MILKING MANAGEMENT

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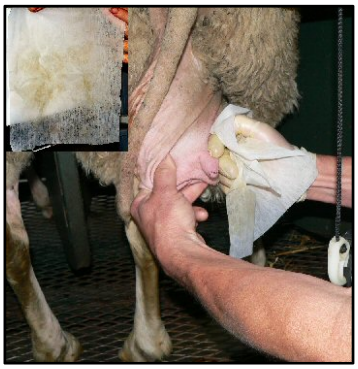
1. PREPARING FOR MILKING

There are many key components that are involved in udder preparation, and they can vary depending on the flock's management system. It is important to ensure that each udder preparation step is performed consistently to get the best results. Udder preparation is especially important when trying to control udder infections due to environmental pathogens (see Section II.3.2), as these pathogens are present on the teats prior to milking.

1.1 CLEANING THE UDDER AND TEATS

Cleaning and disinfecting the teats and udder prior to milking is essential to minimize the amount of bacteria present on the teat. This not only helps minimize the chance of these bacteria from entering the bulk tank, and potentially infecting teat cups, but it also minimizes the chance of bacteria entering the teat of the ewe, and causing an udder infection. If single-service udder wipes are used (Fig. 1), they can replace the action of udder washing.

Fig. 1. Cleaning the udder and teats



1.1.1 DISINFECTANTS USED ON UDDERS AND TEATS

Disinfectants used on the udder or teats of a dairy animal must be approved by Health Canada for such use[1]. The following products listed in Table III.1 licensed for use in dairy cattle according to label directions.

Table III.1. Udder and teat antiseptics approved for use in dairy cattle in Canada (partial list)

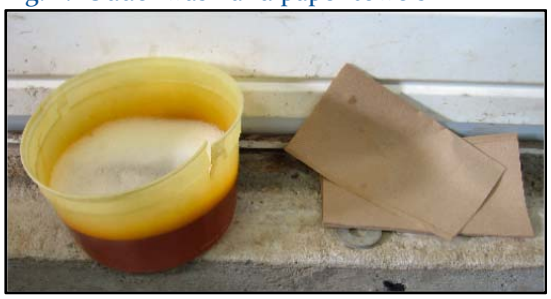
INGREDIENTS	PRODUCTS APPROVED IN CANADA FOR DAIRY COWS
UDDER WASHES / WIPES	
Accelerated Hydrogen Peroxide	DeLaval Prima™ (DeLaval)
Chlorhexidine	**WASHES:** Della Prep™ (DeLaval); Dihexamin ® Udder Wash (Divsersey); Professional Preference Udder Wash (Rafter 8); H-50 Udder Wash (Ostrem) **WIPES:** Dairy Prep Wipes (Agrisan); Kleen & Dri XL (Boumatic); La Lingette Hypre Towel (Matelvage Sarl); Marathon LC (Liberchem); Septicare (Matelvage Sarl)
Iodine	Della-Wash™ (DeLaval); Divosan (Diversey); Iodaphor Prep Udder Wash (Agrisan); Iodophor II (Ecolab); Iosan (West Pentone)
Lactic Acid, glycerin, alcohol	Lactofoam™ (DeLaval)
Linear Dodecyl Benzene Sulfonic Acid	Teat Kleen™ (Ecolab)
Nisin	Wipe Out Dairy Wipes
Quaternary Ammonium	Ultra Prep Udder Wash (Agrisan); Ster-Bac Udder Wash (Ecolab)

[1] Guidelines for approval of teat dips is found on the Health Canada website at: http://www.hc-sc.gc.ca/dhp-mps/vet/legislation/guide-ld/teat_guidelines_trayons_directives-eng.php

INGREDIENTS	PRODUCTS APPROVED IN CANADA FOR DAIRY COWS
TEAT DIPS	
Chlorhexidine	**POST-DIP:** Dairyman's Defence™ Shield (Agrisan); Della-Blue™ Teat Dip (DeLaval); Dihexamin ® Teat Dip (Diversey); H-30 Teat Dip (Ostrem); Ultra Blue Teat Dip (Agrisan)
Glycerin & Sulfonic Acid	**POST-DIP:** Blu-Gard Teat Dip (Ecolab)
Hydrogen Peroxide	**POST-DIP:** Oxy-Gard™ Sanitizing Teat Dip
Iodine	**PRE- AND POST DIP:** Bovitec (Agrisan); Della-Pretech Plus™ (DeLaval); Della-Pro™ (DeLaval); Preodine (Agrisan) **POST-DIP:** Bovi-Kote 75 (Agrisan); Dairyman's Defence™ Premier (Agrisan); Dairyman's Defence ™ Ultra (Agrisan); Della-Soft ACT™ Teat Dip (DeLaval); Duo (Ecolab); I-Deal™ Teat Dip (Ecolab); Dairy Dine Germidical Teat Dip (Dominion); Iodaphor 110 Teat Dip (Agrisan); Iodaphor 110HV (Agrisan); Iodex (Agrisan); K-24 Germicidal Teat Dip (Ostrem); Mastmin® 50 (Diversey); Teat GuardTM (Ecolab): Tri-FenderTM (DeLaval)
Lactic Acid– activator **Sodium Chlorite - base**	**POST-DIP:** 4XLA Antiseptic Pre- & Post-Milking Teat Dip (Activator & Base) (Ecolab); Uddergold® Germicidal Barrier Teat Dip (Activator & Base) (Ecolab)

1.1.2 APPROPRIATE UDDER CLEANING PREPARATIONS

Fig. 2. Udder wash and paper towels



There is a process that should be followed when preparing the udder for milking. The udder and teats should be free of debris before cleaning and sanitizing the udder, as excess dirt and manure can affect the reliability of disinfectant products. When disinfecting the udder and teats, use an approved udder wash at the correct concentration, and a clean paper towel or cloth to wash the udder (Fig. 2). Approved udder wipes are also acceptable. If the water becomes dirty replace it immediately with fresh water and disinfectant. If the cloth becomes soiled, replace it with a clean cloth. Make sure that the udder, hind legs and escutcheon area are shorn to allow for proper washing.

1.1.3 PRE-DIPPING TEATS

Pre-dipping teats is done to reduce the risk of transmission of some environmental bacteria (see Section II.3.2) and so may not be recommended in all flocks. Only teat dips approved for use as a pre-dip should be used (see Table III-1). It is very important that if used, directions should be followed to prevent iodine residues in the milk – a human health hazard. For the procedure used for proper teat dipping, see Section III.7 below.

1.2 DRYING THE UDDER

Drying the udder, and especially the teat ends, is a key component in the udder prep procedures. It is important to maintain proper milking procedures, as this step in udder prep can have an effect on the udder of the ewe, and the milk that travels to the tank.

1.2.1 MATERIALS

There are two options that can be used for drying, or simultaneous sanitizing and drying (i.e. wiping); either using disposable towels or wipes, or washable cloths. Disposable towels have their benefits, as the use of these towels minimizes the chance of bacterial transfer from multiple uses, and they are easily disposed. The most common disposable towels are packages of brown paper towels, which are strong enough to withstand the pre-dip liquid while wiping, however, there are more inexpensive options, such as newspaper cut into squares. Regardless of what is used, the towels should be clean and each one used only once on one ewe, i.e. single service.

Fig. 3. Clean laundered udder clothes

Commercially available udder wipes, which are impregnated with a chlorhexidine sanitizer, may replace udder washing and drying but not pre-dipping. Again, the wipe should be approved for use in dairy animals (see Table III.1) and be single-service. Wipe teat ends and teats first, followed by the udder. Discard when done.

A common material for drying the teats is reusable and washable cloths. This is an economical choice for producers, as the cloths are a one time investment, however, they do have to be washed thoroughly after each milking (Fig. 3). It is important to ensure that reusable towels are being washed and disinfected properly to minimize the chance of bacterial transfer between ewes.

When washing the towels, it is imperative that of the three following requirements, at least two are being met to kill all bacteria present on the cloths:

- Hot water, at least 70°C, for washing
- High temperature for drying
- The addition of bleach at washing

Another component to consider if washing towels in the barn is the quality of the water, including hardness. If poor or unknown a high quality detergent is required to properly wash the towels. In addition, towels should be dried properly, as wet environments promote the growth of bacteria.

1.2.2 PROCEDURE

When wiping the udder, it is important to make sure that the cloth is fully open to get the maximum coverage when wiping the teat. The towel should be completely wrapped around the teat, and should be pulled downwards in the natural direction of the teat. It is imperative that all teat dip is removed from the teat, with particular attention paid to the teat end, before the milking unit is attached.

1.2.3 MILK LET-DOWN

Milk let-down is the process by which the maximum udder pressure is obtained in the udder after a release of oxytocin, which allows for optimal milk production at each milking. Milk let-down in sheep is relatively short, so it is essential that udder prepping is done quickly, but efficiently. Milk-out time is

also quite short, approximately 1.5 to 3 min, so it is also essential that udders are not over-milked, surpassing the natural milk let-down.

Milk let-down is stimulated during the udder preparation steps, which is why these steps are not only important for udder hygiene, but also to stimulate maximum milk let-down and reduce the need for long milking times and damage to the teat ends. Wiping is especially essential for this process. The pulsation from milking equipment also has the ability to stimulate milk let-down; however, if given the option, milk let-down should occur prior to milking.

Fig. 4. Wet and woolly udder is risky to milk quality!

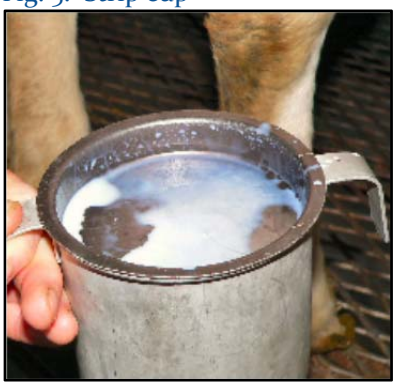
1.2.4 RISKS FROM NOT DRYING PROPERLY

It is essential to ensure that the udder and teats are dried thoroughly before attaching the milking unit, for a variety of reasons. First, wiping the teats to dry them ensures that all debris is removed from the teat, to minimize potential transfer of bacteria into the milk, or being exposed to the teat end. Second, if producers use an udder wash for prepping the teats, there is a potential for this liquid to slide down the teat end, bringing pathogens, particularly environmental pathogens, with it into the teat end, or milk. This may also cause an increase in the bacterial counts in the milk and elevated standard plate counts. Finally, if teats are not wiped properly, and an iodine-based teat disinfectant is used, there is a potential for increased iodine concentration in the milk, which can have human health implications.

1.3 STRIPPING FORE-MILK INTO STRIP CUP

There are two main reasons that the foremilk of ewes should be stripped prior to milking. The first is to promote milk let down. The second is to look at the consistency and colour of the milk, to determine if there is a clinical infection in either quarter (Fig. 5). After the ewe is cleaned and the teats are wiped dry, the milker can manually strip the teat in a downward motion, with the milk being squirted into a strip cup. There are different kinds but all allow visual inspection of the milk. One type has a filter that allows normal liquid milk to pass through the filter into the cup, while the mastitic milk is caught in the filter. Another has a black surface that, when the milk runs across it, will show up clots and changes in colour. If any abnormalities are seen, a follow-up test can be performed on the milk to determine if mastitis is likely present (see Section II.5.2).

Fig. 5. Strip cup



Although this technique takes slightly longer, and increases overall milking time, it allows the milker to detect cases of mastitis in the ewes more quickly, which significantly improves udder health in a flock.

1.4 HYGIENE OF HANDS

As the hands are in direct contact to teat ends, it is very important to make sure they remain clean during the milking process. As previously discussed in Section II 4.9.2, hands can be a risk factor for contagious mastitis. Disinfecting hands before milking is a common practice to minimize the transfer of bacteria, however, using gloves are the ideal choice when milking ewes, particularly when hand milking. The use of gloves decreases the chance of bacteria often present in small cracks on the skin or under the fingernails being transferred to the ewe's teat end. Although it is important to disinfect hands or don gloves prior to milking, it is important to maintain this good hygiene throughout the period of milking, and consistent hand or glove cleaning, or even the changing of gloves can be required.

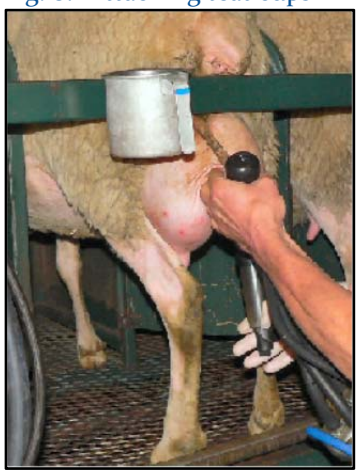
Fig. 6. Wash and dry hands frequently

Fig. 7. Hand washing facilities

1.4.1 *STAPHYLOCOCCUS AUREUS* HUMAN CARRIERS

Humans can be potential carriers of pathogens, particularly methicillin-resistant *Staphylococcus aureus* (MRSA) or other methicillin-resistant coagulase-negative staphylococci bacteria. In addition to *Staph. aureus*, it has also been shown that the coagulase-negative staphylococci species, *Staphylococcus epidermidis*, can be transmitted from the skin of humans to the mammary gland of ewes. These two organisms are two of the most important pathogens in mastitis of sheep and so care must be taken to prevent transmission of these bacteria from the milking staff to the animals.

Fig. 8. Attaching teat cups



2. ATTACHING OF TEAT CUPS TO UDDER PROPERLY

Milking operators can play an important role in maintaining vacuum stability by minimizing air admitted when they attach the milking units. Air admission during teat cup attachment may cause slugging in the milk line, which will result in vacuum fluctuations. Frequent milk slugging can cause slow milking of ewes and increased liner slips. Proper unit adjustment and will minimize liner squawks, which is particularly important toward the end of milking.

Fig. 9. Inflation with plug

2.1 ISSUES OF MILKING SINGLE GLAND ANIMALS

Often the situation arises where milk can only be produced by a single gland. This may because one gland is severely damaged from a previous bout of mastitis and/or the teat is damaged so that no milk can be removed. Although milking a single gland animal varies slightly from normal milking practices, there are some easy methods that can be done to make this alteration quite simple.

Commonly, a clean inflation plug can be used on the inflation that is not in use (Fig. 9), to allow for adequate suction, while preventing unwanted debris from being sucked into the unit. If the unit has a

separate automatic shut, this may be used when milking single gland animals. Although the damaged gland of single gland animals is quite visible as compared to a normal gland, it is important to clearly identify which gland is not being milked to avoid accidental milking.

3. RECOMMENDATIONS DURING MILKING

3.1 TIME FROM UDDER PREPARATION TO MILKING

As mentioned in Section I.1.2.2, milk let-down is caused by release of oxytocin from the sheep's pituitary gland. Oxytocin release is triggered by outside signals such as occur when cleaning the udder and teats. This happens very quickly, within less than a minute. Twenty sec of stimulation is adequate for milk-let down. To make sure that this phenomenon is properly taken advantage of, milking should commence in less than 60 sec after udder preparation.

3.2 TIME FOR MILK-OUT

Dairy sheep milk-out very quickly when milked by machine. High producing, slow milking ewes usually are done milking in less than 3 min. Most ewes milk out in less than 2 min and many in less than 1 ½ min. Making sure that ewes are not over-milked is important in preventing mastitis. Over-milking causes damage to teat ends (Section II.4.7.1), slowing milking and increasing risk of mastitis.

3.2.1 RECOMMENDED UNITS PER MILKER

The number of milking units per milker is dependent on the length of the parlour, the amount of time that is ideally allotted to milking, as well as the number of people milking. This is very flock dependent, but there are some general standards that can be followed.

Here are some average times for udder preparation and post-milking management:

- It takes 30 sec to check the milk (stripping the foremilk) and clean and dry the teats and udder.
- It takes another 10-15 sec to apply the teat cups.
- If machine stripping is performed, this may take another 15 to 20 sec.
- It takes another 15-20 sec to remove the teat cups and effectively teat dip.

This means that each ewe will occupy a milker's time for 55 to 85 sec. The average ewe takes 120 sec to milk out. Without the use of automatic take-offs, which should prevent over-milking; there is a danger of over-milking ewes if too many units are in action per person milking.

To make sure the ewes are not being over-milked, use a stop-watch to check how much time the milking unit is on. Do not skimp on time for proper udder preparation and post-dipping. These procedures are critical to udder health and milk quality.

3.3 STANDARD VALUES FOR MILKING EQUIPMENT

It is important to ensure that standard values for milking equipment are monitored on a regular basis. Although the equipment may appear to function correctly during milking, there could be an underlying issue affecting milk flow, or causing teat damage. The following chart demonstrates appropriate recommended equipment standards that are used for milking sheep flocks:

Table III.2. Standard values for milking equipment in dairy sheep parlours

EQUIPMENT PARAMETER	STANDARD VALUE
Pulsation Speed	60 – 180 ppm
Pulsation Ratio	50 – 70% Milk
Vacuum at Peak Flow (kilopascals = kPa)	At the claw: 32.5 to 39 kPa (9.6 to 11.5 inches mercury) Low Line System: 38-42 kPa Mid Line System: 41-46 kPa High Line System: 44-48 kPa 1 kPa = 0.295 inches of mercury (Hg)

As mentioned in Section II.4.9.2, improper set-up and maintenance of milking equipment will result in an increased problem with mastitis.

Basic information on the components of milking machines is available from the OMAF Factsheet at http://www.dairyweb.ca/Resources/USWebDocs/MilkingMachine.pdf

3.4 PREVENTING LINER SLIPS AND SQUAWKS AND IMPLICATIONS FOR MASTITIS

Squeaks and squawks are indicative of liner slippage, when the teat cup liner loses contact with the teat skin and air enters the liner through the mouthpiece. Liner slips may cause reverse milk flow, where milk droplets are forced at high speed towards the teat end. Liner slippage can be a significant cause of mastitis in dairy flocks.

There are many reasons why liners slip in a milking parlour, including the following:

- Liners which are old and worn
- The mouthpiece is misshapen
- Milking wet teats
- Milking at low vacuum level or a high number of vacuum fluctuations
- Blocked or partially blocked air vents
- Poor conformation of the udder and teats may increase risk if combined with above issues (Section II.4.6)

3.5 MACHINE STRIPPING, IMPLICATIONS FOR MASTITIS

Machine stripping where at the end of milking, the udder is massaged while the teat cups are in place. This is done to remove any residual milk that may be present in the cistern of the gland (Section I.1). In dairy sheep, the cistern can hold as much as 50% of total milk yield, compared to 20% for cattle (Section I.1.2.2). Additionally, conformation of the udder and teats in sheep is often less ideal for machine milking, so that residual milk may be trapped when the udder collapses at the end of the milking period (Section II.4.6). The advantage to machine-stripping is that it increases the amount of milk removed from the gland over-all. However, there are disadvantages to machine stripping and implications for udder health.

Fig. 10. Machine stripping

Machine stripping increases the length of milk-out, not just because of the time required to manipulate the udder (Section III.3.2.1), but machine-stripped ewes also take longer to milk out in general than ewes that are not machine-stripped. Over milking causes teat-end damage (Section II.4.7), which slows milking and increases the risk of mastitis organisms getting into the udder. Through-put of the parlour is much slower when machine-stripping is practiced. The time spent machine-stripping should not interfere with the time spent in udder and teat preparation.

4. REMOVAL OF THE MILKING UNIT

4.1 SHUT-OFF VACUUM TO UNIT BEFORE REMOVING CLUSTER

Vacuum should always be shut off before teat cups are removed. This is accomplished by using a valve or clamp on the longer milk hose or a shut off valve on the claw. When milk flow lessens at the end of milking, as visually detected by the milker, the vacuum is manually shut off before removing the unit from the udder. Pulling a unit off when it is still under vacuum needs to be avoided to minimize teat end damage.

Fig. 11. Using shut-off valve to remove unit

4.2 AUTOMATIC TAKE-OFFS

Automatic take-offs (ATO) are becoming increasingly more popular in milk parlours as a labour-saving device. The automatic take-off removes the milking unit from the sheep once the milk flow is sensed to be below a certain threshold. The ATOs can range from simple vacuum operated units controlled by milk flow float sensors to sophisticated electronic devices (Fig. 12).

Fig. 12. Automatic take-off

In general the ATOs should do the following:

- Sense the end of milk flow without over-milking
- Shut off vacuum to the claw before starting to retract the unit
- Have as little restriction to milk flow path from claw to pipeline as possible
- Be easily cleaned in place
- Be regularly checked for efficiency of removal

Some milking management points to consider when using ATOs are the following:

- A ewe with only a single gland may not be milked out properly using the automatic take-off.
- Ewes must be prepared properly for good milk let down.

5. HAND MILKING

As an alternative to milking machines, hand milking ewes is a traditional method that can be very successful in certain flocks. This milking method is generally used on smaller flocks, and is extremely cost effective, as milking equipment is not required. Even though it is more time consuming than an automated system, milkers can milk a ewe in 2 to 4 min.

5.1 HOW TO MAINTAIN HYGIENE AND PREVENT CONTAGIOUS MASTITIS

The main principles of maintaining hygiene while milking are essentially the same as maintaining good hygiene when prepping the udder for milking. Hands should be disinfected prior to milking, and ideally, gloves should be worn to decrease the chance of transferring contagious bacteria to the udder of ewes. Latex gloves may cause an allergic response in some people; blue nitrile gloves can be used instead.

Fig. 13. Wear gloves when milking

Teats and udder should be as dry as possible while milking, as any residual liquid from the udder wash, teat dips or disinfectants may drip into the milk. It will also contaminate your hands during milking allowing of transmission of bacteria between ewes. Because the teat ends are not covered when hand-milking, if there is splatter on the teats from urine or manure during milk, it is important to wipe the teats before continuing.

6. TEAT DIPPING

6.1 TYPES OF TEAT DISINFECTANTS

In Canada, teat dips are treated as prescription drugs, in terms of regulatory standards, and require a drug identification number (DIN) in order to be marketed for use with livestock. This assures us that the dips have been tested for effectiveness, safety and risk of residues. As there are no products that are currently licensed for dairy ewes, all teat dips are used through extra label drug use (ELDU).

Although there are no teat dips that are officially approved for sheep, there are many that have been approved for dairy cattle that have been used in the sheep industry (see Table III-1 for a list of those products). Post-dips are more commonly used in sheep flocks; however, pre-dips are also available for use. Generally, teat disinfectants are iodine, chlorhexidine acetate or hydrogen peroxide based. Some have teat conditioners added to these dips, such as lanolin or glycerine, to improve the condition of teats. Even though these conditioners have beneficial effects on teat condition, some producers have reported that the conditioners make the teats greasy, which can make milking, especially hand milking, difficult.

All teat dips need to be handled properly to maintain their efficacy. Containers of dip must be closed at all times, and stored in an area such as a cupboard with doors, that does not expose the dip to extreme hot or cold temperatures, nor to sunlight. Pre- and post-dips, if not the same product, should remain separate. Teat dips should not diluted in any way, which can compromise the efficacy of the dip. After teat dip is removed from the storage container (e.g. into a teat dip cup or sprayer), it should NEVER be returned to that container. Expiry dates of these products should also be observed, as an expired product can drastically affect its strength as a teat disinfectant.

Fig. 14. Proper teat coverage

6.2 PROPER COVERAGE OF THE TEATS

It is essential that not only the teat end, but also the entire teat up to the base of the udder, is completely covered on all sides to

ensure maximum amount of protection of the udder from harmful bacteria (Fig. 14). If there is manure or debris on any part of the teat that comes in contact with the milking unit, there is an increased chance of these bacteria entering the udder, contaminating the milk in the bulk tank.

6.2.1 DIP VS SPRAY

Care must be taken to ensure proper coverage of teat dip regardless of whether a teat cup and teat spray system is used.

- For teat dip cup (Fig. 15), there are times when there is not enough dip in the cup, therefore not allowing for the entire teat to be covered. If care isn't taken, the solution can be contaminated between animals.
- With a spray system (Fig. 16), often the placement of the spray nozzle is not positioned correctly under the teat, leaving exposed areas.

Fig. 15. Dip cup

Teat dip cups have been the traditional method of applying teat dip, as the system allows for full coverage of the area of the teat that is exposed to the milking unit. Teats that have abnormal placement on the udder can be dipped correctly. Teat sprayers allow for easy and quick application of disinfectant on teats. However sprayers may increase the risk of poor coverage of the teats, particularly in sheep, as their teats are not completely vertical, compared to dairy cattle (Fig. 16, Fig. 17). In addition, sprayers tend to emit quite a bit of spray, more that is sometimes required, and this increases the potential of increased iodine content in milk, as iodine has the ability to permeate the skin of the udder and be absorbed into the milk.

Fig. 16. Teat spray

6.3 RETURN VS NON-RETURN DIP CUPS

Return dip cups were the first containers developed for easy application of teat dips when milking. These are hand held cups that are shaped for easy application on teats (see Fig. 15). The base of the container is a squeeze bottle that holds a reservoir of dip, which is squeezed up, into the cup as needed. This allows the milker to regulate the amount of teat dip being applied to the udder. This is an open system, so teat dip can be exposed to all ewes in the flock.

Fig. 17. Non-return cup

Non-return dip cups are the same design as return dip cups, but the teat dip from the cup cannot return back to the original dip container, which decreases the chance of transferring bacteria to the uncontaminated dip. This type of dip cups is preferred, and they decrease the potential transfer of pathogens.

Fig. 18. Poor coverage by spray

6.4 CLEANING THE CUP

Cleaning the teat dip cups after each milking is important to decrease the spread of bacteria from milking to milking. Both the inside and outside of teat cups should be rinsed out at the end of each milking. If the dip cup is a return cup, all teat dip should be cleaned out after each milking, to decrease the chance of bacteria being transferred from milking to milking.

If manure or any debris falls in the teat dip cup during milking, any excess teat dip should be removed from the cup and rinsed. In addition, if any ewe that has been confirmed as having a *Staph. aureus* intramammary infection, the teat dip cup should be emptied and rinsed before using it on the remainder of the flock.

6.5 ENVIRONMENT POST-MILKING

The teat sphincter is relaxed and does not close for approximately 30 to 120 min after milking, leaving it exposed to pathogens. Post-dipping the teats following milking helps decrease the chance of transferring pathogens into the udder, however, its efficacy is limited.

Fig. 19. Water available after milking

To prevent risk of environmental pathogens entering the teat sphincter, discourage lying down following milking. Offering water and feed immediately after milking will help to do this. Fresh, water should be freely available as soon as they leave the parlour, but it is critical that the area around the waterer be kept dry and clean as splashing can dirty the teats. If fresh feed is delivered to the feed bunk after the ewes leave the parlour, this entices them to stand and eat rather than lie down. While the ewes are in the holding area of the parlour prior to milking, this is an ideal time for wet bedding to be removed and fresh bedding to be laid down. If at pasture, make sure wet, swampy areas are kept fenced off. Dry lots or corrals should be similarly dry and clean.

Flies have been shown to transmit mastitis causing bacteria as they are attracted to the teat ends. Fly control during the summer, particular biting-type flies is an important part of a mastitis control program.

6.6 IODINE RESIDUES IN THE MILK AND HUMAN HEALTH

Recently, high levels of iodine found in milk have been a human health concern. Excess exposure to iodine-based teat dips can potentially affect the milk of the ewe, as iodine can permeate skin.

Children under the age of 8 have a daily iodine requirement of approximately 90 µg (mg or millionth of a g), with a maximum iodine limit of 300 µg, and adults have a daily iodine requirement of approximately 150 µg per day, with a maximum iodine limit of 1100 µg. It is important that humans are not ingesting excess iodine from dietary sources.

It is suggested that an appropriate iodine level in bulk tank milk should remain below 500 µg/kg,. This can be done by: proper use of teat dips; proper cleaning and drying of the teats; assuring that dietary iodine levels be limited to requirements only (See Section I.2).

7. MILKING ORDER

7.1 EWE LAMBS MILKED FIRST

There are several reasons to milk ewe lambs first:

- To ensure that ewe lambs become comfortable in a parlour setting, it is important to milk them first in the milking order to allow for more time to get accustomed to the milking system. If ewe lambs are put into groups with older animals, there is a potential for them to get bullied out of being milked, and this will be associated as a negative experience.
- If ewe lambs are milked together, the milking times will be more consistent between animals, as they are all producing a simlar amount of milk, which saves time later on for the milker.
- Ewes with more than one lactation, are more likely to carry infections with contagious mastitis pathogens. Milking ewe lambs first reduces possible exposure to these infected ewes and their milk.

7.2 PHYSICALLY IDENTIFY CONTAGIOUS MASTITIS EWES

Because animals that are identified with contagious mastitis (e.g. *Staph. aureus*) generally have chronic subclinical infections throughout their lactation, it is important to treat these animals separately from the rest of the flock to minimize the potential of transmitting these pathogens to other ewes. The identification should be a milker level, be visible from the rear of the animal and be semi-permanent, i.e. should not wear off but should be able to be removed if the status of the animal changes. An example is to use leg ties such as shown in Fig. 20. Keep written records of all treatments, culture results and management decisions on each ewe (Fig. 21).

Fig. 20. Leg tie to identify udder health status

There are three common ways to manage these animals:

- Have a separate milking unit that is used for only confirmed infected ewes. For example, a special bucket milker is used.
- Disinfect each milking unit separately after it has been used on an infected animal. This is very time and labour consuming however.
- Identify ewes known to be infected with a contagious mastitis pathogen, and manage them as a separate group. Milk this group of animals last in the flock. By doing this, you eliminate the chance of infected milk being transferred to an uninfected ewe through the teat cups of the milking unit. In addition, all milking units will be disinfected after the end of milking, which eliminates the need of disinfecting them separately after each infected ewe is milked. More information is available in Section VI.8.

Fig. 21. Keep written records