Controlling Mastitis on Organic Farms

Presented by Alan Thatcher

http://www.organicpastoral.co.nz/

Mastitis – what is it?

Inflammation of mammary gland

- **Clinical** - changes in milk and/or udder, almost always due to bacteria entering the udder through the teat canal

  Acute - sudden onset - redness, swelling, heat, pain and decreased function. Can result in a sick cow as bacteria and toxins cross into bloodstream

  Chronic - progressive development of fibrous tissue ± abscessation - can remain clinical or progress to subclinical

- **Subclinical** - means the milk and the udder seem normal. An infection may establish without clinical signs or it might be subsequent to a clinical episode

Causes of Mastitis (major pathogens)

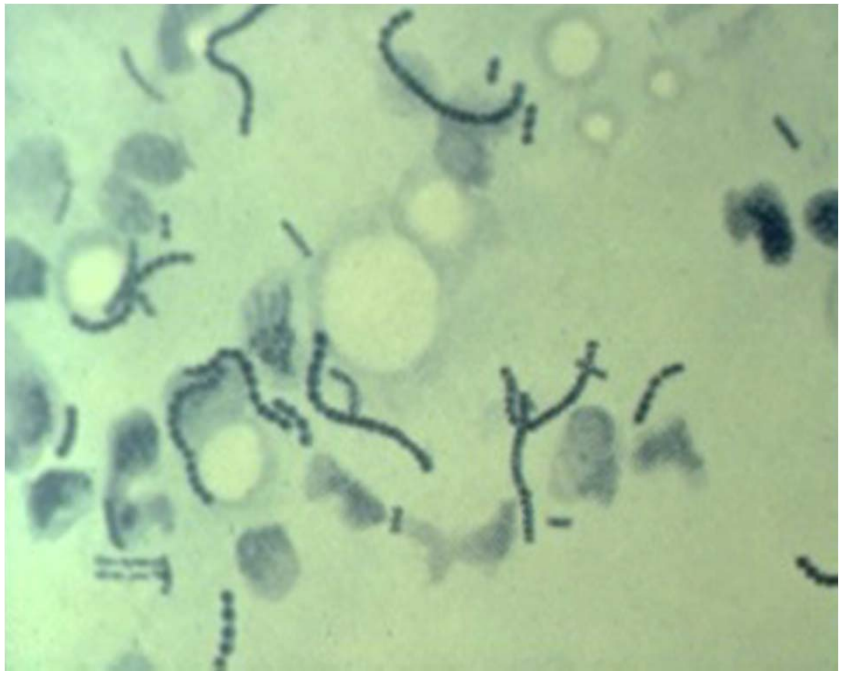
- Environmental mastitis
  - ***Streptococcus uberis* (very common)**
  - *Streptococcus dysgalactiae* (uncommon)
  - *E coli* - coliforms (uncommon)

- Contagious (cow associated) mastitis
  - ***Staphylococcus aureus* (very common)**
  - *Streptococcus agalactiae* (common)

Strep dysgalactiae can come out of the environment and then pass from cow to cow. In NZ this probably doesn't happen with *Strep uberis*

Streptococcus uberis

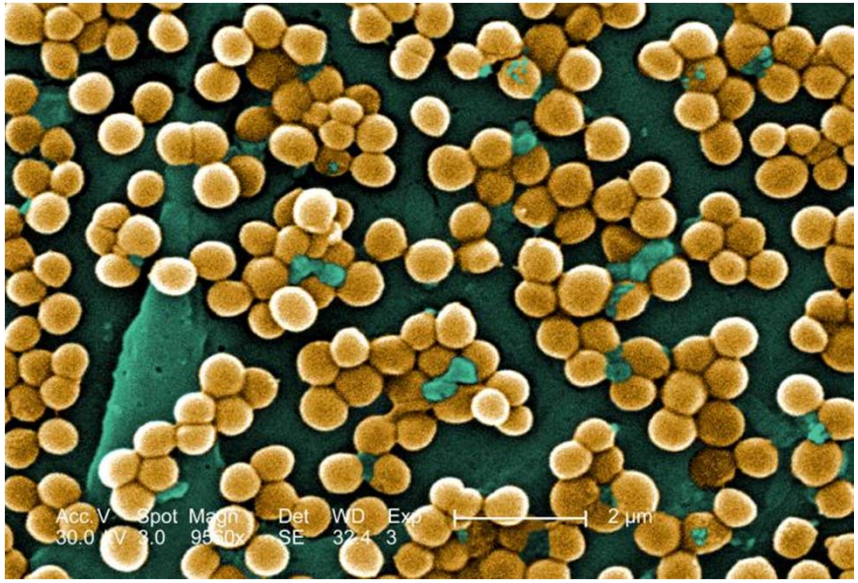
- The classic environmental bacterium
- Lives on the skin of some cows. Also retained cleanings, infected wounds but the main source is the **GUT**



MUD + MUCK = MASTITIS

Staphylococcus aureus

- lives inside udders or on teat skin – does not survive for long in the environment
- spread by passing infected milk from cow to cow at milking time, via contaminated cups (or hands)



Invasive strains of *Staph aureus* are often difficult to cure especially during lactation

Other organisms (minor pathogens)

- Although some organisms tend to produce only mild symptoms (if at all), they may still sometimes raise cell counts and often indicate a failure in mastitis control, eg:

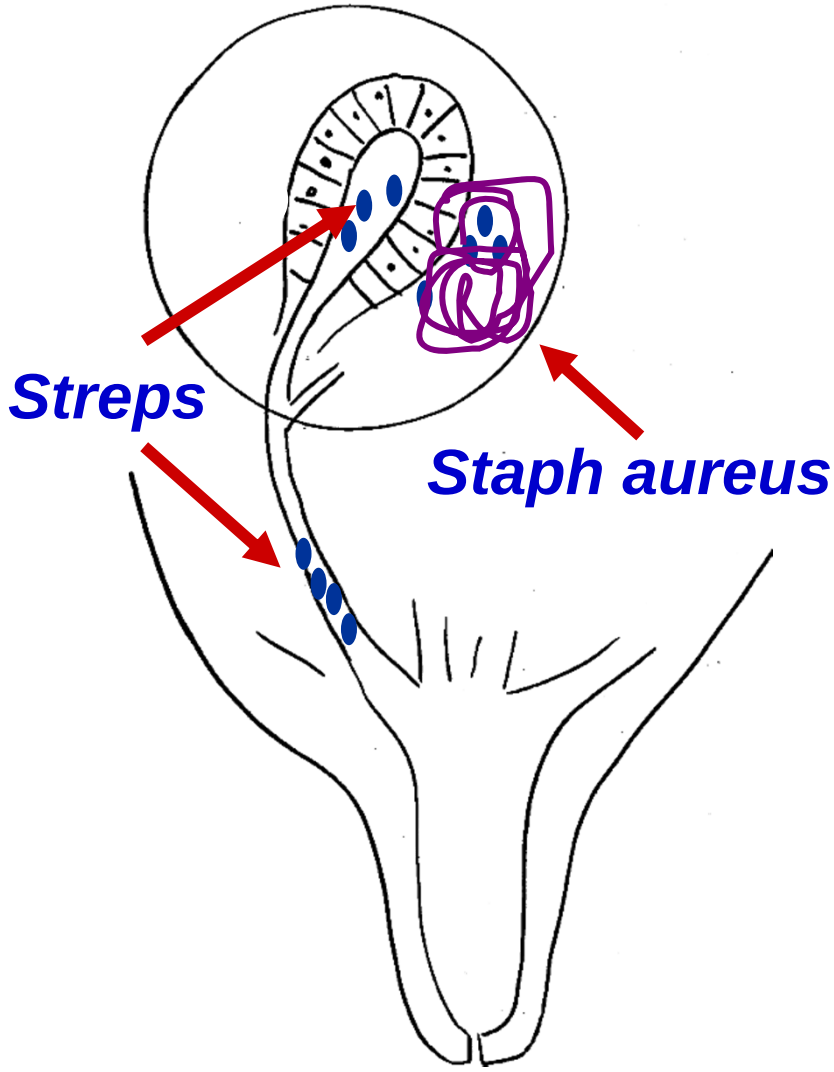
- CNS (coagulase negative staphylococci)
- *Corynebacterium bovis*

Staphs and Streps in the udder

Many strains of *Staph aureus* have the ability to:

- **invade through into the deep udder tissue**
- **prompt a severe reaction - may result in abscesses, permanent scarring and loss of secretory tissue, even if infection eliminated**

Most species and strains of Streps do not invade deeper tissues (but some strains of *Strep uberis* may). Clinical signs sometimes subtle - more 'normally' characterised by changes in milk rather than the udder



Why are invasive bacteria so difficult to get rid of?

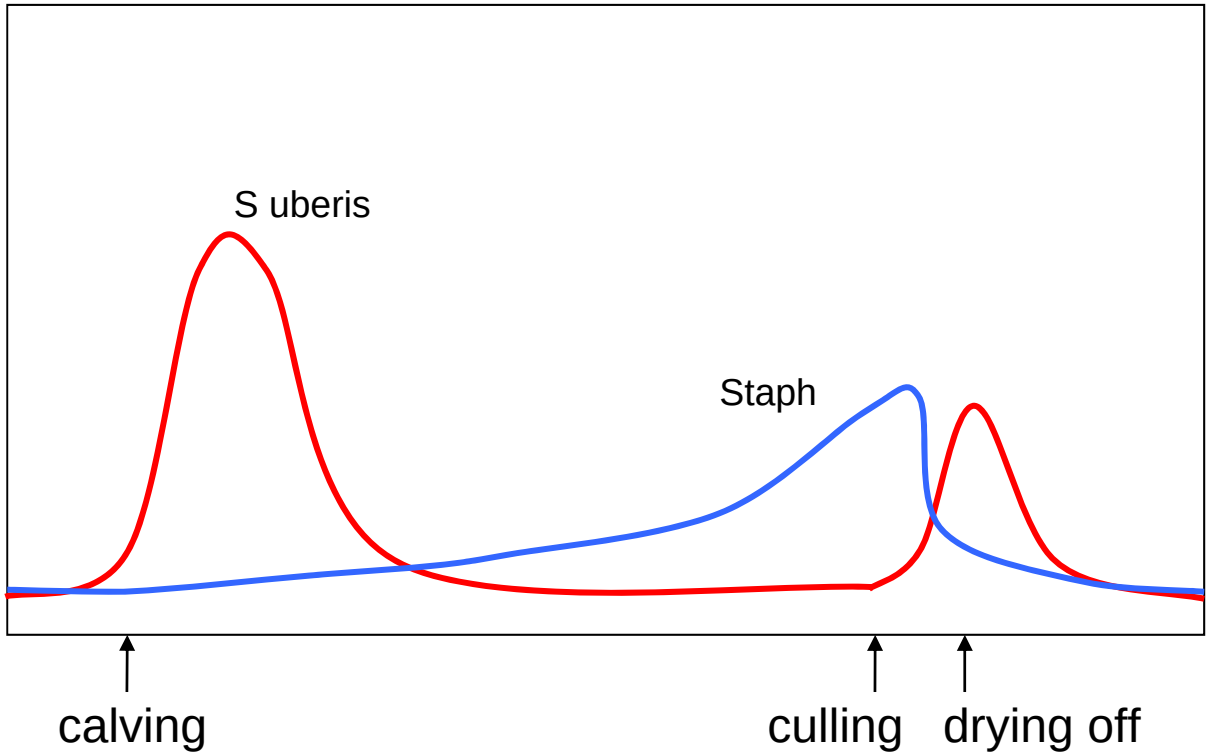
They've got a couple of tricks for staying out of harms way….

(1) Hide inside cells:

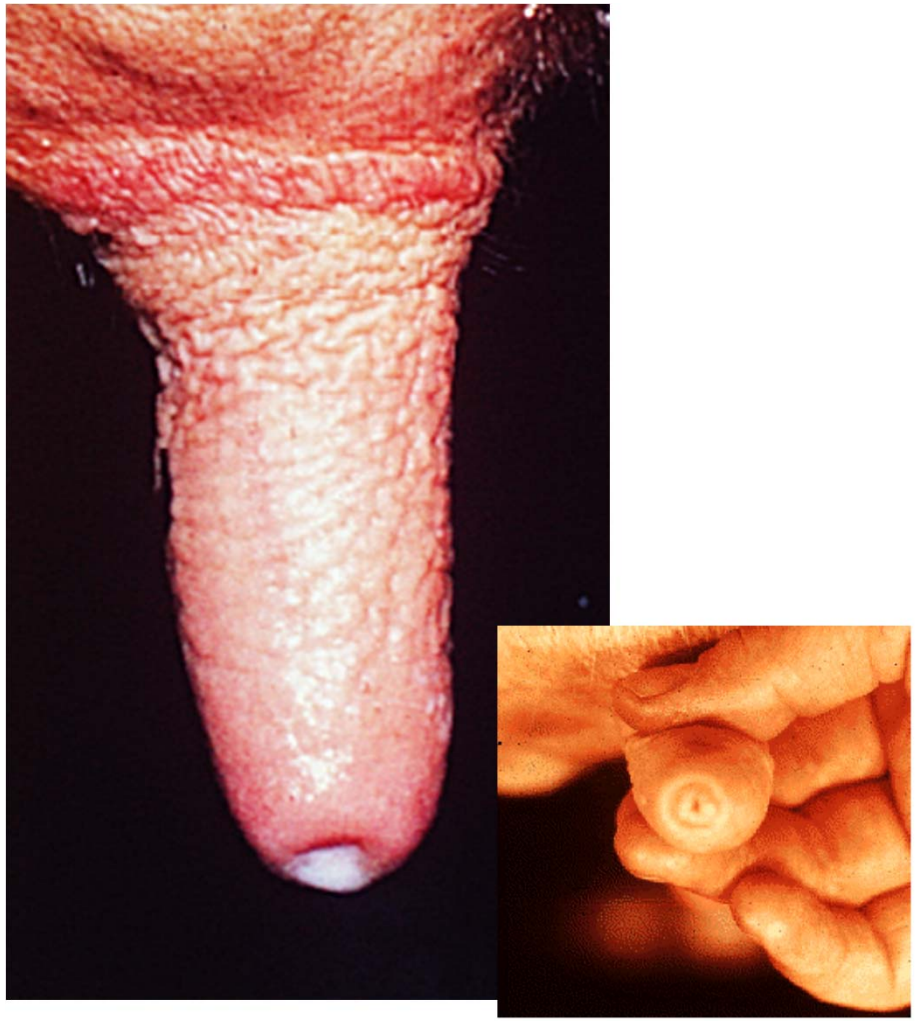
- *Staphs* → macrophages (a type of white blood cell which act as the clean-up crew). Every 2 or 3 days the macrophage dies and re-releases its load of *staphs*
- *Streps* → secretory cells

(2) Hide inside abscesses or walled off scar tissue
- may periodically migrate out

Typical seasonal incidence of infected quarters

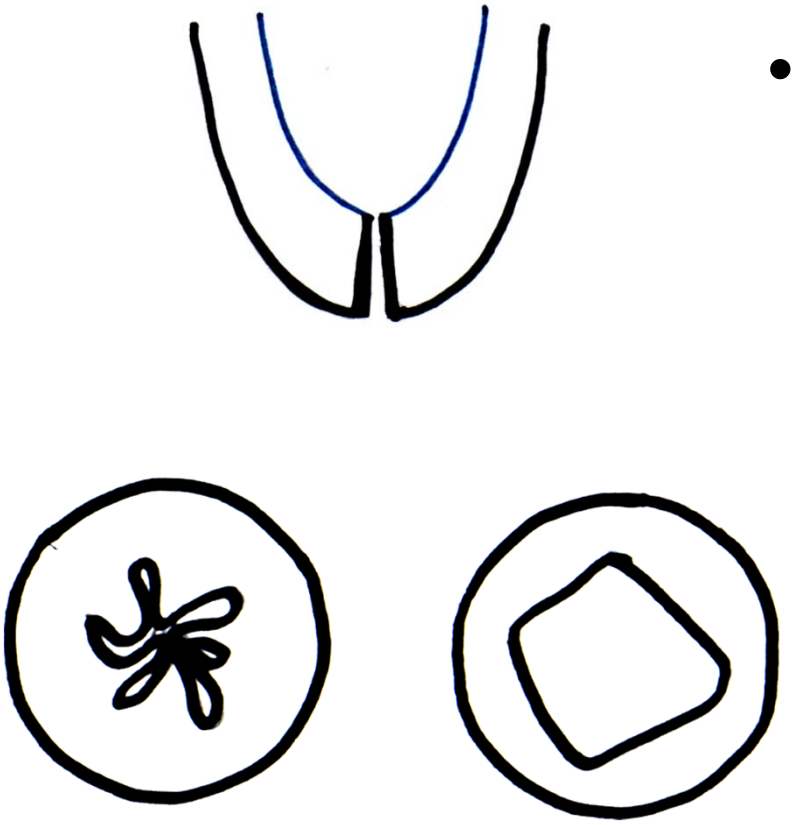


The teat - where it all happens



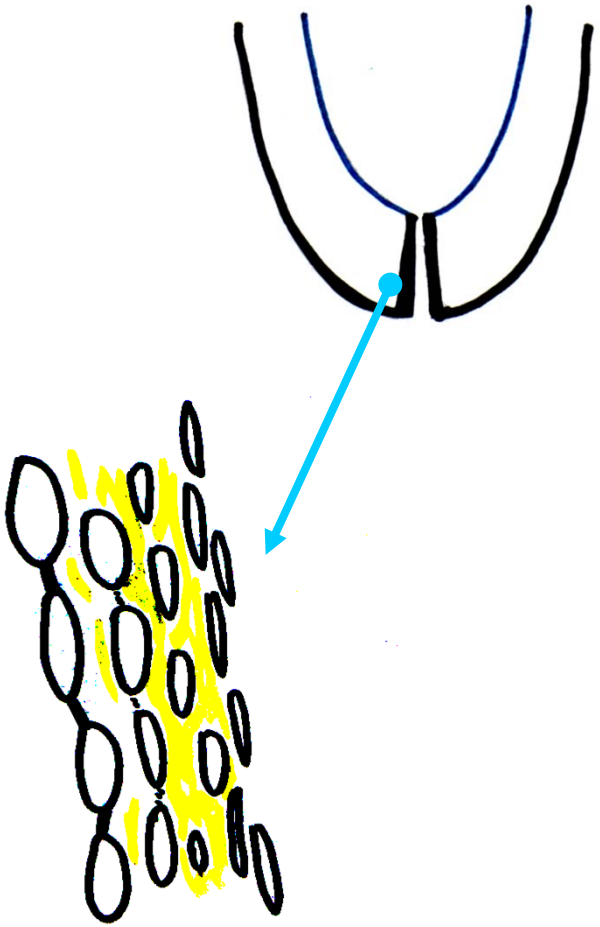
- teat skin
  - thick, firmly attached
  - **no glands**
- teat opening
- teat canal

Teat canal - very specialised skin



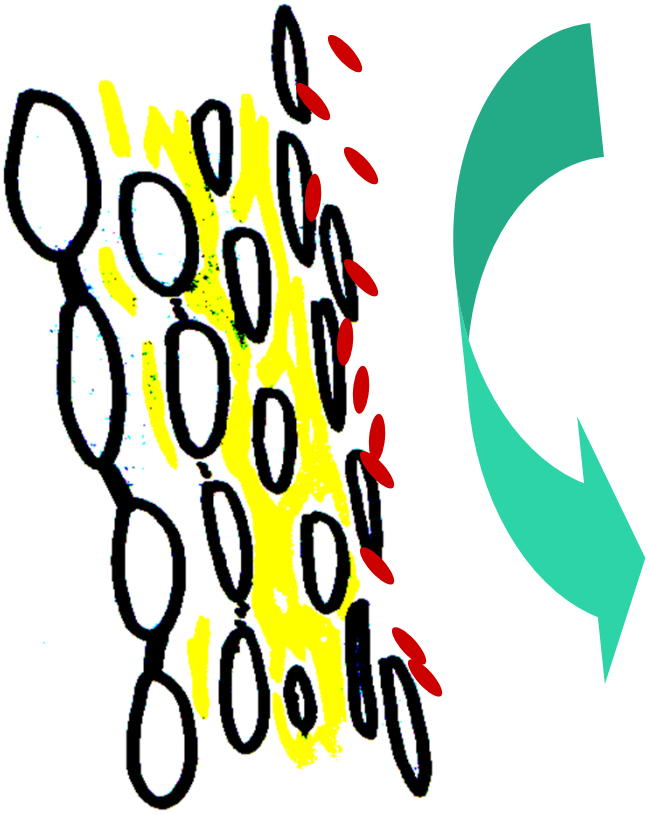
- teat canal
  - **small canal that is responsible for delivering milk so efficiently, and also providing the seal that forms a protective barrier**
  - continuation of the skin
  - folded when closed

Teat canal – very specialised skin



- base cells (furthest left in diagram) connected and rapidly dividing
- as cells move towards the surface they flatten and harden
- also lose the links between them and produce a fat which surrounds them all as a film

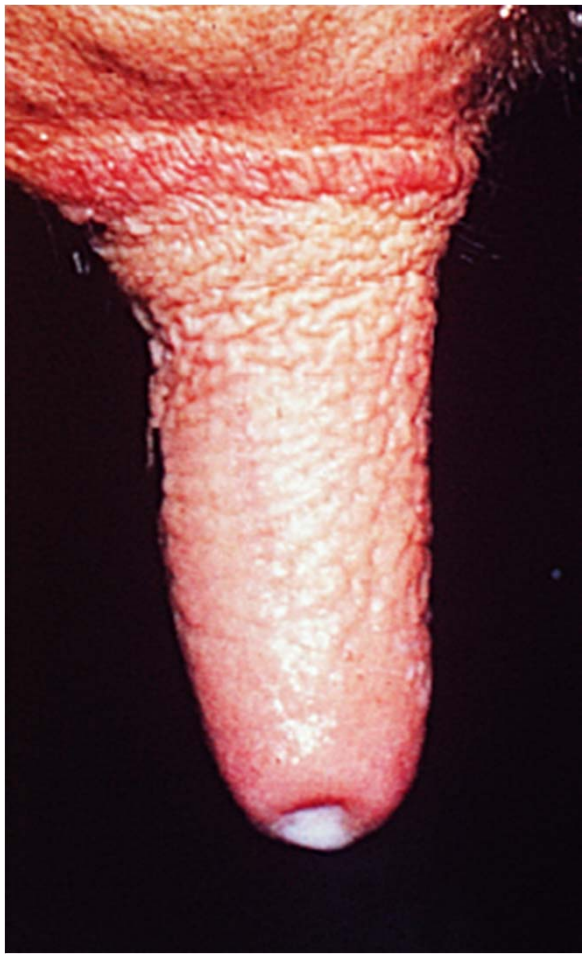
Teat canal - first line of defence



Bacteria stick to surface cells

Surface cells sheer off during milking

Teat canal - first line of defence



Teat contractions close the canal after milking (although some cows may stay open for extended time)

The milk film still remaining, dries from the opening

Good seal does not happen if surfaces are dirty, or the milk film does not dry

Mastitis control is a numbers game

More infections occur when:

- there are more bacteria near the teat end
- the teat canal's ability to resist infection is affected in some way

Teat canal - first line of defence

The teat canal cannot operate effectively if:

- teats are dry and cracked (cracks harbour bacteria, dryness affects the abilty of teat canal to seal properly)

- the canal is damaged by a faulty plant

Teat Damage From Machines

- Teat end damage may be caused by:
  - High vacuum level, faulty pulsation, short liners, teat cup slips
- Check teats look healthy after milking
  - Not ‘blue’, swollen, or with pinprick haemorrhages
  - No cracks, rings at top
  - Teat ends healthy, low incidence of evertion or hyperkeratosis

Checking the system – teats

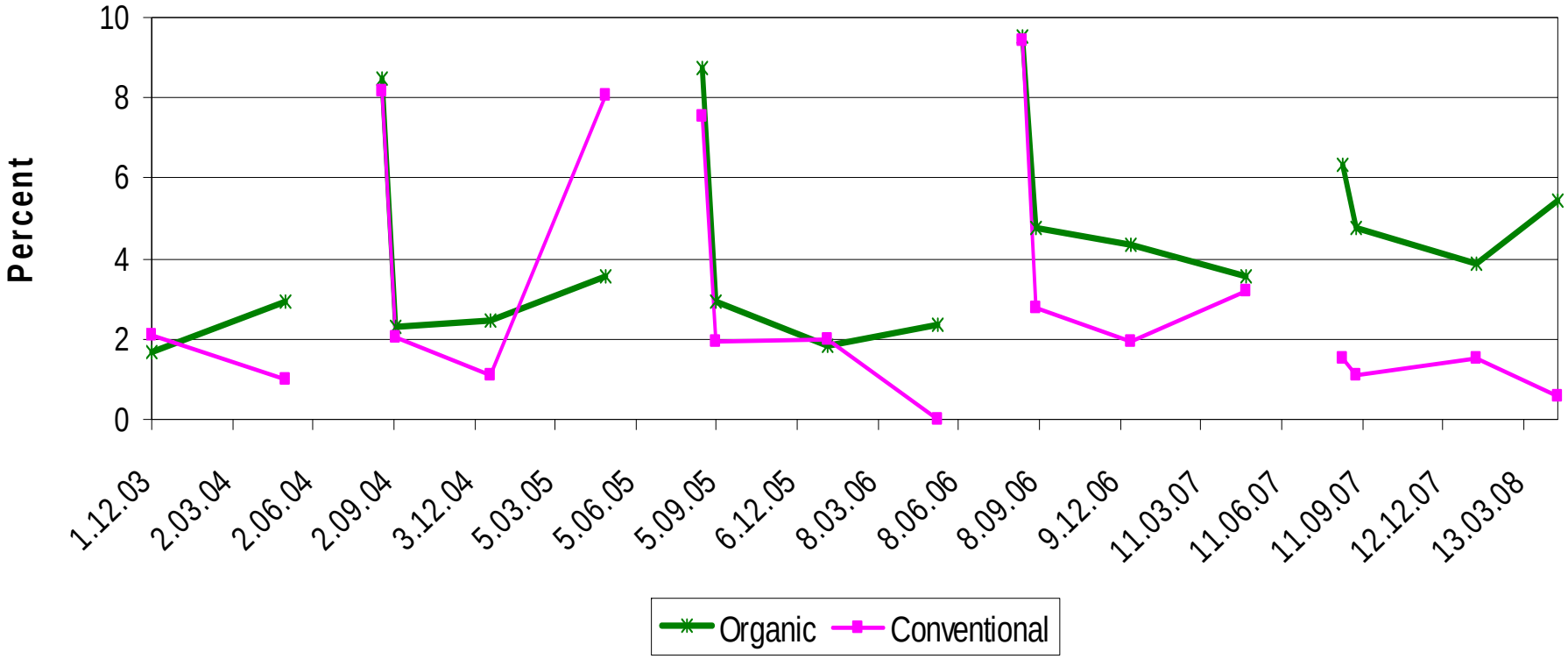
Key test - every milking

Use the cow's own "machine function tester"

- four teats

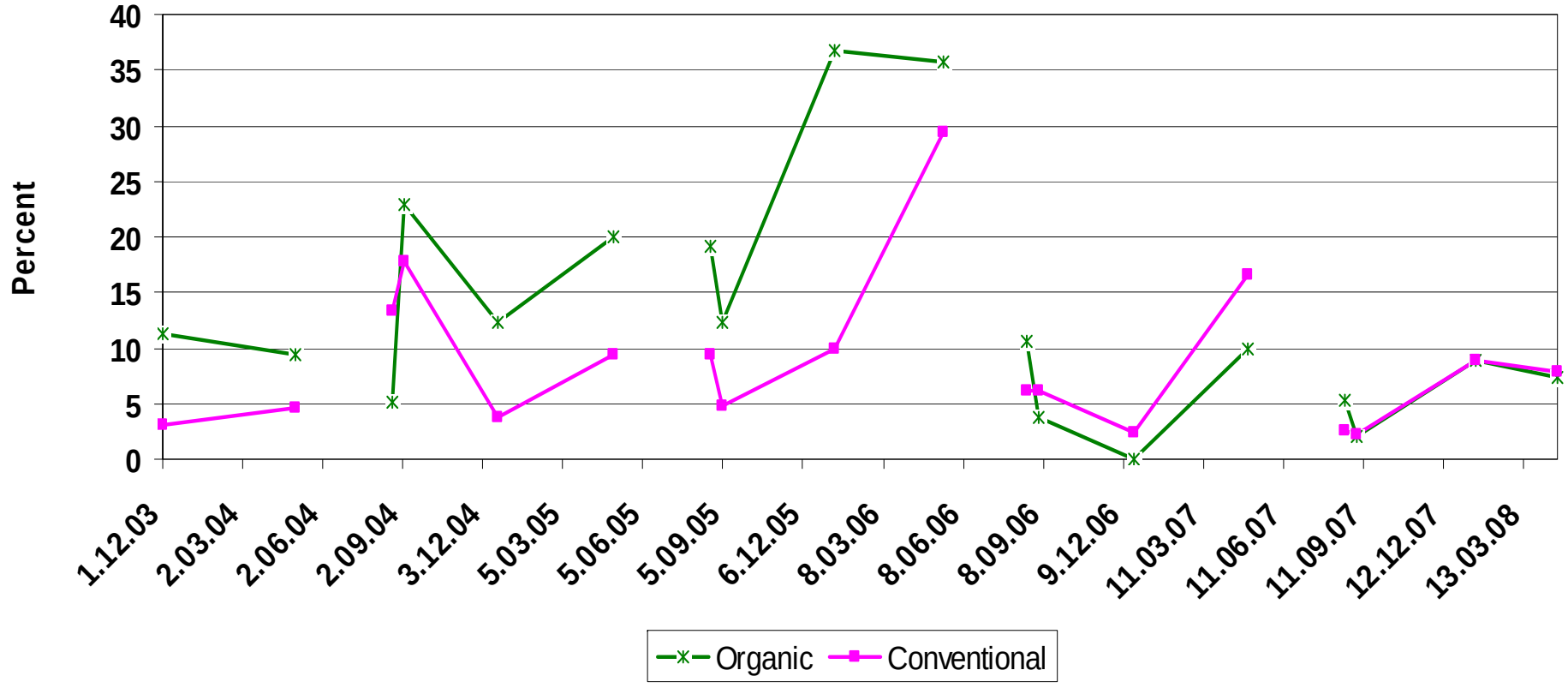
DCRU

Pattern of *Strep uberis* infection 2003 -2008



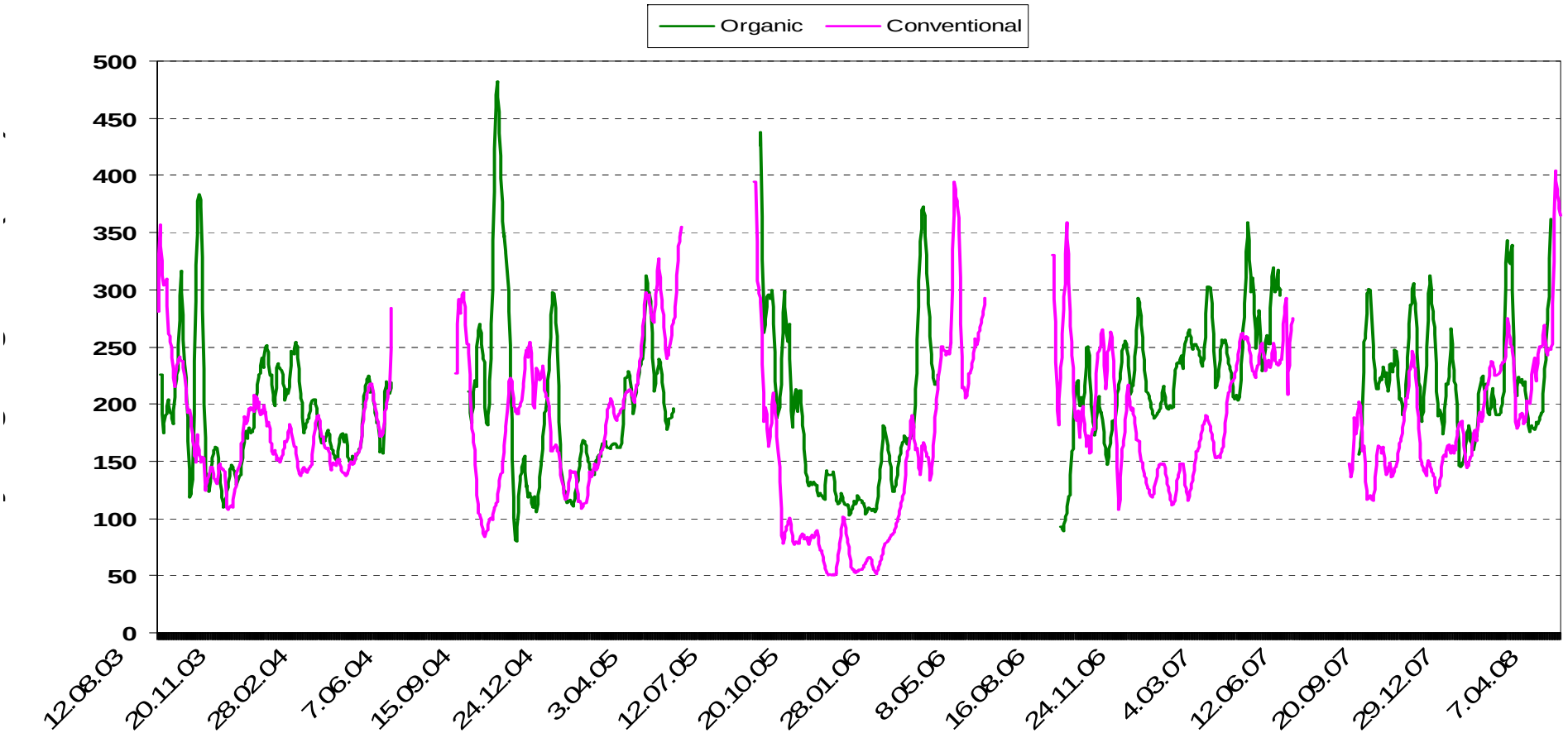
DCRU

Pattern of *Staph aureus* infection 2003 -2008



DCRU

Bulk SCC (10 day rolling average) 2003 - 2008



Most of the cells come from a small number of cows

Our experience with *Strep uberis* is that the majority of infections self-cure, probably because they don't make it past the teat canal. Our experience may be different from yours!

Although *uberis* seems relatively less of a problem, control of both staphs and streps requires an integrated strategy

Principles of Control

- Prevent infection
- If infected:
    - treat appropriately
    - keep SCC under control
- Breed for resistance

Know what you're dealing with

- Clinical signs can give you a guide:

  hard quarter, yellow lumps = invasive organism, usually *staph*

  quarter soft, white flakes = non-invasive, usually *strep*

- **BUT** this is certainly not always the case - you need to culture to make sure.
- Not economic to culture every odd case but good practice is to take a sample before treatment when first detected and freeze it (lasts a couple of months). That way if a problem develops you've got a bank of samples ready to go

No growth and mixed growth bacteriology results

Need 6 -10 samples to get meaningful results

Expect up to 20 - 30% of samples to return as no growth – can be frustrating!
Often due to intermittant shedding of bacteria in milk, especially *staph.* Also sometimes natural substances within milk inhibit bacterial growth

Mixed growth is primarily due to poor sampling technique

How to get a good sample

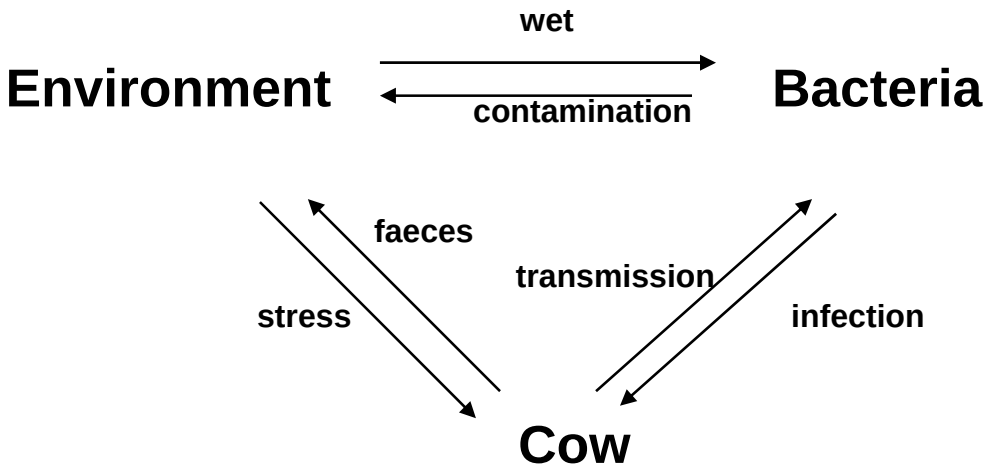
- Label the pottle
- Thoroughly clean the bottom of the teat with meths or a teat wipe. If you're doing 4 quarters, clean the front ones first and sample from the back (prevents recontamination of the teat with your forearm)
- Discard a couple of squirts then hold the pottle on an angle to prevent anything falling in. 5 – 10ml is plenty

Sources of streps and staphs:

- gut (*Strep uberis)*

- skin

- infections (mastitis, RFMs, wounds)



So: **Reduce exposure to organism**
Enhance the cow's defences

Cow/environment

- **Faeces** - effluent disposal, managing stand-off areas, races
- **Stress** - shelter (trees) - ***feed*** (transition management, trace elements, strategic supplements, hospital paddock?)

Cow/bacteria

- **Transmission** - the usual stuff - teat spray, plant checks, ID, separation etc- minimising udder contamination (strategic hay, attention to RFMs and wounds, trim tail switches)
- **Infection** - teat condition (emollient, teat grease, monitoring, pre-calving spraying, plant maintenance)

Environment/bacteria

- **Wet** – ***drainage*** (races, gateways, troughs)
- **Contamination** - minimise mud, spread cows out, stand off

Reducing Exposure

Survival of *S. uberis* in the environment

- Heavy traffic races, particularly that last 100m before the shed, have highest contamination - peaks from May to September
- Survival strongly related to moisture, sunshine and soil temp. May be detected in paddock for up to 2 weeks after grazing during risk period but no more than a couple of days at other times

Reducing Exposure

Strep uberis - feeding strategies

- **Calving**

- transition management

- high protein intakes pre-calving get excessive bagging up of cows and udder oedema in heifers – leak milk. In fine weather cows spend more time sitting down

- 1/3 of precalving diet should be hay ± energy supplement – careful balancing of nutrient requirements with the need to spread cows out and prevent pugging. Consider pros and cons of back-fencing, feeding hay first, strip grazing the paddock from the back etc

- **Drying off**

- a change to a high fibre feed (hay) rather than a severe restriction of intake minimises stress and mud (see later)

We don’t want this…

…or this

Preventing Contagious Mastitis

(1) Teat spraying

(2) Prompt detection, separation and treatment of clinicals

(3) Machine checks

(4) Culling

Teat Spraying

1. Prevents new udder infections
   (Reducing Exposure)
   - Teat sprays kill bacteria on the teat
   - *Proper* teat spraying is crucial in preventing *contagious* spread of mastitis. It is not just for the times when there is mud and muck!
   - Viable *staphs* from 1 infected cow can be recovered from a liner after up to 9 clean cows have subsequently been milked
2. Maintains teat skin condition
   (Enhancing Defences)
   - Emollients e.g. glycerine

Teat Spraying

- Use appropriate dilution rates - if risk is high, use the rate recommended for high risk!
- Mix up small amounts (goes off after a few days)
- Use plenty of emollient but with wet, wind and cold, may not be able to add enough to keep teats in good order → teat grease
- Water quality also important:
  - dirty water = bacterial soup
  - organic matter reduces effectiveness

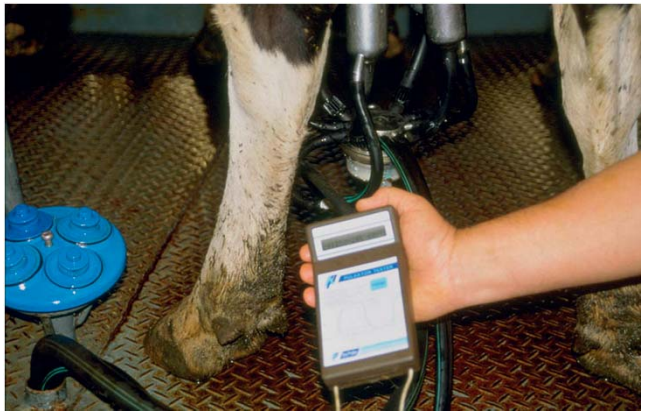
Teat Spraying

Apply Properly

- Cover the whole teat end and sides
- Apply at **all milkings**, to **all teats**, **all year**
- Ideally spray before teat canals start to close (ie no longer than 1 min after cups off)
- To check if there's adequate coverage:
  - use a paper towel just big enough to cover your hand
  - grasp the teat then check the pattern of spray on the towel – it should be roughly square

Milking Machine Testing

- *Minimum* twice yearly testing recommended
  - Dry period - thorough check
  - Spring - quick check of pulsators, vacuum level and reserve, vacuum pump
  - Dry vs wet test (watch for cup alignment!)
  - replace rubberware regularly (2500 milkings)
  - use a qualified tester
  - fix the faults



Somatic Cells

- 95% of “somatic cells” are white blood cells passed into the milk to fight infection.
- Chronic high SCC cows – usually invasive bacteria

Milk from healthy udders has a count of 20,000 to 150,000

- Normal to have elevated cell count within the first 48 hours of calving
- Older cows often have higher counts because they are more likely to have sub-clinical infections
- Elevated count at late lactation as cells concentrate with declining milk volume – care when going onto once a day – cows will produce high SCCs for a couple of days until they adjust – in the meantime may get a grade
- Other reasons

  - oestrus
  - udder not milked out
  - genetic predisposition

Low SCC herds are more stable

- In herds with a low bulk SCC (<120,000) 2 or 3 new infections may be obvious due to a significant rise in the count
- A high bulk count (>250,000) may disguise ½ a dozen new infections as the additional cells get lost in the day-to-day variation typical of high SCC herds
- That variation combined with undetected new infections means high SCC herds have a high risk of grading

Keeping SCC's under control

- Detection and identification
- ¼ milk?
- Stripping (high SCC quarters) – care not to transfer infection with hands!
- Treatment regimes – homeopathics, ACV, manuka honey etc
- Minimising stress
- When all else fails - calf milk, drying off a quarter (must be adequately identified), culling

Remember, every cow shedding bacteria is a risk to uninfected cows

Stress

Stress alone is not a cause of increased cell counts - unless there is an underlying infection.

When animals with subclinical infections are stressed there are often higher cell counts

	Uninfected	Infected
Unstressed	80,000	230,000
Stressed	100,000	1,000,000

Enhancing Defences

Minimising Stress

- **Feed** and environment
- Gentle handling (see Australian work)
- Having regard to socialisation (herd size, aggressive interactions, introducing heifers)

Gentle Handling

Australian Study on Human/Cow Interactions – 6 year project

- Fear of humans accounted for up to 20% of the variation in milk yield between farms and was associated with lower productivity
- Farmers put through a training course reported a marked improvement in cow behaviour and a change in their own beliefs about how much force is needed.
- Significant (up to 10%) production increase at zero cost

IT PAYS TO BE NICE TO YOUR COWS !

Supportive therapies

Homeopathic regime

- Dried off with Lac caninum for 3 days.
- After 5 days treated with S.A (Staph aureus) nosode for 3 days.
- At calving, treated once a week with S.A. nosode for 3 weeks. If positive to milk culture, treated with the nosode for that bacterium for 3 days.
- Tonic drenches – ACV etc
- If there is a sudden rise in bulk SCC, immediate trough treatment with SA nosode for 2 days while the problem cow(s) are found.
- Complicating factor: every second day pick up!

Supportive therapies

Manuka honey (intramammary):

- good laboratory activity against streps and staphs.
- should use medical grade (UMF 10+) organic. Some farmers just use supermarket honey but if no UMF claim, probably not active.
- dose 5ml (in 5ml syringe with nozzle – available from Shoof). Will need to warm it up to get it to flow (use a waterproof plastic bag or microwave). Massage well in. May be irritant to some cows (acidic) - milk clots, mild teat swelling
- Dexel trials indicate good cure rates for non invasive streps. For tissue invaders (ie most staphs), cure rates somewhere between self-cure and antibiotics.

Long dry period

- At DCRU, inadvertant long dry period at end of 05/06 season (3 ½ months +)
- Large proportion of cows positive to staph at the end of the season calved clean (self cure)
- Probably a mild strain but more likely to cure if young and had infection for a short time.

Acknowlegements

- The DCRU systems trial is funded by Dairy InSight
- Thanks are due to the staff at DCRU, the staff of Ag Sevices and especially Kim Dowson

Breeding for resistance

- Not highly heritable
- However, rapid progress possible with high selection pressure…
- May be linked to udder shape and teat canal width and function

SAMM plan

Drying Off

- Any cows in poor condition or producing under 5 - 6 litres per day should be dried off early. *This reduces risk of grading when herd goes on OAD*
- Culling decisions should be made well in advance

Previous Week

- No more than a moderate reduction in feed, replace grass with hay
- Do not reduce water
- Ensure teatspraying at high concentration
- Milk once-a-day for 3 - 5 days (milking every 2nd day will increase mastitis) ***then stop.***

Dry Period

- Teat plug takes 7 – 10 days to form properly, although big variation between cows and some (around 5%) don't form one at all
- Bring all cows in to be checked 10 days after drying off (not before, although visual check in paddock should be done)
- Palpate all quarters
  - Do not break teat plug of normal quarter
  - Check udder contents of any that are hard / hot / swollen / red (can sometimes feel clots in teat)
  - Treat any infected quarters
  - Teatspray all quarters
- Recheck weekly, 2 - 3 times, as necessary

Calving Period - heifers

Pre calving

- Train heifers through shed before calving (if close to calving, teat spray them while they're there) Note a large proportion of heifers don't have teat plugs.

- Watch feed levels, feed hay

- Check udders prior to calving, milk out leakers and teat spray

Post calving

Remove calf promptly (ideally within 12 hours) and milk out completely twice daily. Treat udder oedema if necessary

Calving Period - Springer Mob

- Aim to retain teat plug
  - Avoid excessive ‘bagging up’
  - Watch feeding levels
- Good transition feeding
- Milk out ‘leakers’ to remove pressure prior to calving, (run with colostrum cows)
- Keep on clean pastures, not mud or feedpads
- If feasible, remove calf within 12 hours of calving (feed extra fresh colostrum if cow milked prior)
- Withhold milk for 4 days after calving even if milked out before

Post Calving – Colostrum Mob

- Ensure milked out completely 2x daily
- Check for clinicals at every milking for the first 4 milkings (strip foremilk) – may be hard to detect
- Use RMT/conductivity meter from 5th milking
- Check every ¼ before milk goes into the vat at 4 days
- Treat all positive quarters, separate and milk last
- Teatspray.

Rest of Lactation

- Same principles apply with emphasis on:
  - Continued teatspraying, the whole lactation
  - Early detection and early treatment of clinicals
  - Ensuring correct milking technique
  - Monitoring bulk milk SCC and finding individual problem cows when bulk SCC increases
  - Monitoring teat condition
  - Collecting samples for bacteriology
  - Keeping focus in face of distractions such as AB, silage/hay, holidays

Key Control Measures
- an integrated approach

- Vigilance
  - knowing the cows
  - regular RMT of known high SCC cows
- Separation of infected cows
- A clean, stress-free environment
- High quality teat spraying (also ensuring teats are in good condition)
- Stripping of high SCC quarters
- Appropriate supportive therapy
- Appropriate culling