

# Preventing lameness in dairy cows: Hoof lesions; their identification, treatment, management and prevention.

## SUMMARY

- **Lameness in dairy cattle is a recognised welfare problem. It is estimated that 15% of the national herd is affected at any one time**
- **The cost of a typical case of lameness is £180**
- **Many of the major environmental and management risk factors for lameness are known**
- **Application of the latest information could save the average farm in the region of £25 / cow / year**
- **The farmer or herdsman is at the forefront of lameness control on the average dairy farm**
- **Research has shown that 88% of lameness is seated in the foot. The majority of cases are associated with a hind foot (86%) with most of these (85%) in the outer claw of the hind foot**

## Introduction

Lameness in every dairy herd can be split into three main categories:

**Claw horn (Hoof) lesions** including solar ulceration, white line disease, white line abscessation and thin soles.

**Skin lesions** including digital dermatitis, foul in the foot and interdigital growths.

**Non-foot lameness** including bone, muscle and joint damage and in particular trauma with secondary infection due to 'cubicle injuries', or trauma associated with calving.

This technical note will focus on claw horn lesions; their identification, treatment, management and prevention.

The control measures for skin lesions include routine footbathing of all cows, plus slurry management with particular focus on the prevention of slurry pooling. Such measures are beyond the scope of this technical note and readers are referred to two farm management information booklets available from the Milk Development Council:

"Minimising slurry pooling in dairy housing"  
"Effective footbathing of dairy cows"

## Anatomy of the bovine foot

The foot consists of 2 claws and 2 accessory digits. Each claw consists of 3 basic components: The outer hoof capsule (hard outer casing of the foot), corium (forms the hoof and consists of blood vessels, nerves and connective tissues) and bones (figure 1).

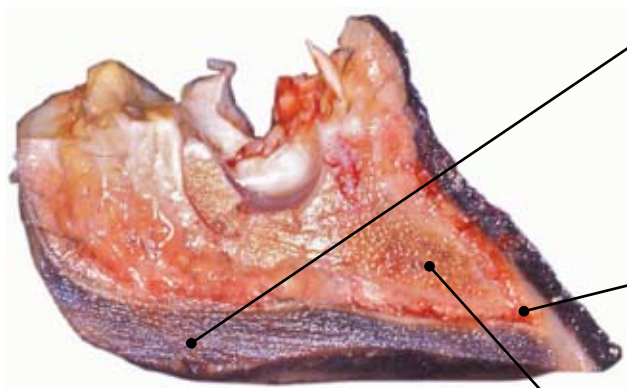


Figure 1: Bovine hoof in cross section

### HOOF CAPSULE

This is a highly modified specialised form of skin produced by the corium beneath. The hoof wall and sole are joined at the white line. This junction allows a small amount of movement between the wall and sole during walking. Unfortunately these characteristics also make the white line an inherently weak area.

### CORIUM

This completely lines the inside of the hoof and makes the horn. The horn of the wall grows down from the corium in the top part of the claw and the solar horn grows from the corium on the flat underside of the claw. At the heel the corium is expanded and contains fat, fibrous tissue and elastic tissue to make the digital cushion, which acts as a shock absorber.

### BONE

The most important bone in the foot is the pedal bone. It is equivalent to the last bone in our finger.

## Claw horn lesions of dairy cows



Figure 2: Sole ulcer



Figure 3: Sole haemorrhage

### Solar ulceration

This happens when normal horn production by the sole corium is interrupted and results in exposure of the corium as shown in figure 2. As the cow walks the pedal bone presses down on the sole towards the back and inside of each claw. This is more pronounced in the outer claw, which is often more over-grown and mis-shaped than the inner claw. This pressure point in the outer claw is the site of solar ulceration.

Evidence of an early sole ulcer is the presence of large amounts of blood staining deep in the horn at the sole ulcer site (figure 3).

## White line disease and abscessation

The horn of the white line is softer than that of the sole or wall. As a result, foreign materials such as slurry, soil and stones are more likely to penetrate the white line than the sole. They can introduce bacterial infection and result in pus and an abscess that causes severe and acute onset lameness (figure 4).



**Figure 4: White line abscess**

The shearing forces exerted on the white line as the cow moves (particularly when cornering) are high which can cause weakening. If the forces are violent, for example the sudden movement of a cow escaping from being bullied or a cow slipping then the white line can be significantly weakened and more susceptible to foreign body penetration. There is some evidence that inclusion of 20mg per cow per day of biotin in rations given continuously at all stages of production may reduce lameness incidence, principally due to white line disease, however the effects may not be seen for 4-6 months after commencing supplementation.

## Thin soles

This condition is more common in dairy cows but the cause is uncertain. Excessive wear of hoof horn on long tracks (particularly if cows are walking long distances to grazing in the summer) or fresh roughened concrete in new sheds has been implicated as potential causes. Poor horn production is another possibility. Cows present with varying degrees of lameness, increased amounts of sole haemorrhage and a very thin layer of horn present which is easily depressed on palpation.

## Corium dysfunction

Corium dysfunction underlies many types of lameness. Also it may be responsible for hoof overgrowth because it interrupts hoof horn formation resulting in poorer quality horn that is structurally weak.

Corium dysfunction appears to be associated with changes in blood flow in the foot. Too much blood in the vessels of the corium can lead to the walls of the vessels tearing and blood being released and incorporated into the horn. This blood can often be seen in the sole and/or white line when paring cows feet as red or yellow areas of horn (figure 3).

The weakened horn that results from an episode of corium dysfunction can result in lameness due to white line disease or solar ulceration

around 1-3 months later. This is when the weakened horn comes into wear and fails to give adequate protection to the corium.

The risk factors for corium dysfunction include changes in management and physiology of the cow at calving, housing on concrete, inadequate lying times, wet underfoot conditions, nutrition and growth rates during the rearing period and hoof overgrowth. These will be discussed in more detail below.

## Key steps for lameness prevention

### Locomotion scoring

Accurate identification and recording of the lameness cases is essential for control. However farmers and herdspersons only identify between 38 and 54% of lameness cases in their herd that can be identified by locomotion scoring.

Locomotion scoring is a reproducible technique that can identify severely lame, moderately lame and sound cows (figure 5). If used in conjunction with routine foot trimming (below), it can identify lameness cases early and stop them developing into a more severe lameness that is difficult to treat.



**Figure 5: Locomotion scoring (walking sound)**

It consists of watching each cow walk on an even non-slip surface. Commonly when cows are exiting the parlour is a good opportunity for locomotion scoring.

The simplest scoring system is three categories (sound, uneven / slow and lame). Lame cows (figure 6) tend to walk more slowly with uneven



**Figure 6: Locomotion scoring (walking lame)**

strides, they tend to arch their backs in an attempt to redistribute body weight away from the source of the pain and may nod their head as they walk. Severely lame animals have difficulty turning.

## Routine foot trimming

Routine preventative foot trimming, in conjunction with locomotion scoring provides the best means of reducing the level of herd lameness, identifying and trimming moderately lame cows before they become severely lame. **This single action is likely to be the most important control measure for reducing lameness in any herd.**

With larger herds the best means of achieving this is to employ the services of a qualified, registered foot trimmer and sub-contracting this work. Regular visits throughout the year with locomotion scoring in advance of the visit is the best possible combination to try and ensure that the correct cows are selected for trimming.

Alternatively farm staff can carry out this work. However it is essential they attend a training course on foot trimming to ensure appropriate competency.

The feet of most dairy cows form horn at a greater rate than it is worn away, particularly in the outer claws of the hind feet. This overgrowth comprises lengthening of the toe and thickening of the sole generally, but especially towards the toe. If the cow is standing on concrete then the overgrown outer hind claws are likely to bear more weight, exacerbating the problem, and further increasing the risks of solar ulceration.

At its simplest routine foot trimming restores the balance of weight between both claws of the foot and reduces the forces on the sole ulcer site, thus reducing the risks of a sole ulcer developing.

The key steps of foot trimming are summarised below, however it cannot be over emphasised that there is no substitute for practical training and experience. Apply these steps to all cows trimmed whether lame or not, to ensure the correct hoof shape and balance.

## Foot trimming methodology

### 1. Step One: Inner claw of hind foot.

- If necessary trim the toe to a “correct length” of 7.5 cm (roughly four fingers width) from the coronary band to the toe tip (figure 7).
- If in doubt leave the toe slightly longer rather than cut too much off.
- Cutting the toe too short can have serious consequences:



Figure 7: Toes trimmed to correct length.

- (a) Exposure of corium leading to bleeding and discomfort.
- (b) Render a correct trim impossible, without making the sole too thin.

### 2. Step two: Inner claw of hind foot.

- Trim the sole to reduce its thickness to approximately 5 mm at the cut edge of the toe. Most horn is removed from the toe (figure 8)
- The white line often reappears at this stage.
- However if the inner claw was the correct length prior to trimming then it should need no horn removed from the sole.
- On the inner claw in most cases the heel should not be touched, as it is essential to maintain the height of heel of the inner claw. Once the inner claw is trimmed it acts as a template for trimming the outer claw.

### 3. Repeat steps 1 and 2 for the outer claw



Figure 8: Inner claw sole thickness reduced at toe.

- It is important to get the size of this claw the same as the inner claw in terms of height/thickness of sole all the way from toe tip to heel
- It is also critical to get the sole of the outer claw particularly flat and at right angles to the line of the leg so the cow's stance is no longer cow hocked.

### 4. Step 3:

- Dish out or model the normal non-weight bearing sole on the middle third of the inner aspect of each claw (figure 9).
- Extend it about one-third the way towards the outer wall of the outer claw. Make it smaller on the inner claw.
- Do not go too deep and expose corium.
- This step relieves weight bearing from the typical sole ulcer site.



Figure 9: Inner aspect of each claw “dished out” to relieve non-weight bearing surface.

#### 5. Step 4:

- Remove additional horn from the lateral claw so that it is equal in height to the inner claw (figure 10).
- Heel horn of the outer claw usually has to be removed to do this.



**Figure 10: Knife is used to check each claw is level.**

#### 6. Step 5:

- Remove loose under-run horn at the heels, while trying to maintain adequate weight distribution across and between claws.

#### **Curative foot trimming and lameness record keeping**

Steps 1-5 should be carried out as part of any examination of a lame cow to ensure that the foot is returned to the correct shape and balance and that no lesions are missed. However it is worthwhile bearing in mind that as the majority of lesions are identified in the outer hind claw, maintaining any horn height on the inner claw is beneficial to take weight of affected areas.

#### **Points to consider when foot trimming lame cows are as follows:**

- Ensure that treatment of lame cows is carried out in conjunction with your veterinarian and registered foot trimmer.
- Proper training in foot trimming techniques is essential
- Shifting the weightbearing surface off affected lesions is essential to relieve pain and promote healing. This can be achieved either by leaving the unaffected claw untrimmed and higher than the affected claw, or alternatively applying a block to the healthy claw. One of these approaches should be applied every time the corium is exposed. If possible the cow is best kept on concrete after trimming and block application so the affected claw does not sink into grass, mud, or deep litter bedding.
- Achieving proper drainage for white line lesions is essential so that all necrotic / purulent material is removed.
- An area of hoof wall adjacent to any white line lesion should also be removed so that there is no channel for the build up of more dirt / stones etc.
- For the treatment of sole ulcers the sole should be dishd as much as possible so that weight is no longer carried on the sole ulcer area. Necrotic and under-run horn should be removed from over the top and round the edge of the ulcer to promote healing. Healing occurs from the outside of the lesion in. Shifting the weight off the

affected site is essential to promote healing of ulcers as discussed above.

- Further treatments such as topical and systemic antibiotics and bandages should be used in consultation with your veterinarian.

Lameness recording is essential as part of farm assurance and also to monitor the changes in main causes with time and adapt control strategies. It also highlights chronic lame cows that are requiring repeat treatments. These cows should be considered for further more radical veterinary treatment or culling. Registered foot trimmers will provide a record of lame cows examined and any lesions found as standard. Simple recording systems work the best and the basic information required for lameness records to inform control strategies is:

1. Cow identification,
2. Date,
3. Lesion type (subdivided into claw horn lesions, skin lesions and non-foot lameness).

## **Controlling the risk factors for claw horn disease**

#### **Management around calving**

Hormonal, metabolic and management changes occurring around calving have an effect on the structural anatomy of the foot. This can increase the risk of claw horn lesions some three to four months after calving. Managing the cow on straw for a period of time after calving does help minimise some of the above changes and reduce the risk of lameness developing. Previous studies keeping cows on straw for 2 months after calving have shown a positive effect in reducing lameness incidence. However it is accepted that this is not possible for many herds and may be detrimental for mastitis control. A shorter period on straw of upto a week may still be beneficial however and keeping a freshly calved group separately managed on straw will be beneficial for other health reasons.

#### **Heifer management and introduction to the main herd**

If a heifer goes lame in her first lactation then she is three times more likely to be lame in her second lactation. Looking after heifers pre-calving and the first lactation group can progressively reduce herd levels of lameness and improve cow longevity.

The management around calving discussed above applies equally to heifers. It is important to ensure that heifers are trained to use cubicles before they join the main herd. If heifers cannot be reared in cubicles, then a short period (2-4 weeks) in the cubicle shed during the summer prior to calving will suffice.

The time to foot-trim first lactation cows needs to be considered carefully. Most heifers will not be trimmed during the rearing period. If left to drying off at the end of their first lactation they will have significantly overgrown feet. We therefore suggest trimming at between 3-4 months of lactation to reduce the risks of claw horn disease developing.

#### **Nutrition and growth rates during the rearing period**

Heifers fed a dry straw based diet rather than a wetter silage based diet had significantly less white line and sole lesions and reduced levels of lameness. The exact reasons for this difference were unclear. However the heifers fed a wet diet stood longer feeding, produced less viscous slurry and had higher levels of slurry heel erosion.

### **Improving the lying times**

Ideally a cow should spend between 12 and 14 hours a day lying down. To achieve this the cubicles should be well designed and well bedded. A technical note on cubicle designs is available which discusses some of the design issues in more detail. Adequate bedding and a base of either a mat or mattress is essential to promote lying times in existing cubicles and reduces the level of cubicle injuries.

### **Improving the walking surfaces**

Cows' standing and walking on concrete has a significant effect on lameness levels within a herd. The walking surface must be as clean as possible and non-slip. Providing rubber covered walking surfaces to "soften" the floor significantly reduces the incidence of lameness, particularly in herds where cows are housed for longer periods of time.

Attention should also be paid to farm tracks used by cows to get to and from the parlour from grazing during the summer. Ideally tracks should be free draining, free from stones and only be used by cows. Driving

up and down cow tracks soon makes them unsuitable for cows and results in them walking single file in the mud at the side of the track. Gateways and the areas around water troughs also should also be 'cow friendly'.

## **Conclusions**

The most important causes of lameness within a herd will change with time. Therefore lameness control should be addressed in the herd's veterinary herd health plan.

### **The essential components of a lameness control program include:**

- Monitoring lameness incidence and causes
- A planned foot trimming program
- Strategic, regular footbathing
- Prompt treatment of lame cows
- Specific management of first lactation cattle
- Clean and comfortable walking surfaces for the cows.

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