with each other. For example, it is known that dairy farms with a low somatic cell count may experience sudden outbreaks of clinical mastitis.
Subclinical mastitis
Subclinical mastitis usually goes unnoticed (hidden) at farm level, because the milk and udder appear normal. This form of mastitis is much more important than clinical mastitis, because it is more prevalent, and results in the greatest loss of milk. However, symptoms of infection are present in the udder, resulting in, amongst others, increased somatic cell count and reduced milk production. It can be detected through individual cell count recording and laboratory diagnostic tests. In most cases, subclinical mastitis indicates the presence of an infection that has not been effectively treated. The presence of subclinical mastitis may be an important cause of the occurrence of clinical mastitis. Dry cow treatment of all quarters of all cows is the best way to cure subclinical mastitis. Eventually, culling of problem cows may be the only way to remove the infection source from the herd.

Clinical mastitis
Clinical mastitis can easily be recognized since flakes are formed by the white blood cells that have moved into the milk in large numbers. In addition, the udder or a specific quarter often shows signs of an inflammation, such as a higher temperature, an abnormal swelling and/or oversensitivity of the infected quarter. The milk from seriously affected quarters can be watery, clotted or a thick purulent discharge with a foul smell may be produced. In most cases, the cow has an increased body temperature. Each case should be treated immediately to maximize chances of curing the infection. Clinical mastitis may be frequent even though the bulk milk somatic cell count is low.

Pathogens
The majority of infections are caused by the following types of pathogens:
- Streptococcus agalactiae, Streptococcus dysgalactiae and Streptococcus uberis;
- Staphylococcus aureus;
- Escherichia coli;
- Klebsiella pneumoniae and Pseudomonas aeruginosa;
- Actinomyces (Corynebacterium) pyogenes;
- Mycoplasmas (fungus).

These bacteria can be divided into three categories of pathogens:

udder-related bacteria
The so-called udder-related bacteria, which are spread from infected quarters to other quarters can easily survive within the udder. The transmission takes place typically during milking, since the hands of the milker, udder cleaning cloths and the milking machine come in direct contact with the various udders and teats. Streptococcus agalactiae, Streptococcus dysgalactiae, and Staphylococcus aureus are typical examples of udder-related bacteria.

Hygiene during milking must have top priority in controlling these pathogens. Follow a strict programme of teat dipping; milking of infected cows last; culturing milk
samples; treating of infected quarters; dry cow treatment; and culling of chronically affected cows. Optimal milking machine functioning is essential to control these infections.

Clean milking equipment prevents transmission of bacteria

Environmental bacteria
These bacteria are specifically found in the cow’s environment. They are: Streptococcus uberis, Escherichia coli, Klebsiella pneumonia and Pseudomonas aeruginosa. S. uberis and E. coli are causes of udder inflammation during lactation as well as during the dry period.

The infection is principally caused by dirty bedding in free stalls (cubicles). Klebsiella species are found in bedding materials, particularly in sawdust. Pseudomonas bacteria are mainly inhabitants of water pipelines and water reservoirs.

Hygienic measurements are important for control, such as maintaining a neat environment, clean and dry bedding and culling of non-responsive cows. The response of the cow’s immune system is also important. Nutrition, stress and other factors have shown to affect this.

Other pathogens
These groups of pathogens are not dependent on the cow for survival. They can survive and multiply within other organisms, whereby the cow acts as an intermediary. These pathogens may initially cause another illness, with mastitis occurring as an additional affliction. Actinomyces pyogenes and Mycoplasmas belong to this group of pathogens. Actinomyces pyogenes is the causative agent of summer mastitis.

Overall hygiene and effective fly control are a prerequisite to control these pathogens. In addition, teat dipping should be carried out and infected cows should be isolated. It is recommended to cull infected cows where feasible.

MONITORING AND DIAGNOSIS
For the detection of subclinical mastitis it is important to take regular bulk milk samples for somatic cell counts. Furthermore, it is essential to keep an up-to-date administration of clinical mastitis on a ‘mastitis chart’. This chart should be fixed in a place easily accessible to the milkers. It will greatly assist in monitoring the udder health status of the dairy cows.

Monitoring subclinical mastitis at herd level
To evaluate the udder health status of a dairy herd, samples of bulk tank milk should be taken for investigation. Through regular monitoring of the somatic cell count and the number and types of pathogens, a proper insight can be gained into the herd’s udder health status. The milk is graded according to the number of somatic cells per millilitre. A high number of cell counts from bulk tank milk indicates a higher incidence of (sub)clinical mastitis. In general it can be said that a somatic cell
Recording of clinical mastitis

One of the most useful tools in mastitis control is good record keeping. A good system is the so-called "clinical mastitis chart". All data relating to cows with a case of clinical mastitis should be recorded, i.e. the dates of mastitis occurrence, the number of cases of mastitis per individual cow, the quarters infected, the results of the laboratory analyses and the antibiotic used for that specific treatment. With the help of the mastitis chart, the effectiveness of the treatment applied and the cows with severe mastitis problems can easily be identified. Cows who regularly have serious mastitis problems, can be the source of infection to other cows and should therefore be culled. Through good record keeping the dairy farmer can take effective action to improve the herd’s udder health status.

Laboratory analysis

Through laboratory analyses of cow milk samples with increased somatic cell counts and for clinical mastitis, a proper indication can be found of the type of pathogens causing the (sub)clinical mastitis. Moreover, after determination of the susceptibility of the mastitis microorganisms to different antibiotics, very effective treatment of (sub)clinical mastitis can be carried out. Each pathogen needs a specific antibiotic to treat the infection effectively. It is good practice to treat the subclinical cases during the dry period with a specific dry cow antibiotic to achieve the best results possible. Consult your vet for further assistance.

IMPORTANT FACTORS INFLUENCING UDDER HEALTH

Milk obtained from clean and healthy cows is quality milk. The cows should be free of mud, manure and dust. It is recommended to clip the udders and flanks to prevent dirt from sticking to long hairs. Filthy udders and teats are the main source of milk contamination. Visible dirt should be kept out of the milk by thoroughly cleaning the udder and teats before milking. Under all circumstances avoid dirt contamination of the milk during milking.

Monitoring subclinical mastitis at cow level

For detection of subclinical mastitis in cows, identify individual cows with a high somatic cell count with the California Mastitis Test (CMT). This cow-side paddle test in combination with a T-pol reagent and the use of a stripcup is of great help in detecting abnormal milk. For reliable results, the CMT test should be used after discarding of the foremilk.

In the Netherlands, the results of somatic cell counts of individual cows can be sent on request to the dairy farmer together with each milk-recording report. Individual somatic cell counts above 200,000 cells per ml of milk suggest the presence of an important pathogen, in particular, if somatic cell counts at herd level are higher than desirable or are increasing within a certain period of time. The somatic cell count recording of individual quarters is essential to detect the cows responsible for this level.

count above 200,000 cells per millilitre (ml) of milk suggests a significant prevalence of subclinical mastitis in the dairy herd. A high somatic cell count is associated with a substantial loss of milk production.
Although filtration is a recommended practice, it will not remove bacteria and dissolved dirt. A milk filter should be regarded only as a safeguard against the accidental presence of dirt and as a monitor of hygiene.

Prevention of mastitis is much better than cure and, for this reason, preventive measures are essential. Many environmental factors influence the yield and the cleanliness of milk produced. In general, the health of the dairy cow and its udder are affected by:

- water
- milker
- environment
- milking machine
- milking
- nutrition
- herd replacement management
- herd health management programme.

Overall herd hygiene will certainly pay off

**Water**

Clean potable water is the backbone of the entire dairy farm hygiene programme. In most developed countries, the dairy farms are connected to the main municipality water supply systems using treated water. It is important that the dairy farmer is assured of water that is safe for human and animal consumption. The potable water may look and taste good, but to be sure of its quality, a complete water analysis is recommended. The water may contain impurities which may hamper effective cleaning. Similarly, bacteria in the water could affect overall herd health. It is also important to be aware of dissolved solids which may reduce milk production and affect the taste of the milk.

In the Middle East, for example, water supplied by wells is often high in mineral content. Trials comparing untreated water with treated water (that is, water of lower mineral content) have demonstrated that cows receiving treated water were
Although modern milking equipment has made it easier to do a better job, the operator is as important as ever. The first priority is that the milker has empathy with cows, a disciplined attitude and a high degree of personal hygiene. Some milkers do not like cows and this will affect their milking ability. It is sensible to assign these workers to other tasks at the farm. Filthy clothes and dirty hands during milking are unacceptable. The hands of the milker may transfer udder pathogens amongst cows.

A cow is a creature of habit and breaking her routine is probably one of the worst things one can do. Routine practices, treatment and schedules used in the first few weeks after calving will affect production for the entire lactation.

Clean potable water is the backbone of the entire dairy farm hygiene programme.

healthier, drank more water, and produced significantly more milk than cows given normal (untreated) well water. Water with a high calcium content reduces the effectiveness of cleaning and causes the formation of milkstone on inner surfaces. This can cause serious problems with cleaning and therefore milk quality. So it is necessary to confirm that the water supply is free of harmful organisms, is of a well-balanced composition, of minimal hardness and without any taste.

**Milker**
The milking herd together with the milking machine system in use, can only be as good as the milker handling them. Even if a perfect functioning milking machine system exists, the milker still must have the necessary knowledge to operate the milking machine. The milker should not only know how the milking system works but should also be aware of necessary regular maintenance to keep the installation in top working order. A professional approach is always important with cow milking. Since milking is considered by many as the most important task on the dairy farm, it should be performed by the most capable person(s) on the farm.

Improved milking equipment has not subsided the importance of the milker.

Good training and motivation of the milker are essential for clean milk production. Appropriate training in dairy husbandry will give the milker a clear understanding of the role he or she is expected to play in the whole dairy setup. Good communication with your milkers is a must. Introduce bulletin boards in your dairy to relay information regarding milk production and milk quality. Up-to-date record keeping is an absolute must within the dairy business. In addition, a bonus system based on
quality premiums or other fringe benefits for general herd performance contribute to the involvement of the employee.

Environment
The dairy cow lives in a very vulnerable environment in which specific and non-specific udder infection causing microbes can survive and, in many cases, proliferate. The dairy cow is very susceptible to udder health problems at the time of drying-off, and during and after calving. In the dry period it is essential to check the udder regularly. The housing of dairy cows, the calving pattern throughout the year, and the seasonal climatic conditions, such as temperature and humidity, all have a considerable influence on cow health. It should be emphasized that farm cleanliness is of utmost importance in maintaining a low incidence of udder contamination.

Bedding materials can be an important source of pathogens, owing to prolonged contact with the teats. Dry dust-free (without mould) and clean bedding material should be regularly provided. Regular removal of manure and drainage of muddy areas helps to eliminate significantly the occurrence of flies in its breeding areas. The floors in barns should be properly sloped to maintain a dry surface area. Other environmental causes of increased exposure to pathogens are overcrowding, poor maintenance of housing facilities and general lack of cleanliness.

• housing
The housing of dairy cows has a great influence on the cow’s udder health. Of importance are the climate, the size of the resting place and the bedding material used. If the cows are restricted in their freedom of movement in free stalls then it will increase the incidence of teat injury. Cows often injure their teats, when the resting place is too small. The climate in the housing should always be fresh and cool with average humidity. Draught and direct contact with too cold air must be avoided at all cost as this adversely affects udder health.

Clean and dry bedding contributes significantly to an optimally hygienic environment

• heat stress
Under hot weather conditions, factors such as high humidity, mud, manure, and bedding become even more important as they influence the numbers of pathogens present on udders and teats. In general, high temperatures in combination with high humidity increase the occurrence of udder infections and consequently reduce
milk production. The construction of shade structures on elevated areas in open-air corral systems contributes greatly to heat stress reduction.

Under (sub)tropical conditions proper cooling can increase the well-being of dairy animals above that in more moderate areas. New developments in evaporative cooling have been very successful. Nowadays, corral coolers are available for dairy operations in dry, hot and humid climates which helps to reduce heat stress problems. The system is based on distinctive air-water mixing and evaporative convection cooling.

flies and other insects
Flies and other insects are a nuisance in the milk parlour, calf pens, dairy barns and holding areas. Each fly lays about 100 eggs for a number of days. That is, a few flies can develop into a hoard of flies in a short time. The method of manure handling and storage has a great effect on overall hygiene. If manure is allowed to build up or is handled improperly there will be serious problems with hygiene and fly control. The first step towards effective fly control is the removal of manure and thorough cleaning of all areas where fly eggs and maggots are found. The emphasis must be on eradicating the breeding places of flies. Regular cleaning and disposal of all manure accumulations is an absolute must. Biting flies and insects reduce milk production by causing stress. However, more importantly, they may transfer harmful organisms among cows, leading to various diseases (e.g. mastitis, pinkeye and scours). Therefore, fly control is essential during hot and humid weather when conditions are optimal for multiplication. The application of special eartags, spraying or fly-traps can be of assistance.

High-quality milk production starts with clean milking parlours

Milking machine
In the Proper Milking Management manual the operation of the milking machine and the milking-related equipment is thoroughly described. Many actions and interactions during the milking process may contribute to increased somatic cell counts and udder infections. The milking machine may effect the development of
mastitis in the following ways:

**Teatcup liners**
The teatcup liners should not be worn or be too wide. Tiny cracks in liners are an ideal niche for the growth of bacteria. Usually liners should be renewed after about 2,500 milkings depending on the type of liner. The same applies to the milking tubes. All rubber parts that are in contact with milk should be replaced in time when showing signs of wear. Consult your supplier for further advice.

Abrupt reduction in milking vacuum. The main cause is sudden air admission through slipping of liners, which creates the formation of milk columns in the milk tube. It happens as well if milk pipes become completely flooded with milk and consequently the vacuum supply to the cluster unit is restricted. Low-level milk pipes of the correct diameter in milk parlours and with the desired slope to the milk receiver assist in maintaining a constant vacuum and better milk flow.

**Milking speed**
The milking speed is related to the ease of milking of the cows and the vacuum level in the milking system. The milk flow will speed up with an increased vacuum level. However, an increased vacuum level will result in higher strip yields (the amount of milk left behind in the udder after the milking unit has been removed). The adjustment of the vacuum level is a compromise among the milking speed, pulsation ratio, the strip yield and physical load on the teats. Do not use working vacuum levels above 50 kPa.

**Instable or insufficient vacuum level**
Improper use of the milking machine may predispose the cow to a mastitis infection through a teat-end injury. It may carry pathogens from one cow to another during milking. During milking, the udder pathogens can easily be transferred from an infected quarter to an uninfected quarter of the same cow within the clawpiece, for instance in case of an abrupt reduction in milking vacuum.

**Other sources**
Pulsators should be clean and operating properly. It has been shown that cows
milked with irregular pulsations and conse-
quently causing vacuum fluctuations have a higher incidence of mastitis than cows milked at regular vacuum. These vacuum fluctuations may cause liner slip at the end of milking and may lead to a blast of air and milk droplets ("impacts") towards the teat end. Exactly the same will happen if the cluster is removed while under vacuum. These "impacts" may penetrate the teat orifice and may cause high infection rates.

Excessive over-milking and machine stripping will damage the tissue lining of the udder, teats, and teat orifice and must be avoided under all circumstances.

It is good practice to regularly inspect the milking machine equipment and to perform testing on a twice-yearly basis to keep the installation in good working order. Never forget that the most important parts of the milking machine are the people who operate, maintain and service the installation.

**Milking**

Good milking practice is thoroughly described in the Proper Milking Management manual. Furthermore, it is emphasized that the 5-point plan described in the chapter on mastitis control in this manual is routinely followed.

**Nutrition**

Nutrition may sometimes have an effect on the cow’s udder health. Rations deficient in vitamin A or E and the selenium (Se) trace element may cause an increased incidence of mastitis, owing to reduction of the natural defenses of the udder. Sometimes this will happen when the cow’s diet depends heavily on stored forages, especially silage. Selenium is an essential tissue nutrient required by all body tissues including the udder. Selenium as well as vitamin E are needed for a proper udder immune function.

In practice, selenium and vitamin E deficiencies are quite common during the dry period when often less attention is paid to good nutrition. Therefore, enough care should be taken to ensure that the rations are properly supplemented with minerals, especially selenium, and vitamins.

Fresh, green forages are the major sources of vitamins A and E.

Rations with an imbalanced roughage/concentrates ratio may lead to a reduced fibre intake and consequently play a part in causing metabolic disorders, such as milk fever, ketosis and rumen acidosis. The stress caused by these imbalanced rations, especially during the beginning of lactation when milk production is at its highest level, make cows more susceptible to udder health problems. Consult Feeding Management, Volumes 1 and 2.

After milking the cows should remain standing to prevent bacteria from entering the udder.
Just after milking, the teat orifice (teat end) is most susceptible to bacterial invasion. For this reason, it is good practice to encourage cows to remain standing for at least one hour after milking. It is recommended that fresh and palatable feeds are provided after the cows have left the milking parlour. This keeps the cows standing and gives the teat dip or spray enough time to act, thus reducing the exposure of the teat orifice to environmental pathogens.

Herd replacement management
Utmost attention should be paid to the purchase of in-milk dairy replacement stock from unknown sources. It is advisable to send milk samples of these cows for culture to animal health clinics, prior to admitting these cows to your milking herd. If culture facilities are unavailable, then check with a cow-side paddle test, for quarters with an increased somatic cell count. Sometimes these animals were culled by the previous owner for having an udder health history. If these animals are carriers of subclinical mastitis, they may easily transfer udder pathogens to healthy cows. Not checking purchased cows for the presence of udder infections is tantamount to asking for trouble.

Heifers are less likely to be infected with udder pathogens, but occasionally heifers get udder infections before calving. Always check the mammary system of heifers during their pregnancy. Hygienic conditions are important, just before calving as well as during and after calving.

From practical experience we know that, it is important to rear young heifer calves in individual calf pens to prevent suckling. Besides this, weaners and bulling heifers should be kept in separate groups in a clean and dry environment, and not be mixed with the dry cows. Furthermore, practice fly control to prevent udder infections in heifers, especially during grazing.

Herd health management programme
A good method for controlling mastitis in dairy herds is to use a herd animal health and management software programme. These comprehensive management programmes can assist in daily animal management, herd performance monitoring and problem analysis. Animal data are entered via a menu-based system and the animal events can be organised around many parameters, such as reproduction, milk yields, health records, inventories for drugs, feeds, semen, etc. These programmes provide access to a large amount of data required to help in daily management with action lists, allow for performance monitoring and analyze problems.

The use of these software packages in conjunction with regular visits of the field officer responsible for milk quality control, after-sales services of the milking machine agent and the vet greatly assist in improving udder health and overall milk production efficiency.

MASTITIS CONTROL
The primary objective of controlling mastitis is to reduce the number of new udder infections. For this reason, it is essential to introduce management practices...
for dairy managers and their milkers to reduce the rate of new infections and to shorten the duration of existing infections. It involves the conscientious application of only a few basic practices and may be described as the **5-point plan for mastitis control**. This plan is successfully in operation worldwide.

### 5-point plan for mastitis control:

1. **Proper milking hygiene, good milking technique, and desired milking machine function;**
2. **Dipping of teats after milking;**
3. **Treatment of all quarters of all cows at drying off;**
4. **Prompt treatment of clinical udder infections during lactation;**
5. **Culling of chronically infected animals.**

Proper mastitis control leads to more milk from healthier udders.

Of utmost importance is that teats are dry and clean before milking starts. Furthermore, provide a relatively stable vacuum level, avoid slipping of teat cup liners during milking and shutoff vacuum to the claw piece before removing the teat cups. Milk only as many cows as you can handle efficiently.

### 2-Dipping of teats after milking

The transfer of mastitis pathogens is inevitable during milking time. Therefore, it is necessary to dip teats at the end of milking to destroy remaining pathogens. It is recommended that each teat be fully covered by dipping or spraying with a suitable teatdip shortly after the clusters have been removed.

### 3-Treatment of all quarters of all cows at drying off

Treatment of all quarters of all cows with long-lasting antibiotics for dry cow treatment is recommended, if there is a high incidence of mastitis. This treatment should take place following the final milking of the lactation.

### 4-Prompt treatment of all clinical udder infections during lactation

In daily practice the observant milker will soon detect cases of clinical mastitis. These cases require immediate action with appropriate therapy in close cooperation with the vet. Keeping an up-to-date administration of individual quarter mastitis cases on a 'mastitis chart' will assist in controlling udder health. Treated cows should be clearly marked to help prevent accidental contamination of bulk milk.

### 5-Culling of chronically infected animals

Cows with repeated flaring-up of clinical and/or subclinical mastitis and not responding favourably to treatment should be culled. These cows can be the main source of infection for other animals.

Proper milking hygiene, good milking technique, and adequate milking machines

The primary objectives of proper milking hygiene, good milking techniques and desired milking machine function are thoroughly described in the Proper Milking Management manual.
SUMMARY

It is imperative that in order to maintain good udder health and clean milk production, initial bacterial contamination of milk should be avoided as much as possible. Herd health management, with the emphasis on udder health and its surrounding environment, is an essential condition for the production of quality milk from healthy udders.

A sound mastitis control programme will definitely assist in reducing the level of mastitis cases. The benefits will be an increased milk production, reduced veterinary expenses and fewer dairy cows culled. Accurate identification of the pathogen causing subclinical mastitis is essential for effective treatment. Furthermore, good recording of data relating to cows with clinical mastitis will assist the dairy farmer in taking the requisite action.

The general guidelines for good udder health are:

1. constantly monitoring udder health;
2. using a strip cup to be sure that milk is normal;
3. using the CMT paddle test for detecting abnormal milk or subscribing to an individual somatic cell count programme;
4. recording mastitis cases on a ‘mastitis chart’ for monitoring udder health;
5. practicing the 5-point programme for mastitis control;
6. keeping your cows and their environment clean at all times;
7. clean and disciplined milkers;
8. allowing time for feeding after milking to allow teat dip to act and dry;
9. checking-up your milking machine every 6 months;
10. consulting your vet about setting up an effective mastitis control programme.
FURTHER REFERENCES

- Milk Hygiene and Milk Quality, lecture notes IPC-Livestock/DTC ‘Friesland’.
- Milk, lecture notes IPC-Livestock/DTC ‘Friesland’.
- Mastitis Control and Herd Management by Bramley, Dodd & Tiffin, NIRD (1980).

Earlier publications:

- Reproduction Management
- Young Stock Management
- Foot Care Management
- Feeding Management, Volume 1

- Feeding Management, Volume 2
- Milking Machine Management, Volume 1
- Milking Machine Management, Volume 2
- Proper Milking Management
Dairy Training Centre Friesland (DTC-Friesland) is part of IPC Livestock. It is established by various Dutch farmers’ organisations and controlled by the Ministry of Agriculture, Nature Management and Fisheries. The Centre conducts a variety of international training programmes and courses. We also provide consultancy and management services.

All courses have a strong practice-oriented character based on the training concept of learning by doing. The practical training is very intensive; one instructor deals with groups of six students and for subjects like milking even with three students only. DTC-Friesland offers training in the following subjects:

- **Dairy Husbandry**
  - machine- and handmilking, milking machines, milk hygiene
  - feeding, ration calculation, feedplans, quality of feedstuffs
  - fertility management, heat detection
  - breeding, use of A.I., culling, body conformation
  - housing, tying/cubicle systems, hygiene
  - health, mastitis control, hoofcare
  - calf rearing
  - farm economics
  - farm administration

- **Forage production**
  - pasture management
  - fodder crops
  - silage making
  - farm machinery

- **Milk processing**
  - manufacture of cheese, butter, yoghurt, ice-cream, etc.
  - milk collection and payment systems
  - marketing
  - management of a dairy unit

- **Sheep husbandry**
- **Dairy goat husbandry**
- **Intensive beef production**
- **Horse keeping and animal traction**
- **Teaching methodology**

Visits to farmers’ organisations, A.I.-stations, Health and Extension service etc. are integrated in the courses to provide a good picture of the dairy sector in the Netherlands.

**AD HOC COURSES**

Our major activity is the organisation of ad hoc courses on request. These training programmes are tailor-made and completely designed according to the requirements.
of the client. The courses deal with one or more of the earlier mentioned subjects. Duration of the courses varies from 1 week to several months. The courses are conducted in English. For some special subjects training can be provided in French, Spanish or German. If facilities are available locally, our staff is prepared to conduct courses abroad as well.

**SIX-WEEKS COURSE: MODERN DAIRY FARM MANAGEMENT**

This course is especially designed for persons in charge of a large-scale dairy enterprise, and includes all aspects involved in managing a dairy herd. The course offers a good opportunity to refresh one’s knowledge and learn about recent developments in dairy farm management.

**SIX-WEEKS COURSE: MILK PROCESSING**

The course is designed for (assistant) managers of small to medium-sized dairy plants and future staff of new dairy enterprises; i.e. on-farm milk processing. Both six-weeks courses are conducted annually in September. However, for groups of at least six persons it can be organised at any time during the year.

**TRAINING FACILITIES AND STAFF**

The centre has three farms, each with a different management system. One farm is especially equipped for international courses. The total stock at the three farms includes 240 dairy cows, 50 fattening bulls, 45 dairy goats, 85 sheep and 12 Friesian horses. Additionally, the centre maintains close relations with twenty neighbouring farms which are used for practical training.

Our staff consists of fifty dedicated and well-qualified trainers. All have up-to-date knowledge of modern dairy farm management, and over 70 man-years experience is present in various dairy development projects throughout the world.

**ACCOMMODATION**

A modern hostel provides full board and lodging in single or double bedrooms. An international kitchen and many recreational facilities are present. Social excursions are organised during the weekends to enable the students to get acquainted with the Dutch culture.

For more detailed information on our activities, please contact:

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