Crown Copyright - This document is subject to Crown copyright protection & has been reproduced under licence from the controller of HMSO. The user may not supply copies to third parties nor publish / sell this material to others with out written consent of the Controller.

The ADLib Version - This document has been reproduced in full & the technical content is the same as the original. Presentation may vary from the original. Links in this document may take the user to publications other than those produced by government departments & agencies. Where this is the case the background colour of the document will change to white.

Contents

- Foreword 2
- Introduction 3
- Causes of Lameness 4
- General Environment 5
- Housing 6
- Straw yards 8
- General 9
- Outdoor Areas 10
- Nutritionally Induced Laminitis 11
- Breeding 12
- Heifer Management 13
- Prevention of Lameness 14
- Foot Trimming 15
- Foot Care Strategy 16
- Remember 17
- Further advice and information on farm animal welfare 18
Foreword

This booklet describes the main aspects of lameness and outlines some of the practical and common-sense management measures that will help prevent or treat this serious problem. If the advice is followed it should help ensure better welfare standards for the animals through a reduction in the level of lameness. At the same time it will help maintain or more likely improve the efficiency of production.

Whilst this booklet embodies much of the latest scientific advice and the best current husbandry practices, it cannot be exhaustive and is not intended as a substitute for expert advice. If in doubt about a problem a veterinary surgeon or a husbandry or technical expert should always be consulted. Please remember that without good stockmanship animal welfare can never be adequately protected.

Please note that in addition to Dairy Cattle this booklet covers Dairy Heifers. There are similar publications specific to Beef cattle, Sheep and Pigs.
Introduction

The level of lameness in dairy cattle in the UK is unacceptably high. It is a major cause of pain and discomfort to the animals and a financial loss to farmers. The financial cost to the national dairy herd was estimated in 1993 at between 44m and 89m. The average direct cost per lameness case was estimated in 1997 at between 120 - 130. This figure takes into account treatment and veterinary charges, reduction in milk yield, withdrawal of milk because of antibiotic residues and herdsman's costs. The variation in the cost to the industry is related to the differences in lameness rates recorded. When associated costs are taken into account, such as the adverse affects on fertility, increased replacement costs and culling rates, the cost of an average case doubles to more than 240.

In recent years a number of surveys have been carried out to assess the incidence of lameness. A survey by Liverpool University Veterinary School showed that for every 100 cows there were 55 new cases every year, with a prevalence of 21%. The problem has become more severe over the years. The Farm Animal Welfare Council (FAWC) which reported on the Welfare of Dairy Cattle in 1997 noted that some stockmen appear not to perceive lameness as a problem and the severity and extent often go unnoticed and untreated. One thing that all the studies have in common is the large range in incidence of lameness between herds, with some farms exhibiting very low incidence, e.g. only 2 cases per annum in 100 cows, up to and in excess of 200 cases. One study has estimated that about half of the cows exhibiting lameness were slightly lame, over 42% were moderately lame, with the remaining 8% severely lame.

The incidence of lameness as a major problem in dairy cattle has increased in recent years and has been shown to be more common in large herds and a particular problem during the winter housing period. The problem was worsened over the years due to the inadequate size of cubicles and deficiencies in their design and construction. Cows and heifers suddenly introduced to concrete surfaces after calving appear to be more susceptible to lameness. Around 80% of cases of lameness are due to foot problems and the remainder to leg damage. Foot lameness is seen most commonly in the hind feet, particularly in the outer claws. The majority of leg lameness is due to physical damage from badly designed cubicles and to injury at calving.

A number of inter-acting husbandry and management practices can pre-dispose the herd to lameness problems. Early diagnosis is important so that the probable causes of the problem can be identified and a control strategy put into action.
Causes of Lameness

Lameness only describes a clinical symptom. It may be caused by a wide variety of foot and leg conditions. Environmental, infectious, nutritional and genetic factors are all significant in the production of specific lesions. The most common causes of lameness are:

- solar ulcer
- white line disease
- Digital dermatitis
- Foul-in-the-foot, including 'Super Foul'
- Acute laminitis
- Punctured sole
- Heel horn erosion
- Overgrown claws, especially the outer hind claws
- Leg injuries

The following are aspects of husbandry and management of the dairy herd which need to be considered in relation to controlling the incidence of lameness.
General Environment

Certain conditions in which cows are housed or are required to move around for access to grazing, housing, feeding and milking areas can pre-dispose them to lameness.

Walking and standing in slurry and silage effluent will soften the horn of the hoof. Badly designed or maintained cubicles discourage cows from lying down, and the additional time spent standing puts extra stress on feet and legs. Poorly designed cubicles and those which were installed some years ago, and which have now been outgrown by the cows, are responsible for much of the hock and knee damage that is seen. Many cubicles were installed when the predominant dairy breed was the British Friesian, which commonly weighed around 550kg. However, increased use of the Holstein means that many cows now weigh in excess of 700kg and as a consequence the length and width of cubicles are too small.

Narrow passageways and sharp turns in loafing and feeding areas and around the parlour can cause the cows to move awkwardly, putting additional stress on their feet.

Roads, tracks and gateways which have rough, broken surfaces or are constructed of loose, sharp aggregate are likely to cause bruising and puncture wounds.

Smooth concrete, particularly at turning points, water troughs or well used thoroughfares, also significantly increases the risk of lameness. Poor stockmanship, such as rushing animals, will exacerbate these problems. Cows should be moved at their own speed, particularly where underfoot conditions are not ideal.
Housing - Cubicles

Cubicles need to be attractive to the cows and as comfortable as possible to encourage maximum lying time. Cubicles must provide lying areas which are well-drained and bedded, as required by the Welfare of Livestock Regulations 1994. The major factors affecting cubicle acceptability are adequate length and width, a comfortable solid base and divisions which do not cause physical damage. The size of cubicles is dependent on the weight of the animal. Variations in cattle size and cubicle design necessitate specialist advice being sought prior to installation or adaptation of existing systems.

Cubicles must be of a design, type and size so as to be comfortable and not to cause injury to the animal. They should allow cows to go down, lie and rise without difficulty. It is therefore recommended that the cubicle size is based on the average body weight of the largest 20% of the herd. Therefore, as an example, if the average weight of the largest cows in the herd is in the order of 725kg then the length of the cubicle needs to be 2.4m. The length of the cubicle is not just for the lying space, but to allow the cow to lunge forward as she rises. A cubicle of adequate length allows the cow to rise naturally and ensures that the cow can stand with all four feet on the cubicle base, and not with her rear feet in the passage and therefore slurry.

The width of the cubicle will vary depending on the type of division. Adequate width enables the cow to lie comfortably without undue pressure being exerted by the divisions on vulnerable parts of the body.

Head rails and brisket boards can be used to position cows correctly both when standing and lying. However, if these are incorrectly sited and impede free movement, they can deter the animals, particularly heifers, from using the cubicle. Head rails should be sited 150-250mm below average wither height and one-fifth of the cubicle length away from the front walls. Brisket boards should be no higher than 100mm and sited one quarter of the cubicle length away from the front walls. They should have rounded edges to prevent any injury and to provide comfort.

The base should preferably be permanent, e.g. concrete or bitmac, and have a fall of 75-100mm from the front to rear. Not only does this provide free drainage of any liquid so that the cubicle base remains drier, but cows have a preference for lying uphill.

Sufficient cushioning should be provided with adequate bedding to keep the cow comfortable, to prevent contact sores and to keep teats, udders and flanks clean. A bare, solid base is unacceptable. It is imperative that adequate quantities of bedding, normally straw, are used in any cubicle. Exposed areas of concrete can cause physical trauma, particularly to knees and hocks.

Straw is the preferred bedding material for comfort and availability, although other materials can be used, e.g. sawdust, shredded paper. Sand can also be used to a depth of at least 75-100mm but does require a retaining lip. This prevents free drainage of liquid, so increasing the level of management needed to ensure cows are kept clean.
Where certain slurry systems preclude the use of straw (up to 1 tonne per cubicle per winter is necessary), then alternative cushioning materials are required. Mattresses, carpets and mats have been shown to be the most successful in providing a comfortable and insulated surface, encouraging maximum lying times. Bedding will still be required in order to ensure that cows are kept clean and to absorb any moisture. Any foul or wet material must be removed at least once per day, but preferably twice daily, from all cubicles and replenished.

There must be at least one cubicle available per cow and preferably a few extra. FAWC advises a figure of 5 more cubicles that the number of cows within any management group.

Kerb height should normally be in the region of 150mm and certainly no more than 200mm. If too shallow, this allows the bed to become contaminated during scraping of the slurry passages. In addition, if cows stand half-in the cubicle, then a high kerb causes unacceptable strain on the hind legs.
Straw Yards

With loose housing in straw yards, lying space with easy access should be available to enable all cows to lie down without difficulty. Sufficient straw should be used to maintain a dry bed and care should be taken to avoid excess through narrow access routes, which become wet and fouled. Water troughs should be sited away from the bedded area.

A long rectangular yard is preferred as it allows a concrete trip for feeding/watering and loafing with easy access from the long side onto the bedded area. This layout avoids unnecessary walking and disturbance to other cows on the bedded area, allowing maximum lying times.

These points are important in the maintenance of a clean, dry bedded area as they reduce poaching and the amount of dung and urine falling onto the bed. Suitable space allowances are required so that the cows are not overcrowded.

As with cubicles, many straw yards have not been adapted to take into account the increasing size of cows. With modern breeding and the Holstein influence, the bedded area required is now in the region of 6.5m².

Smaller breeds, e.g. Channel Island, will require between 5 and 5.5m². In addition, straw yard areas require a concrete feed/loafing area with 2.5m² space normally required per cow. Straw usage will typically be in the region of 3 tonnes per cow per winter.
General

Whenever the housing and feeding system, slurry needs to be removed frequently from all concrete areas. This should be a minimum of twice daily. Cows prefer to walk on clean surfaces and actually change the way they walk when slurry is deeper than 5cm.

Concrete floored areas, both rough and smooth, can cause problems. Rough and broken concrete can cause abrasion of the sole and puncture wounds. Care should be taken when laying new concrete to use the correct mix and properly graded aggregates. Whilst the final surface should provide grip, it should be tamped to a finish which will not cause damage to feet. Repair to broken concrete should be made using concrete or non-slip epoxy materials. Worn, smooth concrete can cause slipping, leading to bruising of the sole and to other foot and leg damage. Where concrete has become worn, grooving can reduce the risk of injury to cows.

Good results have been obtained by cutting grooves 40mm apart, which run at right angles to the direction of cow movements.

These provide better resistance than grooves that run parallel to the direction of cow traffic. A grooved finish on new concrete is recommended and the latest evidence suggests that a honeycomb pattern (hexagonal grooves 10mm deep, 12mm wide with 46mm between grooves) provides equally good slip resistance in all directions but without unacceptable high pressure upon the hoof.

In milking parlours carborundum dust as the final floor finish provides long lasting, very good slip resistance, but the floor is still able to be easily and readily cleaned to comply with hygiene regulations.
Outdoor Areas

Many access routes to and around dairy buildings are constructed from various types of aggregate. This leads to loose material which can both be uncomfortable to the cow whilst walking and can lead to bruising of the sole or solar penetration. Maintaining gateways free from all stones and flints is as important as the maintenance of access routes.

Specialised farm tracks (typically 1-2m wide and dug to a depth of 0.3m) which are dedicated for use by the cows allow them to walk in comfort, provided they are constructed with a base which allows quick drainage and a soft surface such as shredded bark.

The trench is lined with a semi-permeable membrane and packed with clean gravel over a perforated pipe. The membrane is then folded back over the gravel and covered with the surface material.

Such tracks have been used on some farms for over 20 years and, with good maintenance, have worked well. Specialist advice should be sought before installation.

When allowed to walk at their own speed, cows are able to place their feet carefully to avoid obstacles or rough or sharp objects. Cows generally will walk in single file and follow well-worn cow tracks.

When they are forced to hurry they bunch together and cannot choose where to place their feet, so are more likely to sustain damage from sharp stones. In addition to gateways, areas around field water troughs also require careful construction. Similar principles to farm tracks apply. Regular maintenance is essential.

Cows should not be walked regularly to grazing for distances of more than around 0.5 kilometres on concrete or tarmacadam surfaces, as excess wear to the hoof can occur.

Ideally, cows should not use the same roadways as vehicular traffic, particularly concrete or tarmacadam roads. Where this is inevitable, the road should be brushed clean at least twice per week to remove loose stones and other aggregates.
Nutritionally Induced Laminitis

Laminitis is the acute or chronic inflammation of the laminae, which lie immediately below the outer horny wall of the foot, resulting in great pain to the cow. The condition may be caused by traumatic, septic or toxic factors.

Any feeding mismanagement is likely to provide a risk factor for foot health. Major changes of diet for cows at calving, heavy feeding of concentrates after calving and high proportions of cereals in the diet are all thought to be pre-disposing factors to laminitis.

The risk of lameness related to feeding can be reduced by planned feeding management, including correct ration and forage analysis. The guidelines to be followed to minimise the risk are:

- where concentrates and forage are fed separately, the forage to compound dry matter ratios in the diet should be no less than 40:60 with complete diet feeding/total mixed rations, the forage ratio can be lowered
- no more than 4kg of compound should be fed at any one meal
- access to forage should be allowed immediately after feeding compound, i.e. forage should be freely available after parlour feeding
- the level of protein should be suitable for the level of milk production; levels up to 19% crude protein in the total diet dry matter may be required for high yielding cows, although this would be too high for lower milk output
- a digestible fibre such as well made silage should be included as part of the energy source
- high energy diets should be introduced gradually, particularly around calving adequate comfortable lying areas and clean bedding to encourage animals to lie down should be provided excessive stressful activity for cattle should be avoided.
Breeding

Physical characteristics of feet and legs are inherited. The important features are the shape of the foot, depth of heel and hock and pastern angle.

Whilst there is no established link between these features (shape of foot, depth of heel and hock and pastern angle) and the general incidence of lameness, it is good practice to be aware of the potential risk when selecting sires. Sire selection is a complex process and, in the main, improvement of production characteristics are those which are most sought after in commercial herds. Nonetheless, it is imperative that sire selection should take fully into account good linear assessment scores for straightness of leg and foot depth and angle. The majority of sires available through AI will have been pre-selected for satisfactory type characteristics. However, where weaknesses have been identified within herds, then corrective mating must be carried out.

Replacements should not be bred from cows with a history of severe clinical lameness or badly deformed feet and legs, particularly a history of corkscrew claw. It is therefore important for good records to be kept of all cases of lameness. Remember, although cows may have good foot shape and good conformation of the rear leg, this does not mean that they necessarily have strong horn. Certain breeds, e.g. Channel Island, have far harder horn than 'black and white' cows and as a consequence suffer less solar damage.
Heifer Management

There are three factors likely to lead to a high incidence of lameness in heifers around the time of calving when they join the milking herd. These are:

- sudden introduction to concrete floors and slurry
- stress as a result of calving, establishing their place in the herd hierarchy and change in diet
- Unfamiliarity with cubicles leading to decreased resting time.

Evidence suggests that there is an increase in lameness that develops in the pre-calving period. Studies identify lameness peaking soon after calving in heifers. This suggests that management of the heifer prior to calving has a very important influence on her welfare as she enters the dairy herd. Lameness, often occurs because animals are reluctant to lie down when first housed and spend too much time standing. The consequences can be reduced growth rates, loss of weight, premature culling and reduced reproductive performance. Management practices prior to calving can alleviate these problems. When the herd is housed in cubicles, the replacement heifers should also be reared in cubicles and should be introduced to concrete surfaces and changes in diet from 6 weeks before calving. Where practical, heifers should be managed as a separate group to reduce stress. However, if space allowances or number of cubicles are suitable and feed barrier management is good, then practical experience shows that heifers do not exhibit major problems.
Prevention - Footbaths

The Welfare Code of Recommendations for Cattle, paragraph 51, states that 'Regular attention should be paid to the feet of all classes of cattle'.

The proper use of footbaths can help reduce the incidence of foot lameness, particularly that caused by foul of the foot, heel erosion and digital dermatitis, when used with the appropriate treatment. A footbath used with a suitable chemical performs three functions:

- potentially damaging material is removed by washing action
- disease-causing bacteria are killed
- horn is hardened and less easily damaged.

There are different types of footbath solutions available and the appropriate chemical and concentrations should always be used. Preferably two footbaths should be used in tandem, the first containing water only to clean the feet, and the second containing the solution.

Footbaths should be used throughout the periods of risk i.e. during the winter housing period and in spring and autumn. Depending on the type of lameness, cows may need to be walked through the footbath three or four times each week. Veterinary advice should be sought on footbath use.

The footbath should be sited so that cows can walk through with minimum disturbance to their normal routine. The access route from the parlour exit is an ideal location, but care taken that it does not affect cow flow from the parlour. The footbath should be a minimum of 900mm wide and should be close-fenced to prevent cows attempting to walk on the edge. A minimum length of 3m is recommended to prevent cows attempting to jump over it. A depth of 200mm is normally sufficient to accommodate a depth of solution to cover the hoof without undue loss of solution over the sides. Sponge mats can also be used in the base of the footbath and are often used where the cost of the treatment is very high. A well is formed where the cows foot makes contact, and the well floods' with the solution from the soaked sponge.

A flat, non-slip floor is adequate, but ridges running the length of the bath have the advantage of spreading the claws allowing better contact between hoof and solution. Construction should incorporate a means of emptying direct to a suitable collection facility. It must not find its way to a watercourse or groundwater. Advice should be obtained from the appropriate source.

Foot-bathing in formalin does not prevent digital dermatitis. Nor is it any use in treatment of this condition. Other footbath solutions and treatments are necessary and your veterinary surgeon should be consulted for further advice.
**Prevention - Foot Trimming**

The adoption of a routine preventative foot trimming programme can assist in the prevention of lameness caused by misshapen feet. The principal objectives of trimming are to ensure better distribution of weight across each claw and between outer and inner claw. Hollowing out the underside of the claw ensures that it remains self-cleaning. As the majority of cases of lameness affect the hind feet the effort should be concentrated on these. Front feet should not be neglected but need only be trimmed if obviously misshapen.

An ideal time to trim feet is when cows are dried off. If for practical reasons it is no possible to deal with all cows, those most at risk should receive priority. These include animals with obviously disfigured feet, those with a history of clinical lameness and those walking abnormally.

A study by Liverpool University showed seasonal differences in foot shape - toe length increases in the last 3 months of winter and the first 3 months of summer. Poor foot shape was also worse where cubicles were uncomfortable and where cows stood for long periods. Such factors should be taken into account in any foot trimming management policy. Foot trimming is a skilled job and should not be attempted without proper training and handling facilities. Poor trimming can itself cause lameness.
Foot Care Strategy

Good husbandry and management with attention to detail can reduce the incidence and bring about an improvement in animal welfare and a financial benefit:

- Maintain sound, non-slip conditions under foot
- Provide comfortable, dry lying area
- Minimise contact with slurry
- Plan feeding carefully
- Use footbaths where appropriate
- Observe cows walking and examine for the first signs of problems
- Trim feet regularly
- Select sires with sound feet and legs and do not breed from cows with a history of severe clinical lameness
- Keep records of all cases of lameness
- Introduce heifers to herd conditions 6 week before calving
- Seek veterinary advice.
Remember

Any injured, ailing or distressed dairy cattle should be treated without delay and veterinary advice sought when necessary. Provision must be made for the segregation and care of seriously sick and injured animals. When the lameness is so severe that the animal has to be destroyed on the farm, this should be done humanely, and, where possible, by a person who is experienced in both the technique and the equipment used for slaughtering the animal.

Carefully inspect all animals for signs of lameness before transport.
Further Advice and Information on Animal Welfare

For general advice on prevention and cure of lameness and for advice on specific cases - consult your veterinary surgeon.

General welfare advice on lameness may also be obtained from:

- The State Veterinary Service (Local Animal Health Office - address and telephone number in your local telephone directory)
- Specialist consultants

**PB No. Title**

0074 Codes of Recommendations for the Welfare of Livestock (Cattle)
0621 Farm Fires: Advice on Farm Animal Welfare
1147 Emergencies on Livestock Farms
1148 Lameness in Pigs
1149 Lameness in Sheep
1151 Lameness in Beef Cattle and Dairy Followers
1381 Guidance on the Transport of Casualty Farm Animals
2531 Summary of the Law Relating to Farm Animal Welfare
2594 Explanatory Guide to the Welfare of Animals (Slaughter or Killing) Regulations 1995
3426 FWAC Report on the Welfare of Dairy Cattle

If you would like any further information or advice relating to this code please contact DEFRA's Animal Welfare Division on 020 7904 6512.

DEFRA (Department of Environment, Food and Rural Affairs). Further copies of this publication are available from: Defra Publications, Admail 6000, London, SW1A 2XX, Tel: 0845 955 600.

(C) Crown Copyright 1998, PB4020
Reproduced for ADLib under Licence April 2004.