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Mastitis

Introduction

Milking routines need to take account of udder health and the elimination of mastitis. Vigilance and good husbandry come at a price . It is however a price worth paying in terms of commercial gain and the well being of the animal. The recommended protocols will take up more time but the financial return is well worth the effort.

Medipure will recommend certain actions to be carried out as part of good practice in support of eliminating the painful and costly incidence of Mastitis.
Treatment kits and training in aseptic practice will be offered as part of a robust regime .
Goals :-

- Cleaner milk production
- Increased milk yield
- Increased well being and comfort in the animal
- Reduction in the incidence of Mastitis

Top tips :-

- Cows should be able to stand for 20 minutes after milking. Reason : to ensure the teat closes tightly eliminating the possibility of contamination by contact with dirty bedding and passageways
- After milking make sure that the cluster is removed within 90 seconds of the milk flow stopping. This will avoid teat injury . Make sure the ACR's are set correctly [every 6 months]. Remove the cluster slowly equalising the pressures within the udder and avoiding 'suck-back' which can induce infection within the udder quarter.
- Teats should be dipped or sprayed within one minute after milking before the teat canal begins to close. Suprox ANK is ideal for this treatment. Teats should finally be treated with a proven natural oil or cream which will help with the healing process on teats which are sore or inflamed. 'Teatrub

ll' [from Medipure] is formulated to help the healing process as part of the other treatments and is guaranteed safe with no residues .

- Aseptic procedure is paramount. Clean hands or clean gloves [wearing gloves does not ensure cleanliness] are essential for milking. This is the biggest risk factor in the spreading of mastitis between teats and animals. The availability of effective disinfectant [strategically placed] like Suprox ANK is important.
- Strip and inspect the foremilk of each cow prior to milking to spot the early signs of mastitis.
- Prepare the teats for milking. The most effective method is to use a specially formulated pre-dip product [Suprox ANK] followed by drying with a paper towel. At the very least you should clean the teats with a medicated towel [Suprox ANK wipes] .

Barriers and Opportunities Discussed.

Barriers to adopting robust procedures must be overcome if Mastitis is to be managed and eliminated from herds.

[1] Statistics show that milking parlour labour is looking after about 10% more cows than they did 10 years ago.[No real improvement in automation or efficiency over this period means people work harder / longer with timeline pressures]

[2] Milk buyers are becoming ever stricter in not allowing contaminated milk anywhere near the dairy food chain.

[3] The effect of ever-rising workloads is a worry, however – especially when it comes to the milking routine. The degree to which these rising workloads are linked to poor hygiene is not known . However since the incidence per 100 cows has increased from 40 to nearly 70 poor hygiene is the most likely cause. Cutting corners through time constraints gives rise to short, medium and long term losses due to Mastitis and milk quality.

[4] A number of studies have shown that the 'smart way of working' in this respect leads to the reaping of huge benefits and improved profitability and time management.

Working 'Smart' means consistent and sustained pre-milking and teat cleaning – wiping –spraying routines .Rewards are in milk quality and quantity . Typical infection rates of Mastitis can render a 10,000 litre cow to lose 10% of its yield . This could be anything up to £200 with milk at 20p per litre.

[5] Taking an analytical look at the 'losses ' to the business is often a valuable excersize – a number of formulas are available to help in this respect.

When introducing changes it is important to get a handle on the effect of making the change. The herdsman should be involved at every step in monitoring the change and managing the infection rates. Adopting the recommendations and working in the 'Smart' way WILL result in significant reductions in the incidence as well as saving money and time.

[6] Medipure has advise and monitoring protocols in respect of infection control issues in all aspects of animal husbandry. Improvements in working procedures and record keeping paperwork can be supplied by Medipure allowing the benefits to quantified . Consistent accurate feedback will lead to sustained improved efforts by herdsmen.

[7] Incentives to reduce infection by paying bonuses for reducing the somatic cell count and numbers of mastitis cases are not uncommon.

Discussion Notes from a web survey : Methods of Control and Prevention ……..Information available in the public domain.

Mastitis is a multi-factorial disease, closely related to the production system and environment in which the cows are kept. Mastitis risk factors or disease determinants can be classified into three groups: host, pathogen and environmental determinants.

Genetic resistance

Genetic resistance to mastitis has been well researched. There is a body of work on the genetics of SCC and sub-clinical and clinical mastitis (Poso and Mantysaari, 1996). This work has established a favourable genetic correlation between low SCC and mastitis incidence at the cow level. Others have reported on the significance of certain BoLA alleles in resistance to *Staphylococcus aureus*-infection (Aarestrup *et al.*, 1995).

SCC

The correlation between SCC in the milk and the immune response of the udder to infection is not clear. There is evidence to suggest that minor pathogens increase milk cell counts and can help to protect the udder against mastitis. For example, it has been shown that *Corynebacterium bovis*-infection protects the udder against infection by major pathogens (Kurek, 1980).

Several field studies have also concluded that low BTMSCC herds have a higher incidence of environmental mastitis compared to herds with high BTMSCC (Schukken *et al.* 1990; Green *et al.* 1996 ; Waage *et al.* 1998). There is also experimental evidence to suggest that moderate to high individual cow milk SCC can provide protection against experimental infection by environmental mastitis pathogens (Matthews and Harmon, 1989).

Cow and udder conformation

Udder and foot conformation have been shown to be important risk factors for mastitis (Seykora and McDaniel, 1985; Grindal and Hillerton, 1991). Most conformation related traits have high heritability, and are generally recognised by farmers and herdsmen as major selection criteria for breeding.

Nutritional status

Various nutritional factors may lower a cow's disease resistance.
Organic nutritional management of dairy cows may increase the risk of mastitis by causing unrecognised mineral deficiencies in the absence of routine supplementation. On the other hand, organic feeding restrictions are less likely to lead to high yields and ketosis, decreasing mastitis risk.

Age of host

Both mastitis incidence and SCC levels are higher in older cows (Emanuelson and Peersson, 1984; Bendixen and Astrabad, 1989; Harmon, 1994). Organic livestock production standards do not directly discourage culling of livestock for age or parity, but positive animal health and welfare aim at longevity, and the culling of healthy young animals would probably be considered as contradictory to positive welfare management. There is very little information on the longevity of organic dairy cows

Stage of lactation

Most mastitis surveys show that 2/3 of all clinical mastitis cases occur in early lactation (Faye and Fayet, 1986; Jones and Ward, 1989). Mastitis research carried out on Danish organic farms did not find any increase in dry period mastitis (Vaarst, 1995), whereas a UK survey found that 50% of the surveyed farms had relatively high levels of dry period mastitis in comparison with conventional farms that had virtually no dry period mastitis (Hovi and Roderick, 1999).

Other diseases

It is recognised that other diseases, particularly ketosis, milk fever, lameness and post-puerperal endometritis/metritis, are closely associated with mastitis incidence (Oltenacu *et al.*, 1988; Grohn *et al.*, 1989; Peeler *et al.*, 1994).

Information from surveys of disease incidence or prevalence on organic dairy farms from the UK and other European countries suggests that disease levels are either similar or, particularly in the case of ketosis, lower than on conventional dairy farms (Ebbesvik, 1993, Von Weber, 1993; Vaarst, 1995; Weller *et al.*, 1996).

Pathogen determinants

Mastitis pathogens

Whilst over 100 different micro-organisms have been identified as causative agents of mastitis, only a few species of staphylococci, streptococci and Gram-negative organisms are of economic or epidemiological significance. The importance of the various mastitis pathogens has also markedly changed throughout the past 50 years as a result of different control and husbandry methods used. Major mastitis pathogens are classified as being either environmental or contagious.

The routine use of antibiotics and improved understanding of the complex aetiology of mastitis have meant that the targeting of control, and even eradication, of some mastitis pathogens, has became more efficient. Increased emphasis on somatic cell count reduction and targeting certain contagious micro-organisms (i.e. *Streptococcus agalactiae*) may have changed the relative importance of the principal mastitis pathogens in the national herd. Low SCC herds may be more susceptible to environmental mastitis caused by *Escherichia coli*, which are becoming more important, whilst *Str. agalactiae* is rapidly disappearing (Jones, 1998). This phenomenon is coupled with apparent changes in the virulence of some pathogens (*Str. uberis*) and with the emergence of previously non-pathogenic or minor pathogens (coagulase-negative staphylococci) as mastitis causing pathogens (Myllys *et al.*, 1994; Watt, 1997).

There is also increasing evidence that bacteria that until recently have been considered non-pathogenic or opportunistic udder pathogens are becoming more common as primary mastitis pathogens. These bacteria include *Corynebacterium bovis* and coagulase negative staphylococci.

Whilst mastitis levels in organic herds have been studied in various European countries, including the UK (Hovi and Roderick, 1999; Weller *et al.*, 1996), very little information exists on the occurrence of different mastitis pathogens in organic dairy herds. Hovi and Roderick (1999) found no difference in the prevalence of different pathogens in a limited sample of organic and conventional farms. It has been suggested, however, that udder infections with contagious pathogens, particularly those that show fewer clinical signs, would become more important in organic herds where blanket antibioitc dry cow therapy is not used (Baars and Barkema, unpublished).

Contagious mastitis pathogens

The contagious pathogens usually have a mechanism to adhere to the epithelial cells of the udder or to become intracellular, in order to protect themselves from the intramammry defense mechanisms. *Staphylococcus aureus*, *Streptococcus agalactiae* and *Streptococcus dysgalactiae* belong to this group of pathogens. *Actinomyces pyogenes* is an opportunistic, contagious mastitis pathogen, usually spread by flies. Mastitis caused by these microbes is often chronic and causes elevated SCC levels. It is possible to eradicate contagious mastitis pathogens from a herd by aggressive antimicrobial therapy and/or culling and biosecurity (Pyorala, 1995). Antibiotic dry cow therapy has been seen as a major factor in diminishing the significance of these pathogens in British dairy herds (Jones, 1998).

Environmental mastitis pathogens

Environmental mastitis bacteria include a large number of both Gram-positive and Gram-negative species. *Str. uberis, Str, equinus, Enterococcus faecalis* and *Enterococcus faecium* of the Gram-positive species and *Escherichia coli, Klebsiella* spp., *Enterobacter* spp., *Serratia* spp. and *Pseudomonas* spp. of the Gram-negative are the most common environmental pathogens of the bovine udder. *Str. uberis* and *E. coli*, however represent by far the largest proportion of the identified intramammary infections caused by environmental pathogens in the UK (Jones, 1998).

The significance of *Str. uberis* and *E. coli* has grown in the past 15 years as *Str. agalactiae* and *S. aureus* have been controlled successfully in many herds. It has also been suggested by various surveys that these

pathogens, particularly *E. coli*, have become more significant in herds with low somatic cell counts (Schukken *et al.* 1990; Green *et al.* 1996; Waage *et al.* 1998; Peeler *et al.*, 1999). It is estimated that currently approximately 20% of mastitis cases in the UK are caused by *Str. uberis*, and a similar proportion by *E. coli* (Jones, 1998).

Whilst it has been recognised that teat injuries, wet bedding and contamination with faecal material are important risk factors for *E.coli* mastitis, it has also been suggested that improvements in hygiene are not reducing *E. coli* mastitis incidence, as cows are becoming more susceptible to the disease (Green and Bradley, 1998). One of the reasons for the increased susceptibility is likely to be the increased milk flow capacity in cows, leading to milk leaking (Schukken *et al.*, 1990)

Opportunistic udder pathogens

Opinions on the significance of *Corynebacterium bovis* as an udder pathogen vary greatly in the literature. Some workers suggest that, whilst intramammary infections with *C. bovis* cause increased SCC in affected quarters, the presence of this minor pathogen provides protection against major pathogens (Lam *et al.*, 1997; Schukken *et al.*, 1990). Others, however, find no protective effect (Hogan *et al.*, 1988).

In many countries with intensive dairy production, coagulase negative staphylococci (CNS) have been identified as emerging mastitis pathogens, suggesting that increasing numbers of bacteria considered non-pathogenic, until recently, are capable of causing clinical itramammary infections (Myllys, 1995). Generally, it is accepted that the mastitis caused by these organisms is mild or subclinical. It has been suggested that the susceptibility of dairy cows to mastitis caused by CNS is a reflection of lowered resistance in the cow's udder (Myllys, 1995).

Environmental determinants

Increased opportunity for growth of pathogenic udder microbes in the cow's environment

Organic standards recommend the use of straw or other appropriate bedding material and require that all animals have access to dry lying areas. Loose housing is also a requirement. Whilst a requirement for drying lying areas is likely to decrease the risk of mastitis, loose housing on straw yards is likely to increase the risk of environmental mastitis.

Introduction of new pathogens into the herd

The most likely risk factor for introducing new mastitis pathogens into a dairy herd is a new cow or heifer that carries an infection. A closed herd policy is the best safeguard against this risk and organic standards recommend limiting the number of animals brought in annually to 10% of the herd.

Culling policies

The presence of chronically infected cows in a dairy herd is a well-recognised risk factor for mastitis. Due to poor cure rates with antibiotic treatment and due to their contagious nature, *S. aureus* infections are seen as particularly dangerous.

Mastitis treatment practices

Mastitis treatment practices can affect the transmission of pathogens within the herd. If the main aim of the treatment is not to eliminate the pathogen as quickly as possible, the duration of infection increases, increasing the risk of transmission.

A UK survey of organic dairy farms revealed no difference in mastitis levels between the farms that used primarily antibiotics and those using primarily alternative therapy, mainly homeopathy (Hovi and Roderick, 1999).

The fact that antibiotic DCT is not used as a method of treatment for chronic cases of mastitis or for cows that have an udder infection at drying-off is likely to increase the duration and prevalence of udder infections in the herd. This may be reflected in higher subclinical mastitis levels and a higher dry period incidence in organic herds (Hovi and Reoderick, 1999).

Milking hygiene

The main aim of milking hygiene is to prevent the spread of contagious mastitis from one cow to another and the introduction of environmental or contagious bacteria inside the teat canal during milking. The most effective way of avoiding these risks is to milk infected cows separately or last and to keep udders, teat and the milking machine clean. None of the UK organic dairy herds surveyed by Hovi and Roderick (1999) practised separation of infected animals at milking.

Disinfecting of teat after or before milking

Teat disinfecting or teat dipping after milking has a major effect on the microbes growing on the teat. The dipping practice was first introduced to prevent the spread of contagious pathogens during milking. Disinfecting of teats before milking has also been recommended as a way of preventing the spread of contagious pathogens during milking (Bramley and Dodd, 1984). Whilst these methods have been very successful in combating contagious mastitis, it has been suggested that, as well as killing off the pathogenic microbes, the disinfectants also destroy other microbial flora that function as "healthy" competition against colonisation of the teat, particularly by environmental mastitis-causing organisms (Green *et al.*, 1996).

The organic standards discourage the use of chemicals and encourage natural resistance to disease. However, most organic dairy farmers surveyed by Hovi and Roderick (1999) used post-milking teat dipping, at least during the housing period, and some even used pre-milking teat disinfection.

Teat injuries

Teat injuries are also likely to lead to improved survival of pathogens on the teat. The main causes of teat injuries tend to be lameness and inappropriate housing systems (Oltenacu *et al.*, 1988). Existing information from organic dairy herds in the UK and elsewhere suggests that lameness is not a specific problem for organic dairy herds (Weller and Cooper, 1996).

Udder cleanliness

Udder cleanliness is an important factor in the general resistance to mastitis. Dirt on udders and teats increases infection pressure, damages skin and prevents beneficial, commensal flora from establishing. As organic standards require provision of dry bedding areas, udder cleanliness is enhanced. In a UK survey of organic dairy farms, housing conditions were scored above average in most herds (Hovi and Roderick, 1999).

Milking machine and milking technique

Milking machine faults and poor milking techniques are probably among the main environmental risk factors for mastitis, alongside housing hygiene. Unstable or excessive vacuum, faulty pulsation, liner slippage for various reasons and teat cup hygiene contribute to mastitis risk by either damaging the patency of the teat canal or by causing pathogenic organisms to enter the teat canal during milking (Manninen, 1995). The organic production standards do not have any special implications for milking techniques or milking machine maintenance. In a UK survey of organic dairy farms, all farms had their milking machines tested twice per year or more often (Hovi and Roderick, 1999)

Husbandry practices

The teat canal remains open for up to 45 minutes after milking. A recommended husbandry practice is to prevent the cows from lying down until the teat canal has closed, to prevent bacterial penetration. In a UK survey of organic dairy herds, only 6 out of 16 organic farms prevented cows from lying down directly after milking (Hovi and Roderick, 1999).

Stockmanship

Stockmanship and other characteristics of the herdsman have been considered important enough by some workers to warrant a separate category among disease determinants (Schwabe, 1984). There is, however, very little published information on mastitis and stockmanship. Organic standards offer little guidance on stockmanship. The human-animal relationship is mentioned in the old UKROFS standards, specifying that animals be housed in conditions allowing them regular sight, smell and sound of human activity, but this has been removed from the current standard (UKROFS, 2000).

The conventional approach to mastitis control and prevention

For the past 25 years, the theory and practice of conventional mastitis control in the UK have been based on the Five Point Plan, developed at the National Institute for Research in Dairying in conjunction with the Central Veterinary Laboratory, in the 1960s.

The Five Point Plan For Control of Mastitis in Dairy Herds

1. Routine post-milking teat dipping.
2. Prompt treatment of clinical mastitis with antibiotics.
3. Blanket antibiotic dry cow therapy for the whole herd.
4. Culling of cows with chronic mastitis.
5. Milking machine maintenance with annual testing.

The Five Point Plan is unsuitable for organic dairy farms, due to its emphasis on antibiotic DCT for every cow at drying-off as well as on the elimination of existing infections by antimicrobial therapy and culling. Strict control of somatic cell counts by antimicrobial prophylaxis and aggressive culling does not fit with the organic principles of positive health care, reduction of chemical inputs and animal welfare. Furthermore, the Five Point Plan offers very little guidance on disease prevention strategies recommended by organic standards or on mastitis treatment without antimicrobials.

The organic approach to mastitis control and prevention

The organic livestock production standards emphasise positive health care and prevention of diseases, particularly by improving or supporting an animal's own defence mechanisms (EU Regulation 1804/1999, UKROFS, 2000). Good husbandry, breeding of resistant animals and optimisation of production levels are seen as the cornerstones of mastitis prevention. The main issues related to mastitis and mastitis control covered by the EU and UKROFS standards are listed below:

Aspect of mastitis control **Organic standards**

Patency of teat duct	+Breeding for resistance and improved housing encouraged
Intramammary resistance	+Breeding for resistance encouraged
	+Production stress controlled by restricted feeding practices
	-Routine vaccination not encouraged
	-Routine selenium supplementation not encouraged
Elimination of existing infections	-Use of dry cow therapy restricted
	-Number of antibiotic treatments in any year restricted
Prevention of new infections	+Closed herd policy encouraged
	+Improved housing and low stocking density encouraged
	-Use of dry cow therapy restricted

A survey of 16 established and 7 conventional farms and their approaches to mastitis control was carried out in 1997-1998 in the south of England and Wales (Hovi and Roderick, 1999). The producers surveyed considered that the mastitis situation on their farms was generally good and in most cases better than the recorded mastitis incidence suggested. It was evident that mastitis treatment records kept on all farms were under-utilised, and that bacteriological identification of mastitis pathogens was not commonly used as a monitoring mechanism.

Most surveyed farmers considered low herd SCCs as a risk factor for mastitis and felt that it was impossible to maintain low SCCs without using antibiotic DCT and culling healthy, young cows.

On organic survey farms, mastitis control measures related to the milking machine, milking hygiene, housing type or hygiene, husbandry and detection of mastitis did not differ from those observed on conventional farms.

Animal health and conversion plans required by organic standards were not evident on any of the survey farms. The majority of the organic farms (14/16) used homeopathic nosodes as a part of their mastitis control strategy. Whilst the use of fly control in the absence of acceptable lactating cow fly repellents was perceived as being difficult to apply on some farms, others had developed successful strategies that were acceptable under organic standards. None of the survey farms supplemented dry cows routinely with minerals or trace elements.

None of the organic farms used antibiotic dry cow therapy on a routine basis. Drying off without antibiotics was considered difficult by many herdsmen, and the approaches to drying off varied markedly between farms

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Good Practice based on Current Knowledge

Create a herd and an environment that will enhance good udder health.

- Maintain a good mastitis recording system and monitor records regularly;
- Provide encouragement, training and recognition for the herdsman/woman;
- Do not aim at highest possible milk yields;
- Limit your antibiotic use to a minimum, but use them when they can be of help (e.g. *Streptococcus agalactiae* infection in the herd; first and second lactation cows with clinical, non-chronic mastitis that is sensitive to antibiotics);
- Breed heifer calves from healthy cows with good longevity and conformation;
- Maintain good foot health and a closed herd policy;
- Keep your herd free of BVD (Bovine Viral Diarrhoea) and other contagious diseases that may impair immune function;
- Don't stress your cows: keep the cows in stable groups, keep a separate heifer group for introduction into the milking herd, allow adequate space and good housing conditions, don't let the cows suffer from energy deficit in early lactation and keep a good herdsman/woman;
- Keep the milking machine serviced and follow the rules of good milking hygiene; and
- Keep the housing conditions as clean and dry as possible: don't use wet straw, bed as often as you can, assess the cleanliness of your cows regularly during the housing period - if they are dirty, find out why.

Maintain minimum levels of contagious mastitis in your herd.

- Sample all cases of mastitis for bacteriology in order to identify the causative agents (see Practical Advice in the recommendations for the conversion period);
- Eradicate *Streptococcus agalactiae* infections as soon as they are identified (ask your vet for advice);
- If *Staphylococcus aureus* is present in the herd, plan a strategy to minimise it: use scrupulous milking hygiene, both pre- and post-dipping the teats and disinfecting the clusters after high SCC cows, cull chronically infected cows, use targeted antibiotic dry cow therapy, separate infected and high SCC cows into their own milking group; and

- Practise a closed herd policy: if you have to buy in replacements, isolate them for a minimum of 7 days, sample all quarters for bacteriology or require a proof of mastitis status before purchase, include in the main herd first when udder health status clear; also speak to your vet about other diseases, including BVD, mentioned above.

Maintain environmental mastitis levels as low as possible.

- Maintain good housing hygiene: dry and clean bedding daily, respond to changes in weather by increasing bedding when very wet, make sure that you use dry straw, scrape the floors more often, increase straw yard size if needed, avoid water troughs in the bedded area, train the heifers to use cubicles correctly etc.;
- Do not allow the cows access to bedding until 30 minutes after milking; and
- Make sure that the **minimum space (1.2 sqm.100 kg BW)** is allowed in all cow groups.

Maintain SCCs at a level that provides a safe margin to the legal limit of saleable milk of 400,000 cells/ml.

- Maintain a system of a monthly individual cow SCC recording to identify chronically high SCC cows and to cull or treat them;
- Minimise contagious mastitis;
- Withdraw the milk long enough after a case of clinical mastitis, even when alternative medication with no withdrawal period is used: use the Californian Mastitis Test to determine when the milk is ready to go back to the tank or use a quarter milker;
- Consider putting high SCC cows to be suckled by calves until SCC levels reduced (test with CMT; see Practical Advice in the guidelines for the conversion period); and
- Maintain your bulk tank SCC well below 300,000 cells/ml continuously: continuous levels of 280,000 – 300,000 cells/ml should prompt action to find out the cause for these high levels.

Identify and treat any cases of clinical mastitis promptly and with means that will also alleviate the pain associated with clinical mastitis.

- Use CMT or other cow side tests to identify suspected cases/quarters immediately;
- Consider installing an in-line mastitis detection system if you are renewing your parlour;
- **Always** use udder creams (Uddermint™ or Golden Udder™) or cold water massage (minimum of ten minutes per treatment) and frequent stripping to alleviate the pain of swelling and local symptoms in the udder.

Conclusions.

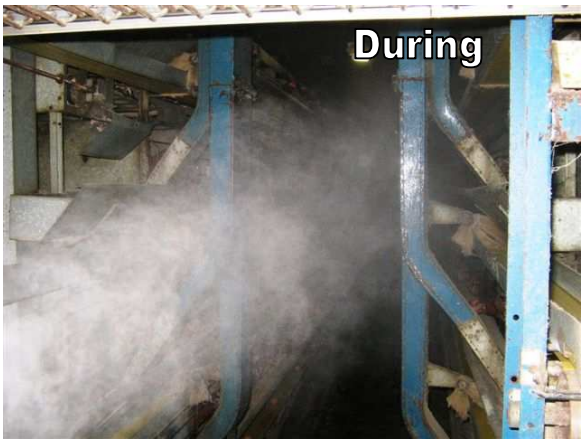
By changing working practices and applying simple hygiene and infection control measures Mastitis can be contained ,controlled and eradicated from herds.

The mindset of the farmer needs to be changed and a realisation that good animal welfare can exist with the ‘smart’ commercial management ethos which needs to be applied in modern farming.

With support from suppliers of disinfectants and treatments into dairy farming , farmers will succeed in making their animals much healthier and there wallets much fatter.

Jim Daly MD Medipure Ltd / Envirolyte UK Ltd

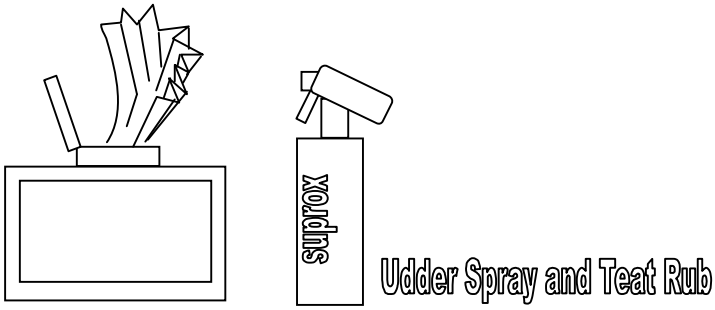
Suprox Fogging - animal housing



Treatment Regime using Suprox ANK

This regime is carried out as part of best practice responding to a mastitis case –
It is assumed that the cows have 3% Suprox ANK dosed into the drinking water.

[1] Pre milking clean teats with Suprox spray and wipes according to manufacturers instruction.
[2] Identify the infected quarter /quarters of the udder.
[3] Inject 100 ccs of Suprox ANK into the teat duct before it closes [within a few minutes of finishing milking – spay and wipe the infected teat with Suprox ANK.
[4] Carry out the injections 3 times per day. [50cc pre-filled hypodermics from the kit – single use]
[5] Massage and strip the teat – feel for lumps .
[6] Apply a treatment oil / cream to the teats
[6] Continue for 3 – 4 days



2-3% dosing of the drinking water
ELA 900 with Dosatron