Technote 3

Managing withholding periods, residues and milk quality at calving

In this technote:

For milk quality reasons, and to manage residues from products used at dry-off, colostrum from all cows must be withheld from the vat for the first eight milkings after calving. First-lactation heifers may have higher levels of colostrum for longer so their milk may need extended withholding (10 milkings). Screening cows on their 4th day after calving using the Rapid Mastitis Test (**RMT**) helps identify animals that could elevate the bulk milk SCC (**BMSCC**) and increase risk of grading.

Withholding periods for milk, cull cow and calf meat need to be observed for cows that receive antibiotic Dry Cow Treatment (**DCT**). Withholding periods for milk (96 hours or eight milkings) also need to be observed for cows that receive Internal Teat Sealants (**ITS**). Each quarter treated with ITS should be foremilk stripped for 10-12 strips to remove residual teat sealant, although flecks of teat sealant may continue to be excreted for the next few days (Kabera *et al* 2018; Swinkels *et al* 2024).

① Dry cow therapy: Withholding periods and residue management

Products at dry-off

Antibiotic DCT are antibiotic preparations infused into each quarter of an udder immediately after the final milking of lactation. They are formulated to maintain concentrations above the minimum inhibitory concentration for mastitis bacteria for 30-50 days, depending on the product used.

➜ **Technote 14** describes the process for deciding the most appropriate dry cow strategy for an individual herd.

Internal Teat Sealants are non-antibiotic preparations that contain bismuth subnitrate and can be infused after the last milking, either alone, or after a tube of antibiotic DCT. Sealant formulations are designed to remain in the teat sinus for the entire dry period, acting as a physical and chemical barrier to bacterial entry through the teat canal. They remain soft and pliable within the udder and are removed naturally by the calf or by manual stripping after calving. Approximately 10-12 hand-strips are recommended to remove the product, before the first machine milking.

Withholding periods

Withholding periods refer to the *minimum* period of time that must elapse between the last treatment of an animal with a veterinary medicine and the supply of products (meat or milk) from those animals for food consumption, and are set following regulatory confirmation of the time required to comply with relevant New Zealand Maximum Residue Levels (**MRL**). The length of time that meat must be withheld is usually longer than the withholding period for milk.

When using antibiotic DCT, there are two principles relating to withholding milk that must be well understood:

1. All antibiotic DCT products are registered with a specified Minimum Dry Period after treatment, also referred to as the pre-natal treatment interval or **PNTI**. This is the withholding period that must elapse before products can be supplied for food consumption. Ideally, this would occur before the cow calves.
2. As well as the PNTI, all antibiotic DCT and ITS products have a recommended withholding period or **WHP** for milk. This is the time that must elapse after calving (rather than after treatment), before milk is supplied for processing. This is usually 8 milkings.

Milk withholding periods:

Withholding periods on the label will take the form of: PNTI + post-calving withholding period, e.g. "49 days + 8 milkings". If a cow calves before the PNTI elapses, the milk must be withheld until the entire PNTI period has elapsed plus the full 8 milkings.

Cull cow meat withholding period:

The withholding period for meat applies from the date that the cow is treated with an antibiotic DCT.

Bobby calf meat withholding period:

The likelihood of antibiotic residue in bobby calf meat depends on (1) the absorption of antibiotic from the mother's bloodstream (Rangel-Lugo *et al* 1998) and (2) the intake of antibiotic from colostrum. Limited information is available on antibiotic residues in calves born to cows given antibiotic DCT.

To minimise the risk of antibiotic residues being detected in bobby calves, a conservative approach is recommended:

- **For calves born after the PNTI has elapsed**, calves are likely to contain only traces of antibiotic, sourced from the dam's bloodstream or from suckled colostrum, so no meat withholding period is specified, although at least four days must elapse between their birth and slaughter for animal welfare regulations.
- **Calves born before the PNTI has elapsed**, and have NOT been fed milk or colostrum or suckled from the treated cow, are subject to the same meat withholding period stated on the label for the cow. The withholding period starts from the

date that the cow was treated, and the calf has to be held until this period has elapsed.

- **Calves that have consumed milk or colostrum** from a treated cow that calved within the PNTI must not be processed as bobby calves. Because calf residues in this situation would be unknown, the default meat withholding period of 91 days would apply.

➜ See the DairyNZ website for more information on feeding **colostrum** to calves.

Remember:

- If cows calve early or a decision to cull them during the dry period is made, the date of treatment and the withholding period of the particular product must be known.
- Recommended withholding periods for milk and calf meat are longer if cows calve before expiry of the PNTI.
- Ensure that the 'dry cow' paddock is well away from the milking herd so that cows given DCT or ITS cannot accidently re-join the milking herd.
- If there is any possibility that milk may contain antibiotic residue, it should be withheld from the vat.
- Ensure all treatments given at dry-off or to dry cows have been recorded.

When antibiotic DCT products are used according to directions on the label and the appropriate PNTI and withholding periods are observed, antibiotic residues will not exceed the New Zealand MRLs, set by the Ministry for Primary Industries (MPI). Each product has its own specified withholding period.

➜ Recommended withholding periods for dry cow products are updated regularly and released annually to vets via the Index of Veterinary Specialities (IVS) and are available **on the MPI website**.

Management of Inhibitory Substance grades

Every dairy processor has to manage the risk of antibiotic residues occurring in bulk milk, resulting in an inhibitory substance or "IS" grade. Increased stringency of testing (e.g. testing each tanker load of milk before it is added to the factory silo and testing of each consignment at herd level through high-risk periods of the year) has reduced some of these risks. However, good on-farm risk management procedures remain the most critical control point for minimising the risk of antibiotics in milk.

Note that early lactation is a key risk time for inhibitory substance grades due to the high incidence of clinical mastitis. To minimise the risk of antibiotics reaching the vat:

- Mark the cow, record her details, and physically separate her from those in supply before treating her with antibiotics (i.e. follow 'MRS T').
- Milk antibiotic-treated cows last and ensure thorough hot washing of the plant following milking.
- Ensure that the withholding period is met before returning the cow to supply.
- Be aware of changes in milking frequency (e.g. once a day milking) or completeness of milking out (e.g. partial milk out of cows with milk fever), which can potentially alter antibiotic removal. Avoid partial milking out unless clinically necessary.
- Avoid use of antibiotics 'off label' (e.g. a frequency, duration, or dose which is not on the label) unless there is no other alternative. Veterinarians and herd owners who choose to go 'off label' are taking responsibility for management of residues upon themselves and require appropriate documentation to support this.

Advisers should check the MPI website for up-to-date information on the maximum residue limit (MRL) for dry cow products.

Where IS grades occur, the processor will require an audit of the on-farm practices. Usually this is undertaken by a contract service provider

(e.g. QCONZ for Fonterra) and the herd veterinarian is encouraged to attend. The herd owner can become distressed as the cause is not immediately apparent. A thorough investigation by an external party will usually help pinpoint the cause of the system breakdown. See Beal (2002) or McDougall *et al* (2004) for more on factors to investigate.

Common scenarios that lead to cows within the withholding period being milked into supply include:

- Failure to physically separate treated cows from the milking mob, so that they are milked separately.
- Failure to disconnect the main milking line from the vat before milking treated cows.
- Cows that have been treated with DCT jumping from the dry mob into the milking mob.
- Cows aborting or calving within the withholding period of the DCT.
- Changes in milking frequency during treatment (i.e. once a day milking).
- Administering DCT when cows have been non-lactating for some days.

Risk factors that have been associated with IS grading (Heuer *et al* 2003) include:

- Milking later into the calendar year
- Short (i.e. <60 day) dry periods for the herd
- Use of Whole Herd DCT rather than Part Herd DCT,
- More than 2 people administering dry cow products at dry-off
- Reduced culling of cows for mastitis
- More antibiotic tubes used in the dry period for treating clinical cases,
- Sale of colostrum
- Not marking colostrum cows
- Reported lower incidence of clinical mastitis during lactation.

➜ **Technote 4** describes detection and management of clinical mastitis in early lactation. **Technote 4.9** describes tests for antibiotic residues.

② Preventing colostrum and SCC grades in early lactation milk supply

Gold colostrum, from the first milking after calving, is a thick, yellow, and sticky substance that contains very high levels of blood proteins (predominantly immunoglobulin G1, **IgG_1**) to help protect newborn calves against disease.

Gold colostrum can have an IgG_1 concentration more than 100 times greater than normal milk, but the levels rapidly deplete with each milking (Lacy-Hulbert *et al* 1996), since the active transport of IgG_1 into the mammary gland ceases at calving (Baumrucker *et al* 2021). But this washout process takes a number of milkings to complete.

Colostrum also contains large numbers of white blood cells (somatic cells) that reflect the normal shift in mammary secretory function at this time, rather than mastitis. However, these cells can release high levels of enzymes that degrade milk fat and casein molecules, and therefore affect milk processability. If mastitis is present, much higher numbers of white blood cells will be secreted in the colostrum, and the IgG_1 concentration may not reduce (Maunsell *et al* 1998).

Elevated presence of somatic cells and IgG_1 in colostrum has a significant effect on processing efficiency of all dairy products (Tsioulpas *et al* 2007; McGrath *et al* 2016). Changes in product quality include:

- Butter – a darker colour, 'off' flavours and downgrading.
- Casein – decreases in yield due to changes in curd characteristics and poor setting.
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- Cheese – increases in setting times, poor set, decreases in yield due to lower casein levels, "off" flavours, shorter shelf life due to high moisture retention by globular proteins, and body defects.
- Condensed milk – graininess.
- Cottage cheese – agglutination of starter bacteria.
- Milk powders – increases in drying times due to high moisture retention in globular proteins, and difficulties in achieving a standard product.
- Pasteurised milk – cream plugs.
- UHT milk – shorter shelf life and deposits.
- Whey – poor crystallisation due to altered composition.

Significant cleaning problems are also associated with processing colostral milk in the factory. It requires more frequent and comprehensive cleaning of heat transfer surfaces, more down-time for dryers and evaporators, and greater use of cleaning chemicals. Reducing colostrum levels in milk has made significant improvements in processing milk to manufactured products.

Managing the risk of grading due to colostrum or SCC

Milk supplied to the factory in early lactation is tested on a per consignment basis for the presence of colostrum and SCC. Regulations set out in NZCP1 (MPI, 2024) require that milk is withheld for 8 milkings after calving.

You cannot assess milk quality by visual appraisal. It is more appropriate to withhold milk for the recommended number of milkings and to ensure that udders are being completely milked out.

Heifers

Immunoglobulin levels and SCC can take slightly longer (~24 h) to decline after calving for heifers compared to cows (Lacy-Hulbert *et al* 1996). For herds with a high proportion of heifers calving in the first few days of the calving period, it may be prudent to extend the withholding period for heifers by an extra 24 hours.

Infected cows

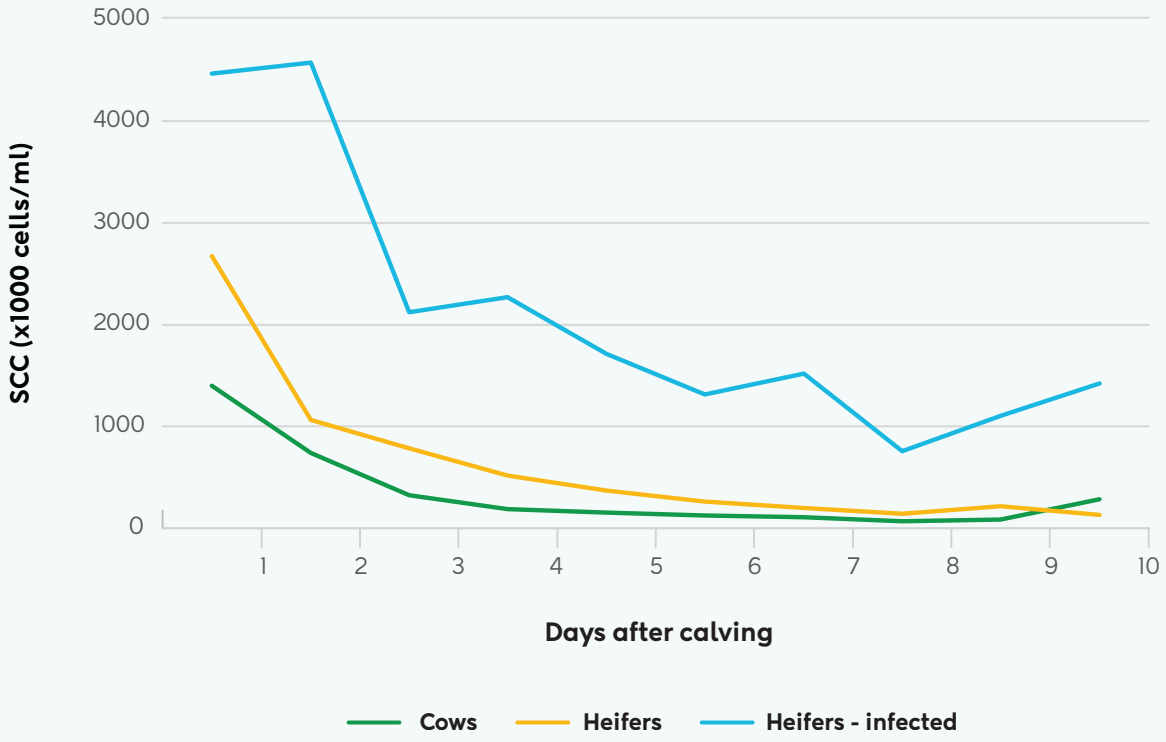
At the start of the season, when the number of cows producing milk for the vat is low (e.g. below 100 cows), cows with undetected clinical mastitis or subclinical mastitis can cause the BMSCC to increase dramatically. These increases may be sufficient to raise the BMSCC over the penalty threshold.

The SCC for cows with one or more infected glands in the colostrum period is much higher than for uninfected cows (Lacy-Hulbert 1997). Therefore, in addition to examining foremilk for signs of clinical mastitis, it is recommended that all cows are screened for subclinical mastitis using a Rapid Mastitis Test (RMT), on the last day before being transferred into the milking herd. If a positive reaction is found, milk from this cow can be withheld for a further 24-48 hours to reduce the risk of causing a BMSCC grade.

A RMT test at the 7th or 8th milking will indicate if the cow has a subclinical mastitis that may pose a SCC risk to the bulk milk.

➜ **Technote 4** describes detection of mastitis in newly calved cows.

Decline in SCC in milk for infected heifers compared to uninfected cows and heifers (Lacy-Hulbert 1997).



Milking Frequency

Many farmers now choose to milk less frequently than twice a day, for part or all of lactation, and for part or all of the herd (Eastwood *et al* 2022). This can mean that cows may be milked once a day (OAD) or three times in two days (3-in-2), from the day of calving.

Since colostrogenesis ceases at calving, the removal of IgG[1] from the udder follows an exponential curve over a few days. Williamson *et al* (2026) determined that IgG concentrations reached a constant value after approximately 80 kg of cumulative milk yield had occurred, irrespective of milking frequency. The shortest risk period for inclusion of milk into the bulk tank occurred at milking 8 (day 4) for cows milked twice daily, milking 7 (day 5) for cows milked 3-in-2 and milking 6 (day 6) for cows milked OAD.

However, to comply with regulatory requirements for supply of milk and dry cow product withholding periods (MPI, 2024), a post-calving withholding period of 4 days and 8 milkings should still be applied.

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