Managing drying-off: What’s new?

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The SmartSAMM team has reviewed the literature about managing cows at the end of lactation. This review has been incorporated into Technote 14 which has been reproduced as the body of this paper.

The key messages from this Technote include:

- Cows have improved production in the subsequent lactation where the dry period is at least six weeks in duration
- The formation of a teat plug is key in reducing the risk of new infection over the dry period. However, not all cows form a teat plug and hence are at increased risk of new infection over the non-lactating period.
- The new infection rate over the dry period is often high under New Zealand management systems, particularly due to environmental bacteria such as Streptococcus uberis.
- Intramammary treatments at the end of the lactation are designed to
  - Cure existing infection
  - Reduce the risk of new infections
- Antibiotics (‘dry cow therapy’; DCT) infused into the mammary gland at the end of lactation results in extended periods in which the antibiotics concentrations are greater than the minimum inhibitory concentration (MIC) which results in improved cure rates compared with therapy during lactation. Thus for chronic infections, particularly those associated with Staphylococcus aureus, antibiotic DCT is an important tool in treatment. Antibiotic DCT will also reduce the new infection rate over the dry period for that period that the antibiotic remains above the MIC.
- Internal teat sealants (ITS) infused into the teat canal at drying off reduce the new infection rate over the dry period and where used in conjunction with antibiotic DCT will result in periods of reduced risk of new intramammary infection beyond the time when the antibiotic DCT is effective.
- SmartSAMM recommends that ALL cows are protected against new infection by treatment with either antibiotic DCT, ITS or both.
- Decisions about the optimal approach for any one herd should be made by the herdowner and veterinarian having considered all available data. The data should be used to assess the herd level prevalence of major pathogen infections, the rate of spread of infection during lactation and the risk of new infection over the dry period.
- Herds may be classified as having a high risk of cow-to-cow transmission of infection and hence likely a high prevalence of contagious mastitis pathogens (such as Staph. aureus), a high risk of new infection at drying off, over the dry period or around calving, or both.
- Once an assessment of the herd level situation has been undertaken, decisions can be made about the use of specific treatment for specific cows within the herd.
- In herds with a likely high prevalence of major contagious pathogens (e.g. Staph. aureus), infusing each gland of each cow with antibiotics may be the optimal decision (‘Whole Herd DCT’).
- Where there is high rate of new intramammary infection over the dry period (e.g. where there is a high incidence of clinical mastitis over the dry period or immediately following calving) use of ITS in cows may be considered.
• In some herds both a high prevalence of contagious mastitis and a high risk of new infection over the dry period (particularly where the dry period is long) may be present and a combination of both DCT and ITS may be optimal.

• The optimal biological and economic decisions at herd and cow level have yet to be determined and hence the outlined approach is intended as a guideline only.

• A ‘matrix’ to help guide selection of DCT and/or ITS is outlined in Table 1 below:

<table>
<thead>
<tr>
<th>Cow status</th>
<th>Risk of contagious mastitis Staph. aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Risk of environmental mastitis Strep. uberis</td>
<td>ITS</td>
</tr>
<tr>
<td>Low</td>
<td>Uninfected cows ¹</td>
</tr>
<tr>
<td></td>
<td>Infected cows ²</td>
</tr>
<tr>
<td>High</td>
<td>Uninfected cows ¹</td>
</tr>
<tr>
<td></td>
<td>Infected cows ²</td>
</tr>
</tbody>
</table>

¹Individual cow SCC <150 at 3 or more herd tests in lactation and no clinical mastitis
²Individual cow SCC >150 at 1 or more herd tests in lactation and/or clinical mastitis in previous dry period or lactation

Table 1. Matrix for selecting a herd approach to antibiotic Dry Cow Treatment (DCT) and/or Internal Teat Sealant (ITS) based on future risk of mastitis caused by cow-associated (contagious) bacteria and/or by environmental bacteria

The presentation will review the practical considerations when advising farmers on their most appropriate herd approach to dry cow products.
At the end of lactation, dairy cows require a dry period that is sufficiently long to allow the udder tissue to repair and rejuvenate.

Alveolar cells, the cells that synthesise milk, collapse and the number of active alveolar cells declines to a minimum during the early dry period (Capuco et al 1997; Wilde et al 1997). New secretory tissue is laid down when cows start to ‘freshen’ ready for calving, so that the total amount of secretory tissue increases from one lactation to the next.

A minimum of six weeks (and preferably eight weeks) is recommended between drying-off and calving for regeneration of udder tissue. If cows are not dried-off at all, the next lactation yield may be as much as 25-30% lower (Bachman and Schairer 2003).

Another physiological change, which occurs at the start of the drying-off period and is critical for preventing new infections over the remainder of the dry period, is the closure of the teat canal with a keratin plug made from the cells lining the teat canal (Williamson et al 1995; Dingwell et al 2004). More than 20% of quarters do not have a teat plug by 6 weeks after drying-off.

Antibiotic dry cow therapy (DCT) increases the proportion of closed teat canals in the first four weeks of the dry period than untreated quarters (Williamson et al 1995). This implies that antibiotic DCT facilitates physical sealing of the canal although no mechanism has been established.

Factors such as the presence of teat end cracking, the level of milk production before dry off (Dingwill et al 2004) or milk flow rate before dry off (Summers et al 2004) have been associated with delayed closure of the teat canal after drying off.
14.1

Calculate drying-off dates to ensure that all cows get at least six weeks (preferably eight weeks) dry period.

The length of the dry period impacts on the daily milk yield achieved the following lactation. Dias and Allaire (1982) found that age, inter-calving interval, and milk yield prior to drying-off influenced the dry period required to maximise yields in the subsequent lactation. They believed that to achieve optimal yields, younger cows needed longer dry periods than older cows, and cows producing more milk required longer dry periods than their herd mates.

Since then, Bachman and Schairer (2003) reviewed 18 studies of the impact of dry period length on milk production and concluded that the best production in the subsequent lactation was obtained for 40-60 d dry periods. In a controlled experiment, Church et al (2008) reported that cows with short dry periods (30 d) experienced a slight production loss compared to cows with a 60 d dry period, but showed no difference when compared to cows assigned a 45 d period. No differences in udder health were observed between the three treatments.

In New Zealand most cows will have a dry period that is longer than 60 d, but in some herds that operate split calving, keeping track of individual cow dry periods becomes more difficult. Care should be taken to ensure that all cows experience a dry period of at least 6-8 weeks (42-56 days).

It is also important to know the length of the dry period to ensure selection of an antibiotic DCT that minimises the risk of antibiotics in milk in the next lactation.

14.2

Dry off high SCC cows early to help lower bulk milk SCC.

14.3

Collect data to assess herd level of mastitis.

Selection of the most appropriate dry cow strategy for a herd is greatly assisted by knowledge of the bacteria most likely to be causing mastitis in the herd. Ideally bacterial culture results from early lactation clinical cases should be available to help make this assessment.

In the absence of culture results, bulk milk SCC data, clinical mastitis records and herd test SCC results (minimum of 3 tests in the current lactation) can be used to make a judgement call, by the herd veterinarian in consultation with the herd manager, during the annual milk quality review.
14.4

Plan to use appropriate treatment or prevention for all cows in the herd.

Antibiotic DCT is used to:

1. Treat existing infections that have not been cured during lactation. Formulation of antibiotic DCT is designed to ensure that antibiotic concentrations remain above the minimum inhibitory concentration for many weeks, maximising the chance of cure.

2. Reduce the number of new infections that may occur during the dry period. Antibiotic DCT protects udders from new infections in the dry period, directly through the effect of the antibiotic and indirectly by promoting the formation of a natural keratin plug that seals the teat canal (Williamson et al 1995).

Internal teat sealant (ITS) is used to:

1. Protect uninfected quarters from becoming infected during the dry period and developing subclinical and clinical mastitis at calving (Woolford et al 1998; Berry and Hillerton 2002).

2. Extend the period of protection when used in combination with antibiotic DCT. This is achieved by maintaining an effective teat seal in cows with a dry period longer than the period offered by DCT alone. This might be appropriate for cows with extended dry periods (i.e. beyond 8 weeks).

Internal Teat Sealants contain the non-antibiotic product, bismuth subnitrate. A number of ITS products are now available in NZ.

Benefits of antibiotic DCT and/or ITS

New infections often occur in the non-lactating (dry) period. Woolford et al (1998) found that about 13% of untreated glands were infected at calving compared to 2.3% protected by antibiotic DCT or 1.6% protected by a combination of antibiotic DCT and an ITS. McDougall (2010) observed that 9% of uninfected and untreated glands developed new intramammary infections over the dry period in pasture-grazed cows, compared to 2-2.5% protected by antibiotic DCT.

The benefits of the combination of antibiotic DCT and ITS have been shown in UK and Australian studies (Bradley et al 2010; Bradley et al 2011; Runciman et al 2010). It appears that cows with higher (i.e. ≥200,000 or ≥250,000 cells/ml) maximum SCC in the lactation preceding drying off, benefit more from the combination of antibiotic DCT and ITS than cows with a SCC of <200,000 or <250,000 cells/ml.

Selecting a herd approach

The most appropriate strategy must be planned with a veterinarian. The SmartSAMM recommendation is to ensure that all cows are protected by some form of treatment during the dry period. This will likely include use of antibiotics in high SCC cows, with cows with lower SCC being treated with antibiotic DCT or ITS.
Approaches include:

1. Whole Herd DCT
All cows in the herd are treated with an intramammary antibiotic formulated for use at drying off. Products vary in the period of time that they maintain antibiotic concentrations above the minimum inhibitory concentrations, and hence have different withholding periods. The predicted length of the dry period for individual cows needs to be taken into consideration when selecting the most appropriate product(s). This approach was known previously as Blanket DCT.

2. Part herd DCT
A proportion of the herd (cows considered “at risk” of infection) is treated with antibiotic DCT and the remainder are protected with an ITS. This approach is similar to Selective DCT treatment.

Cows considered “at risk” and requiring antibiotic DCT include:

- Cows treated for clinical mastitis in their last dry period and/or during the current lactation.
- Cows with 1 or more individual cow SCC (ICSCC) >150,000 cells/mL in the current lactation.
- Heifers with 1 or more ICSCC >120,000 cells/mL in the current lactation.
- Cows with no ICSCC or animal health treatment records.

3. Combination DCT and ITS
In some herds it may be advisable to use a combined approach on some or all of the cows. This involves treating individual cows with antibiotic DCT, followed immediately by an infusion of ITS. Cows or herds for which this option might be selected include:

- Cows with extended dry periods e.g. high SCC cows that are being dried off early to manage the bulk milk SCC, heifers dried off early to manage their body condition score.
- Herds with extended dry periods e.g. herds dried off early under drought conditions or to manage the bulk milk SCC.
- Herds with a high prevalence of contagious mastitis, together with a high risk of environmental mastitis around calving.

Matrix Approach
This step-wise approach provides a guide for advisors to select a herd approach to DCT, ITS or combination of the two.

Step 1: At the herd level, assess whether there is likely to be a high prevalence of mastitis by cow-associated bacteria i.e. Staph. aureus (and hence to treat all cows with antibiotic DCT irrespective of SCC at herd test). Criteria used to identify a herd with a high risk are listed in Table 1.

Step 2: At the herd level, assess whether there is a high risk of mastitis by environmental bacteria over the dry period and at calving (and hence to treat all cows with ITS), or both. Criteria used to identify a herd with a high risk are listed in Table 1.

Step 3: Use the Matrix (Table 2) to categorise the herd and select most
appropriate approach. Some herds may require a combination of antibiotic DCT and ITS where there is a high prevalence of *Staph. aureus* mastitis and a high risk of environmental infection over the dry period.

**Table 1. Criteria to assess whether a herd has a high risk of mastitis caused by cow-associated (contagious) bacteria and/or by environmental bacteria**

<table>
<thead>
<tr>
<th>Herd with high risk of mastitis by cow-associated bacteria e.g. <em>Staph. aureus</em></th>
<th>Herd with high risk of mastitis by environmental bacteria e.g. <em>Strep. uberis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bulk milk SCC</strong></td>
<td>Seasonal average above 200,000 cells/mL</td>
</tr>
<tr>
<td><strong>Clinical Mastitis</strong></td>
<td>High rate of recurring clinicals (&gt;10% of cases)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subclinical Mastitis</strong></td>
<td>High proportion of cows with ICSCC between 150,000 to 2 million cells/mL</td>
</tr>
<tr>
<td><strong>Culture results</strong></td>
<td>Positive for <em>Staph. aureus</em></td>
</tr>
<tr>
<td><strong>Dry period risk</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Mastitis Focus report:</strong></td>
<td></td>
</tr>
<tr>
<td>Clinical case rate at calving – cows</td>
<td>-</td>
</tr>
<tr>
<td>Clinical case rate at calving - heifers</td>
<td>-</td>
</tr>
<tr>
<td>Dry period clinical case rate</td>
<td>-</td>
</tr>
<tr>
<td>Clinical case rate in lactation</td>
<td>&gt;1% per 100 cows in milk</td>
</tr>
<tr>
<td>Clinical treatment failure</td>
<td>&gt;10% cases require retreating</td>
</tr>
</tbody>
</table>

**Table 2. Matrix for selecting a herd approach to antibiotic Dry Cow Treatment (DCT) and/or Internal Teat Sealant (ITS) based on future risk of mastitis caused by cow-associated (contagious) bacteria and/or by environmental bacteria**

<table>
<thead>
<tr>
<th>Cow status</th>
<th>Risk of mastitis by cow-associated bacteria e.g. <em>Staph. aureus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ITS</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td></td>
</tr>
<tr>
<td>Uninfected cows(^1)</td>
<td>ITS</td>
</tr>
<tr>
<td>Infected cows(^2)</td>
<td>DCT</td>
</tr>
<tr>
<td>Uninfected cows(^1)</td>
<td>ITS</td>
</tr>
<tr>
<td>Infected cows(^2)</td>
<td>DCT+ITS</td>
</tr>
</tbody>
</table>

\(^1\) Individual cow SCC <150 at 3 or more herd tests in lactation and no clinical mastitis

\(^2\) Individual cow SCC >150 at 1 or more herd tests in lactation and/or clinical mastitis in previous dry period or lactation.

**Important points for advisors**

When selecting an appropriate dry cow strategy for an individual herd, these factors should be considered:

- History of DCT and/or ITS usage over the past 12 months.
- Incidence of clinical mastitis in previous dry period and at calving.
- Incidence of clinical mastitis through the current lactation.
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- Average bulk milk SCC during the current lactation.
- Individual cow SCC, including number and timing of tests.
- Presence of cow-associated pathogens in herd (i.e. Strep. agalactiae, Staph. aureus).
- Management considerations: e.g. grazing off of dry cows, availability of yards to check for clinical cases for first 4-6 weeks after dry off, and economic considerations.

When selecting the most appropriate antibiotic DCT product, these factors should be considered:

- Predicted length of the dry period.
- Likely pathogens causing mastitis in the herd.
- Likely risk of new infections occurring in the dry period and at calving.
- Management of the risk of residue violations in meat and milk.
- Economics of missing infected cows or treating uninfected cows.

Important reminders for farmers

When planning for use of dry cow products, farmers are advised to:

- Plan to treat all quarters of infected cows when treating with antibiotic DCT. Restricting treatment to only those quarters that are infected results in a higher new infection rate than if DCT is given to all quarters (11.3% of quarters compared to 0.8% of quarters, Williamson et al 1995).
- If using Part Herd DCT, plan to treat all quarters of all cows with any ICSCC above 150,000 cells/mL (heifers, above 120,000 cells/mL) during the current lactation, and all cows and heifers that had clinical mastitis at any time during the current lactation (Woolford et al 1995).
- Ensure that the team infusing the antibiotic DCT or ITS have been appropriately trained. Antibiotic DCT and ITS products do not protect against some environmental bacteria (such as Pseudomonas) that may be introduced into the udder due to poor hygiene during infusion of intramammary infusions (Radostits et al 1994). Thorough aseptic preparation of the teats is especially important before infusing ITS.

Protection against Strep. uberis mastitis – a review

Strep. uberis is ubiquitous in the environment and the cow is most at risk of infection as she transitions from a lactating to dry status, and from dry to lactating. Secretions from the mammary glands of cows that have been dry for 1 to 6 weeks can easily support the growth of Strep. uberis (Cousins et al 1980).

Infection frequently occurs in the first two weeks of the dry period (Parkinson et al 2000; Summers et al 2004; Tucker et al 2009), in the last 2 weeks of the dry period (Green et al 2005) and during the calving period and early lactation (Woolford et al 1998; Zadoks et al 2003).

Strep uberis is often the most common bacteria isolated from cases of...
clinical mastitis in lactation (32% of quarter cases; McDougall et al 2007) or can be equally as common as *Staph. aureus* (Petrovski et al 2009). *Strep uberis* is also the most common pathogen isolated in the early dry period (Woolford et al 1998; Berry and Hillerton 2002).

**Antibiotic Dry Cow Treatment**

During the early 1990s, the prime focus of DCT strategies in NZ was selective therapy, based on the recommendations of the SAMM Plan (Woolford et al 1995), with the main aim of curing existing infections. In the mid 1990s, Williamson et al (1995) demonstrated that the use of antibiotic DCT protected treated cows against new infections with *Strep. uberis* during the dry period, significantly reducing the incidence of mastitis both in the dry period and after calving.

A more recent NZ study (McDougall 2010) has corroborated the efficacy of antibiotic DCT in reducing new infection rate over the dry period. In this study, 55% of low SCC cows (i.e. ICSCC <150,000 cell/ml and no clinical mastitis history), and 18% of quarters, that were left untreated developed a new intramammary infection over the dry period. In contrast cows treated with either of two cephalonium DCT products had an incidence of 16% and 13% respectively, at the cow level, and 4% and 4% respectively at the quarter level. The lower new infection rate was associated with lower SCC and a lower clinical mastitis incidence rate after calving.

**Internal Teat Sealants**

In the mid 1990’s researchers in NZ trialled a non-antimicrobial approach as an alternative to antibiotic DCT (Woolford et al 1998). This ITS product was composed of 4 grams of 65% w/w bismuth subnitrate in a paraffin base. When infused into the teat canal, the viscous paste sinks to the lower teat sinus and remains there, without hardening or setting, until removal by suckling calves or by manual stripping of the quarter.

Teat sealants protect cows that have open teat canals, and are therefore vulnerable to infection. This is especially important in the early dry period, before an intact keratin plug has formed in the teat canal, but may also provide protection at the end of the dry period, when udders start to swell and the teat canal may open up.

The product proved to be as effective as a long-acting antibiotic DCT in protecting cows from new *Strep. uberis* infections during the dry period and at calving. Local and overseas studies have continued to show that ITS are effective at protecting uninfected quarters from becoming infected in the dry period (Williamson 2001, Berry and Hillerton 2002, Huxley et al 2002). More recently, the protective effect of ITS for preventing *Strep. uberis* infections in first calving heifers, prior to their first calving, has also been convincingly demonstrated (Parker et al 2007, Parker et al 2008).

In all circumstances, good aseptic preparation of the teat end before infusion of an ITS is imperative, to avoid introducing highly pathogenic environmental bacteria into the udder. For this reason, ITS may not be recommended for some farm situations.

**Combination treatment**

For cows with one or more ICSCC records of >250,000 cells/ml and/or with a history of clinical mastitis in the preceding lactation, a combination of antibiotic DCT and an ITS increased the chance that the quarter would be
free from an intramammary infection at calving by 40% (Odds Ratio (OR) = 1.4) and reduced the risk of clinical mastitis in the first 100 days of lactation by nearly 70% (OR = 0.68; Bradley et al 2010).

Similarly, the incidence of clinical mastitis was reduced by nearly 40% at 30 days, and over 55% at 100 days after calving when an ITS was combined with an antibiotic DCT, compared to an antibiotic DCT only approach in an Australian study (Runciman et al 2010). A US-based study found a similar added efficacy of the “combination approach”, which resulted in a reduction of 30% for dry period new infections, and 33% fewer clinical mastitis cases in the first 2 months of the subsequent lactation, when compared with antibiotic DCT alone (Godden 2003). Studies in the UK have not shown such dramatic benefits of a combined approach (Bradley et al 2010; Bradley et al 2011).

14.5

Consult with your veterinarian to select the most appropriate antibiotic DCT for your herd.

Choosing the most appropriate antibiotic DCT for a herd depends on such factors as:

- spectrum of activity,
- likely cure rates,
- type of mastitis pathogen predominating in the herd,
- period of protection provided by different products,
- expected duration of the dry period for cows to be treated.

Cure rates following antibiotic DCT are greatly influenced by the bacteria causing the mastitis and how long the cow has been infected, and they vary a lot between herds. Generally, cure rates will be higher for Strep. uberis, Strep. dysgalactiae and Strep. agalactiae, and lower and more variable for Staph. aureus. Cure rates of 92% to 100% were reported following treatment of Strep. agalactiae infections with cloxacillin or cephalonium (Sol and Sampimon 1995). Cure rates for Staph. aureus ranged from 41% to 84% and tended to be lower in older cows (Ziv et al 1981).

A recent meta-analysis found that the relative risk (RR) of bacteriological cure following antibiotic DCT, compared to no treatment, was 1.78 (95% CI 1.51-2.10) for all pathogens, 1.65 (95% CI 1.38-1.96) for Staphylococcus spp. and 1.86 (95% CI 1.48-2.35) for Streptococcus spp. (Halasa et al 2009). In the same study no difference was found between cloxacillin compared to non-cloxacillin dry cow antibiotics (RR = 1.00 (95% CI = 0.96-1.06).

Cure rates of 79% for Staph. aureus, 78% for Strep. uberis and 88% of minor pathogens were reported in one NZ study (Williamson et al 1995). In a study using cephalonium products (McDougall 2010), the cure rate for all pathogens was 90% but cure rates were lower and varied across herds (60-75%) for Staph. aureus infections. Cure rates also varied with:

- Cow age, with cure rates of 95%, 90%, 91% and 85% observed for ≤4, 5, 6 and 7, and ≥8-year-olds, respectively.
• Increasing length of the dry period, with cure rates declining at 0.6%/week (McDougall et al 2010).

There is no data on cure rates for shorter versus longer acting products (Halasa 2009). However, Bradley et al (2010) hypothesised that broad spectrum, longer acting products, such as cefquinome (a 4th generation cephalosporin) may provide superior protection against new infections, compared to a narrow spectrum, shorter-acting, cloxacillin product. When used in combination with a teat sealant, the effect of a cloxacillin product was found to be similar to a broad spectrum product (Newton et al 2008).

When tested in a later study (Bradley et al 2011), cure rates for major pathogen infections were found to be similar across treatment groups, but protection against new infections by Strep. uberis and other environmental bacteria was superior for groups treated with a broad spectrum product, or combination of cloxacillin DCT and ITS, compared to cows receiving cloxacillin DCT only.

The consequences of not treating a previously infected gland are minimal, but no bacteriological cure is likely to occur. Self-cure rates during the dry period are generally low. A decision tree analysis in the UK (Berry et al 2004) found that cows with infected quarters incurred economic losses if left untreated or treated with an ITS. In that study, a prophylactic approach for uninfected cows was also found to be more economically favourable than leaving quarters untreated. However the model was highly sensitive to the scale of the milk yield losses incurred for cows that developed new infections over the dry period or at calving.

14.6 Purchase and store the antibiotic DCT and ITS you will need at drying-off.

Farmers planning to administer DCT and ITS are advised to obtain their supplies (intramammary tubes, materials for teat sanitising etc.) well ahead of the drying off date. Advisers should emphasise the importance of correctly storing antibiotics, as specified on the label, for efficacy and safety reasons in accordance with the Dairy Producing Code 2 (DPC2; NZFSA 2009)

It is important to discourage storage of antibiotic DCT near tubes of Lactating Cow antibiotic tubes. This reduces the risk of accidentally administering antibiotic DCT to lactating cows – which can be a very expensive mistake in terms of antibiotic violations and costs associated with withholding milk from the vat.

It is important that only new and previously unopened packages of teat wipes are used for sanitising teats prior to administering intramammary products, to ensure their efficacy. Teat wipes are only effective if they retain a high alcohol content, which can evaporate and dry out of the wipes are stored incorrectly. Failure to properly sanitise the teat ends before intramammary infusions may result in severe or fatal cases of clinical mastitis, due to the introduction of pathogenic bacteria from the teat end or from contaminated teat wipes.

Under cold conditions, warming of intramammary products prior to use may

Technote 4.11 describes typical antibiotic residue violations associated with DCTs.
reduce their viscosity and improve their usability. This is best done by using a ‘water-bath’ technique, where the product is kept in its original plastic container, and floated in a larger bucket filled with hot water for a period of time to warm the product through. An alternative approach to heating tubes is to place a hot water bottle in the midst of the tubes.

It is vital that individual treatment tubes are kept dry at all times and should never be placed directly in water. Failure to keep the tubes dry can lead to catastrophic outbreaks of clinical mastitis within a few days of treatment.

Acknowledgements

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Key papers


Halasa T, Nielsen M, Whist AC, Østerás O. Meta-analysis of dry cow management for dairy
McDougall S. A randomised, non-inferiority trial of a new cephalonium dry-cow therapy. NZ Vet. J. 2010; 58: 45-58
Zadoks RN, Gillespie BE, Barkema HW, Sampinion OC, Oliver SP, Schukken YH. Clinical, epidemiological and molecular characteristics of Streptococcus uberis infections in dairy herds. Epidemiology and Infection. 2003; 130:335-49.