Dairy Australia
Your Levy at Work

FAQ SHEET

What are the keys to controlling Strep. uberis mastitis in dairy herds?

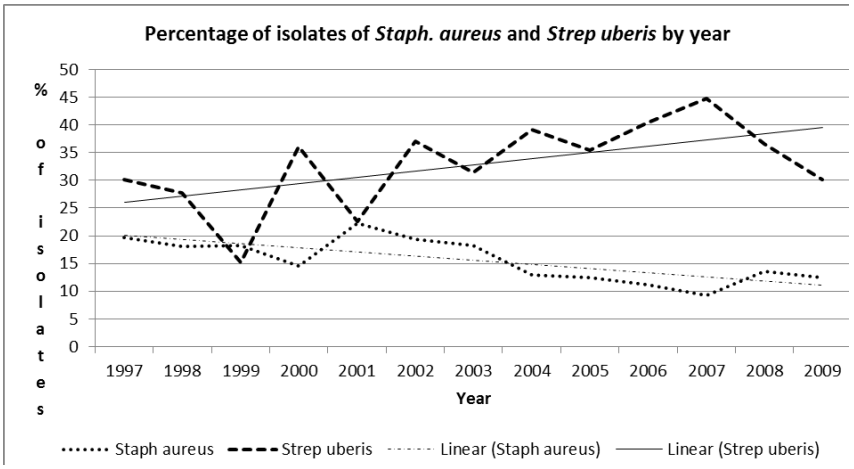
The bacteria Streptococcus uberis (also known as Strep uberis) is a common cause of mastitis in dairy cattle in many countries around the world. Over the past two decades it has become the leading cause of clinical and subclinical mastitis in Australian and New Zealand dairy herds (J Malmo unpublished data, McDougall 1998, Petrovski et al 2009).

Strep uberis is passed in the faeces of cattle (and other ruminants) and can survive for up to 2 weeks in fresh dung or faecal-contaminated mud or straw (Lopez-Benavides MG et al 2007). It is regarded as an environmental pathogen because cows with damaged teat skin or open teat ends that are exposed to contaminated material are likely to develop intramammary infections.

The emergence of Strep uberis as a problem for pasture-based herds follows intensification of the Australian industry, with higher stocking rates increasing cow exposure to environmental bacteria. Typical changes in farm systems that have increased the risk of environmental infection include widespread use of calving pads and feed pads, loafing areas, heavy traffic around water troughs, gateways and laneways. Higher yielding cows and those fed concentrate-based transition diets are also more at risk.

Many cows in the herd can become infected if exposed to environmental bacteria at a vulnerable time: especially in the fortnight after drying-off and the weeks either side of calving - or in the hour immediately after milking.

It is likely that faecal shedding by cows is needed to maintain *Strep uberis* in the environment (Lopez-Benavides *et al* 2005). *Strep uberis* contamination is common in medium to high traffic laneways. Paddocks show a high degree of contamination immediately *after* grazing but no contamination *before* grazing.



Milk culture data from Maffra Veterinary Centre records (1997-2009).

Importantly Strep uberis can also spread from cow-to-cow at milking (Zadocks et al 2009). It is postulated that host-adapted strains can establish chronic infections through adherence, invasion or intracellular survival and the chronicity of infection allows the bacteria the opportunity to spread from cow to cow via the mechanisms associated with contagious mastitis bacteria. It is likely that host adapted strains cause predominantly subclinical infections. Good milking routine (putting cups on clean, dry teats and taking cups off carefully to avoid any sudden admission of air), milking machine maintenance (to maintain the health of the teat skin and teat ends) and post-milking teat disinfection (to ensure minimal bacteria numbers are left on the teat and protect the skin condition between milkings) are all necessary for preventing the spread of infection.

Typically pre-milking preparation in Australia and New Zealand does not involve washing and drying teats with an individual paper towel and it is quite probable that this practice is contributing to the increasing prevalence of this bacteria.

There are more than 70 strains of Strep uberis (Milne et al 2005). Recent studies show some strains are more able to adapt to specific host tissues (survive in mammary epithelial cells for example) while the less host-adapted strains are rapidly eliminated by the cow's immune system (Tamilselvam et al 2006). The implications of strain differences on spread of infection, treatment efficacy and control options are still unfolding.

Because cows are likely to be regularly exposed to Strep uberis in the environment, mastitis management should aim to reduce the likelihood of cows becoming infected rather than eliminate the infection from the herd. The focus of attention here is on having a good dry cow strategy and drying-off process, putting teatcups on clean, dry teats, and minimising exposure of susceptible cows to high traffic areas.

Describe the presenting problem

Strep uberis can cause high bulk milk cell counts or clinical case problems in herds.

Although intramammary infection with environmental bacteria usually occurs in the first two weeks of the dry period or in the weeks around calving (especially if there is teat end damage or oedema), clinical cases of mastitis may not become apparent until a considerable time later (Bradley and Green 2004).

There are also certain circumstances during lactation that will predispose cows to infection with environmental bacteria. When conditions get wet, muddy and humid the risk of clinical and subclinical mastitis infection increases greatly. This is because exposure to the bacteria is higher and the teat skin and teat ends tend to be less healthy. Putting teatcups on udders that are wet or dirty is equivalent to bathing the teat end in a broth of contaminated milk at the beginning of milking.

Another way of infecting cows is to administer intramammary treatments (antibiotic treatments, teat sealants or other infusions) without maintaining meticulous hygiene. In this situation specks of dirt on the tube or teat skin are forced through the teat orifice and teat canal into the udder.

Quarters that become infected have been described as having high cell counts (often above 500,000 cells/mL) that often return to a normal cell count within 2-3 weeks, with a small percentage of cows remaining chronically infected and shedding bacteria in their milk (Hogan and Smith 1997). However it is highly likely that the pattern and effectiveness of the immune response of cows to infection will vary with the strain(s) of the bacteria causing the problem in the herd.

By definition all cows with clinical mastitis caused by Strep uberis will have changes in their milk (wateriness or clots that persist for more than three squirts of milk) but only half of them will also have an enlarged, inflamed quarter. In about 10% of cases the cows develop a fever and go off their feed.

Establishing the timing of new infections and the rate at which infection is spreading can greatly facilitate problem diagnosis. All herd recording organisations in Australia are able to create a Countdown Mastitis Focus report or provide advisers with the necessary files to do so (go to www.mastitisfocus.com.au).

The following types of problems in a herd would be potentially suggestive of Strep uberis:

- Clinical mastitis in cows at calving or in the first 100 days of lactation (even though cows may have been given antibiotic Dry Cow Treatment). If clinical cases have been entered onto herd recording software a Mastitis Focus report will indicate a monthly clinical case rate at calving greater than the 5 cases per 100 cows calved trigger level. The monthly clinical case rate in lactation may also be above the trigger level of 2 cases per 100 cows in milk, particularly during months when the herd has calving cows. Mastitis Focus report example to be inserted here?
- First lactation heifers developing clinical mastitis immediately after calving. The best indicator of this on a Mastitis Focus report is a first calver clinical case rate above the 5 cases per 100 first calvers trigger

Clinical case records are an invaluable aid to the diagnosis of *Strep uberis* problems in herds. The timing of clinical cases and new infections combined with milk culture results provide for a good problem definition and well-directed advice. As paper-based records are rarely converted to an effective overview of the herd situation, farmers should be encouraged to enter cases on one of the commercially available herd software packages.

- Heifers or many of the older cows have High Individual Cow Cell Counts (greater than 250,000 cells/ml) at the first herd test after calving. On a Mastitis Focus report the graph bars indicating the new infection rate will be above 5 cases per 100 cows in milk during months when cows are calving (Spread of infection box on the report)
- Higher than expected numbers of clinical cases throughout the lactation.
- A Bulk Milk Cell Count greater than 250,000 or trending up over a premium milk quality band threshold (not necessarily at the same time as clinical cases of mastitis).

Because *Strep uberis* is associated with cow faeces in the environment it is important to ensure milk samples sent to the laboratory are taken from a stream of milk that has not touched the teat skin or any other surface. Factsheet A of the *Countdown Downunder Farm Guidelines for Mastitis Control* provides a comprehensive description of how to collect milk samples aseptically. If there is any doubt about quality, have an experienced person collect the samples.

Define the problem as *Strep uberis*

As with any mastitis investigation, milk culture results are required from a sufficient number of typically affected cows to determine whether Strep uberis is the cause of the problem in the herd.

Common sampling strategies include:

- Taking samples from every case of clinical mastitis in newly identified cows (immediately before starting a course of treatment). Samples can be refrigerated and submitted to a laboratory within 48 hours OR frozen for up to 3-4 months (see Technote 4, pg 6). The samples are immediately available for culture should a problem start to escalate.
- Using herd recording results to identify subclinically infected cows (cows with an Individual Cow Cell Count greater than 250,000 cells/mL).

Technote 4.3 gives a detailed description of sampling strategies and reasons for milk samples yielding 'no growth'.

Countdown Technote 13 (page 8, section C) indicates that it is important to have at least 20 effective milk culture results when conducting a herd mastitis investigation. The presence of S. uberis in around 25% or more of these samples can be used to indicate increased new infection risk factors associated with this bacteria.

Molecular tests

DNA tests for bovine mastitis pathogens are now commercially available in Australia. These systems provide a rapid screen for the presence of the DNA from multiple bacteria at a single test.

The Pathoproof Polymerase Chain Reaction screening test is now being offered by the company that does the Bulk Milk Cell Count testing for most Australian herds. The system detects the presence of Strep uberis DNA in bulk milk samples in its array.

The 'Vat milk tests FAQ sheet' describes some of the issues that need to be considered when testing bulk-tank milk sample.

As with any vat test care must be taken when interpreting the results. Molecular tests are highly sensitive and can detect very small numbers of bacteria. The challenge is to ensure that these bacteria have come from within the udder, not from teat skin, hands, dirt and faecal particles or unwashed equipment. Follow-up sampling of suspect cows is strongly recommended after a screening test.

Research priority: Only scant knowledge exists on the strains of S. uberis found on Australian dairy farms and strain typing has only been applied in a research context to date. There is little understanding of the relative importance of contagious or host-adapted strains on farm. In the future, strain typing clinical mastitis from cows with high numbers of repeating clinical cases may be the key to unlocking this information.

Activate your advisory team

Resolution of a Strep uberis issue is likely to involve the farm manager, veterinarian, milking machine technician and milking staff at a minimum. Nutritionists also have an important role to play around the advice and support for transition period management.

It is recommended that advisers use a team approach when identifying and prioritising action around the key factors contributing to the problem. This approach gives the best chance of success as each profession understands how their contribution can progress the situation on farm.

Collate and assess findings with the advisory team

Once Strep uberis has been confirmed the job of the advisory team is to identify how and when cows are becoming infected, especially the sources of infection and important risk factors, as these are critical for control.

This is best done systematically to avoid oversights given the multifactorial and often complex nature of herd mastitis problems. The aim of the investigation is for the team to agree to prioritise the key factors and discuss control options with a farm owner.

Technote 13 (February 2003) contains a Mastitis Investigation Pack to help the advisory team systematically collect, collate and prioritise information.

Develop a farm plan to control *Strep uberis*

Control programs should minimise both environmental and cow-to-cow mechanisms of spread even though one may dominate in individual herds.

The keys to controlling Strep uberis in herds are to:

- Ensure teat canals remain closed throughout the dry period.
- Enhance the teat canal defences in the first weeks of the dry period
- Milk out cows that drip milk around calving
- Minimise exposure of susceptible cows to faecal contamination.
- Stop cow-to-cow spread at milking.
- Cure infections.

Ensure teat canals remain closed throughout the dry period; enhance teat canal defences

Use dry cow treatments to protect cows

Strep uberis can enter the udder whilst the teat canal is still closing in the days after drying-off (Leigh 1990). Having an effective dry-off strategy is one of the mainstays of Strep uberis control.

- Properly plan the lead up to drying-off by taking steps to reduce milk production as well as choosing an appropriate treatment strategy (antibiotics and/or teat sealants).

Teat sealants are a highly effective way of reducing the incidence of clinical mastitis around the time of calving. They have been widely available in Australia since 2003 for use in uninfected (low cell count) cows to protect them from infection for the duration of the dry period.

Technote 14 describes the closure of the teat canal during the dry period.

Technote 16 explains the importance of drying cows off when they are producing between 5 to 12 L per day and why it is necessary to plan for this.

The 'Teat sealants FAQ Sheet' (Feb 2003) describes the use of inert compounds to protect uninfected cows for the duration of the dry period.

- Recent experience in Australia shows administration of antibiotic Dry Cow Treatment AND teat sealant at drying-off provides significant further reductions in new infection rates at calving (Runciman et al 2008). This pairing is now being used as a fundamental plank in the control program for many herds with endemic Strep uberis problems. As with any drying-off treatment, farmers need to discuss treatment options and strategy with their veterinarian.
- Ask veterinary advice on the choice of antibiotic Dry Cow Treatment as longer acting preparations (such as cephalonium) are likely to be the drug of choice.
- In herds where selective antibiotic Dry Cow Treatment is an option, including teat sealant in the treatment regime for cows with Individual Cow Cell Counts under 250,000 cells/mL should be considered.
- For herds where maiden heifers are becoming infected, the use of teat sealants (alone) in the 2-8 weeks prior to calving can markedly reduce the incidence of clinical mastitis in the post-calving period (ref: McDougall paper JDS or NZVJ?).

It is important to instruct clients on how to use teat sealant - its administration and evacuation at calving – to avoid problems with milk quality. The Countdown Fact Sheet on 'Using teat sealants in your herd' reinforces the key points.

Milk out cows that drip milk around calving

Control udder oedema and leaking milk before calving

With the advent of concentrate-based transition cow rations in the mid-1990s there has been an increase in cows that have udder oedema and leak milk close to calving. The same is true for heifers fed a transition concentrate ('lead feed'). Animals that drip milk prior to calving or have udder oedema (flag) have patent teat canals and are at risk of clinical and subclinical infection with environmental bacteria.

- Get freshly calved cows and heifers into the milking herd as soon as possible after calving and preferably well within 12 hours of calving (rather than 24-36 hours) (McDougall 2010).
- If springing cows and heifers drip milk prior to calving, milk them twice a day then disinfect their teats after milking. Store colostrum from these animals (or from an alternative source) to feed to their calves. It is the same process for heifers displaying udder oedema even when they are not observed leaking milk.

[graphic] The incidence of clinical mastitis increased with the interval to first milking in heifers (Compton and McDougall 2008) - show Figure 1 – to be sourced

Minimise exposure of susceptible cows to faecal contamination

Manage how cows use highly trafficked areas before and after milking

Exposing cows to medium or high traffic areas during the transition period is likely to increase new infection rates (Zadoks 2007).

- Minimise crowding, pushing and herding in the dairy yard as cows are waiting to be milked to reduce splashing of faeces from the dairy yard surface. Use backing gates judiciously.
- Set up a routine so cows don't lie down in the hour after milking. For example have feed available when cows leave the shed (on feed pads).

If cows have been in an area within the last few days, *Strep uberis* bacteria may still be present.

Design feed pads for regular and easy cleaning

- Regard any area that contains a lot of fresh faecal material (deposited within the last few days) as an infection risk.
- Maintain as clean a feeding area as possible wherever cows and heifers are being fed prior to calving and after calving.
- If concrete feeding areas are used it is ideal to clean off the area by scraping or hosing once daily. And it's very important that the feeding area has been designed to drain effectively.
- If the feeding area has a dirt base, scraping at periodic intervals may provide the best practical means of cleaning.

The Grains2Milk fact sheet provides information on the design of feeding areas www.dairyaustralia.com.au/Farm/Feeding-cows

Minimise faecal contamination of calving pads

The same principles apply when dedicated calving areas or calving pads are used: to keep the area as clean as possible and manage calving cows to minimise exposure to contamination.

- Scrape or hose concrete calving pads every day.
- Scrape dirt-based calving pads at least weekly to remove faecal pats and soiled material?
- If using bedding material, maintain a fresh surface. Sand is often preferred as it is a less favourable substrate for Strep uberis than organic materials (Leigh 1999). However well-maintained straw bedding also does the job (having a lower load than sand that is not regularly replaced for example).
- Calving areas should be rotated and less soiled areas used when the clinical mastitis rate at calving goes above 5 cases per 100 calvers per month or when there is a noticeable increase in the clinical case rate among calving cows

Setting up a routine that maintains bedding with fresh material should be a prime consideration for farms that have moved to a total mixed ration feed system with free stall housing.

Use good transition management programs to promote cow health

Healthy cows spend more time on their feet and less time lying down in contact with potentially contaminated soil and pasture.

- Plan and implement a good transition feed management plan to keep the incidence of milk fever at or below the target levels of 1-2%.
- Apply the normal post-milking teat disinfection when the transition diet is being fed in the milking shed (McDougall et al 2010, Lopez-Benavides et al 2009). Disinfect each teat of each animal at each feed.

InCalf describes a practical approach for reducing retained foetal membranes, acidosis and milk fever at calving in the transition management fact sheet 'Springers: repro ready' at www.dairyaustralia.com.au/Farm/Fertility

Stop cow-to-cow spread at milking

Because Strep uberis can spread from cow-to-cow all of the control measures that apply to contagious mastitis pathogens (such as Staphylococcus aureus) are relevant. No effective commercial vaccine is on the horizon yet. Of the recommendations below, the change for most herds would be to organise to put cups on clean, dry teats.

Put cups on clean, dry teats

Washing and drying dirty teats prior to milking means mastitis-causing bacteria are less likely to enter the teat during milking. Drying teats prevents cup crawl and damage to teat ends. Research into the benefits and practicality of modifying cow preparation practices in Australia and New Zealand to reduce new infection rates with *Strep uberis* and other environmental bacteria is a high priority.

Milking routines in Australia and New Zealand place emphasis on preparing cows to promote good 'let down' but do not typically wash and dry dirty or soiled teats. Cleaning and disinfecting teats prior to cups on may reduce the incidence of new infections (Zadoks 2007).

- Wash and dry all dirty or soiled teats (not udders) using low pressure water. Teats that needed to be washed must then be individually dried with one paper towel per cow. Note in rotary dairies the cups on position may need to be changed.
- Strategic washing of teats is especially important during wet, muddy, humid conditions where many cows are entering the milking shed with soiled teats and udders.
- Where there is evidence of an increase in clinical mastitis caused by E coli a herd may consider the use of pre-milking teat disinfection. Care should be taken to only use a teat disinfectant registered for this purpose and the product should be used according to the manufacturers recommendations. In all circumstances these products are designed to have a certain contact time on the teats and then be removed through drying prior to cups being placed on teats.
- The People in Dairy resources contain useful information on planning the farm roles, responsibilities and workplan in the Working Together Live Library section of the website (www.thepeopleindairy.com.au/working-together)

The 'Pre-milking teat disinfection' FAQ Sheet describes how to use pre-dipping preparations effectively (such as "strip, dip, dry, apply"). Application using the recommended routine is important to avoid a potential increase in iodine residue in milk.

Ensure milking machine operation is not damaging teat skin or teat ends

Milking machines are operating below par if teatcups are frequently slipping, cows are uncomfortable during milking, they milk slowly or incompletely, or teats look swollen or discoloured when cups come off. Damage to teat ends and skin lesions provide a place for Strep uberis and other bacteria to multiply.

- Organise for a complete AMMTA 'dry test' if the machine hasn't been tested for six months or more. This will confirm whether machine functions are adequate, especially pulsation, vacuum and liner shell compatability. It may also be appropriate to have a Countdown trained milking machine technician conduct a milking time performance test on the plant.
- Plan for the farm team to do regular, systematic checks of machine function. This includes checking the evenness of milkout between quarters, counting cup squawks and slips that require correcting, checking teat condition when cups come off. Allocate tasks to individuals in the farm team and have a way of keeping tabs on the observations. (see Technote 6 – 2010 update)
- Check the herd has no underlying teat condition such as injuries or warts that are causing skin lesions.

Technote 6 describes how to check milking machines are operating well.

Implement effective post-milking teat disinfection

Post-milking teat disinfection with emollient reduces the number of bacteria on the teat skin and helps maintain teat skin health between milking providing coverage is adequate and the product is used at the correct concentration.

- Use a product that contains emollient.
- Use a Ready-To-Use product if water quality fluctuates or is uncertain.
- Check that the volume of product used allows 20 mL per cow per milking.
- Check that the coverage on individual teats is adequate. Best practice is to cover all parts of the teat skin in contact with the liner.
- For herds that use automatic teat sprays, consider switching to hand spraying as the situation indicates.

Detect, treat and isolate clinical cases as early as possible

Clinical cases that are treated early have a better chance of cure. Isolation and treatment reduces the chance of infection spreading to other cows.

- At times of high risk strip quarters before every milking to check for new clinical infections, changes in milk or an abnormal quarter. Discuss ideas with the farm team about ways of making this doable as a routine, for example stripping one teat of every cow at each milking (front in the morning, back in the evening).
- Recheck suspect cows at the next milking (cows with changes in one or two strips before the milk changing to normal).
- Milk clinical cases last or use a separate cluster attached to a test bucket. Strep uberis has been isolated from liners after two cows have been milked following a cow shedding the bacteria (Zadoks et al JDS 2001).
- Run a separate hospital herd of mastitis cases and others (such as lame cows).
- Set up a mastitis treatment protocol with the farm vet.

Technote 7 describes how to check teat coverage (whether the expected volume is being used across the herd and the coating on teats of individual cows) and other significant considerations when reviewing the standard procedure used on farm.

It is assumed that the milking hygiene and routines recommended in the *Countdown Downunder Farm Guidelines for Mastitis Control* are established practice on farms. That all milking staff wear gloves at milking and cups-on and cups-off procedures are not contributing to the risk of new infection. Technotes 5 and 8 recap the main considerations here.

Technote 4 explains the critical elements of managing clinical cases in fresh cows.

In extreme situations (adverse environmental conditions or when dealing with an outbreak of clinical mastitis) it is worthwhile putting an extra person on in the shed to focus on critical procedures before, during and immediately after milking. This includes:

- ensuring teats are washed and dried before cups go on;
- stripping cows every day to detect, treat and isolate clinical cases; and
- thoroughly applying post-milking teat disinfection.

Cure infections

The main opportunity for treatment and cure of Strep uberis infections is through antibiotic Dry Cow Treatments at drying-off. The importance of a good dry cow strategy and drying –off process cannot be overemphasised in Strep uberis herds. The drug of choice also needs to be discussed with the herd's veterinarian as longer acting preparations are likely to be recommended. Further information on planning the drying-off process can be sourced via the Checklist for drying-off plan sheet in the Countdown Mastitis control in and after wet conditions resource kit at www.countdown.org.au.

Treatment of clinical cases during lactation often removes clinical symptoms although it may be difficult to achieve a bacteriological cure in some cases.

A couple of large field trials have achieved a bacteriological cure of only 50-60% of cases despite extended and combination treatments (Hillerton and Kliem 2002) or multiple treatment courses (Milne et al 2005). The Strep uberis isolates in these herds were sensitive to the antibiotic being used, suggesting other factors are also important in the cure: such as the immune response of the cells (whether the strain is host-adapted) and the ability of the antibiotics to penetrate host cells. Strep uberis is normally susceptible to penicillins and cephalosporins but these antibiotics are not able to penetrate the host cells. Macrolide antibiotics (erythromycin, tylosin, tilmicosin) have the advantage of being able to penetrate intracellularly but S uberis often shows resistance to this drug family.

Cure rates are likely to vary with the strain of *Strep uberis* causing the infection.

[table] Cure of Strep uberis infection with different antibiotics – still to be populated from references

Antibiotic family	Antibiotic*	Cure (%)	Detail**	Source
Penicillin and beta-lactamases	Cloxacillin			
	Ampicillin and cloxacillin			
	Cephalosporins- cephalonium or cefuroxime			
	Penethemate hydriodide (imusc)			
Macrolides and related	Erythromycin (imusc)			
	Tylosin (imusc)			
	Tilmicosin (imusc)			
Tetracyclines	Oxytetracycline			
Aminoglycosides	Neomycin			

* Intramammary unless otherwise indicated, 'imusc' refers to intramuscular injection

**Any big picture pertinent information about type of study, clinical or subclinical infections, antibiotic dose rate etc

After comparing different treatment regimes, Hillerton and Kliem (2002) recommend intramammary treatments, not in combination with intramuscular antibiotics. Extended intramammary treatment courses may be indicated (Hillerton and Kliem 2002, plus which McDougall paper).

If systemic antibiotics are used as part of a treatment regime it is important to use a drug family with reasonable distribution into the udder after administration (see Table).

Distribution after systemic administration (adapted from Francis, 1989)

Good	Moderate	Poor
Tylosin	Sulphonamides	Aminoglycosides
Erythromycin	Penicillins	Ceftiofur
Lincomycin	Tetracyclines	
Penethamate hydriodide		
Trimethoprim+sulphonamide		

The Withholding Period for a registered antibiotic treatment does not apply when the treatment course is extended or intramammary treatments are combined with parenteral antibiotic treatments. There is currently no guide as to what withhold may be necessary. It may be worthwhile discussing screening for antibiotic residue with the factory field officer.

Given the relatively low cure rate it is important to remain vigilant for recurrence of clinical cases of Strep uberis.

Treatment recommendations for subclinical infections during lactation are less certain. Cure rates in high cell count cows are not well understood and may be even lower than clinical cases (Zadoks 2007). Given the variable and possibly poor response to treatment the cost-effectiveness of treatment of subclinical infections during lactation is questionable.

Cull persistently infected cows: those that have had more than three clinical cases in the one lactation OR cows that have had cell counts above 250,000 cells/mL in two consecutive lactations despite intervening antibiotic Dry Cow Treatment. The number of these cows in the herd is identified on a Mastitis Focus report.

Review progress

One of the keys to effectively controlling Strep uberis, from season to season, is the ability to re-assess risk factors for an individual farm. The risk factors operating on farm for Strep uberis, whether behaving as an environmental bacteria or a contagious bacteria being spread during the milking process have the ability to alter. Adviser need to retain the ability to respond to changing circumstances with the farmers they are advising.

In all herds the described Countdown triggers provide the ability to measure the effectiveness of tailored control plans as well as the impetus for re-tracing your steps should ant specific control points need to be reviewed. The triggers for review and re-planning are: a clinical mastitis case rate during the calving period of greater than 5 cases per 100 calvers; a clinical case rate during lactation of greater than 2 cases per 100 milkers per month and an overall new infection rate (based on ICCC changes) of 5 cases per 100 milkers per month. These measurements may be provided by a Countdown Mastitis Focus report.

In all scenarios, the use of culture information from clinical cases is integral to reviewing progress on farm.

Key papers

Bradley and Green 2004

Francis PG. Update on mastitis – III Mastitis Therapy. British Veterinary Journal 145, 302, 1989

Hillerton and Kliem 2002

Hogan and Smith 1997

Leigh 1990

Lopez-Benavides et al 2005

Lopez-Benavides et al 2007

Lopez-Benavides et al 2010

McDougall 1998

McDougall S (2010) Controlling mastitis in pasture based systems Proceedings of the 3rd AVA/NZVA Pan Pacific Veterinary Conference, Brisbane, Australia PC33.2

McDougall et al 2010

Milne et al 2005

Petrovski et al 2009

Runciman et al 2008

Tamilselvam et al 2006

Zadoks et al 2001

Zadoks 2007

Zadocks et al 2009