Best practice guide on Lameness

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This guide provides an overview of the causes of lameness in dairy cows and the currently available technology to manage lameness on the farm.

Lameness

Lameness in dairy cows is a deviation in gait or posture of the cow. It is almost without argument the most significant problem with dairy cows, at least in the developed world. Lameness includes infections (primarily sole ulcer and digital dermatitis) and injuries to the hoof and lower leg. Some may deny this, but it is almost certainly painful, very painful, and it also can persist for a long period of time, for around three months. Lameness has impacts not only on the health and welfare of the cows, but also on their productivity, condition score and fertility. Lameness impedes cows' locomotion and affects visits to feeding stations, as well as activity that helps the stockperson identify oestrous status, thus reducing fertility. Moreover, weight loss due to lameness reduces pregnancy rates.

Photo 1: *Sole ulcer (left) and digital dermatitis (right)*

Lameness is an extremely common problem, a Liverpool study in the UK reported finding a mean lameness prevalence of 26%, some farms having a prevalence of over 50%. A figure of 30% has also been suggested by INRA in France for clinically lame cows housed indoors. It often goes unnoticed by farmers and stock people, and can fail to be treated seriously by stockmen (who may see it as an unavoidable norm). Lameness can be more common in cubicle housing than in either straw yards, or where the cows are given access to outdoors. Current management tends towards cubicles with zero-grazing, which are likely to increase the possibility of lameness among the stock.

The biggest challenge today is that lameness, unlike say mastitis, continues to increase throughout the dairy sector. This is curious because the causes of lameness are not unknown.

Causes of lameness

- **Too many cows, with too few cubicles**. There should be more cubicle spaces available than the number of cows housed. If a cow cannot easily find a clean space in a cubicle the motivation to lie down may induce the cow to lie down in a passageway, which will be less comfortable, dirtier and may cause damage to the leg.
- **Changing of groups**. Either bringing in new stock or changing animals from one group to another can raise the risk of infections in their hooves.
- **Slurry**. If slurry is left pooling in passageways and the stock have to stand in this, the hooves are likely to become infected.
- **High yielders**. Higher yielders have a greater load on their hind legs from full udders, and combined with weaker legs structure, this pressure can damage the leg integrity. Metabolic stress may reduce the response to infective agents.
- **Poor cubicle design**. This may cause injuries when lying down, or during ling down and may dissuade cows from lying in cubicles. Less time lying, and lying in passageways, can damage hooves.

- **Flooring**. Poorly designed or poorly maintained flooring can damage hooves through abrasion or puncture injuries.
- **Genetic selection for productivity**. At the cost of strong hind legs, selection for higher yields can lead to animals with greater susceptibility of leg damage.
- **Too much energy and protein in the diet**. This can be a cause of laminitis.
- **Too little energy in the diet**. Poor body condition score can also be a risk for lameness, possibly through the thinning of the protective layer of the digital fat pad.
- **Lack of footbaths**. Or poorly managed footbath use can reduce the capability of cows to clean and harden their hooves, leaving them vulnerable to hoof infection and hoof damage.
- **Insufficient foot care**. Regular hoof treatment can improve lameness, extended periods with no foot care, or inexpertly treated hoof care, can be associated with increased incidence of lameness in the herd.

Stockmen can be quite poor about identifying lameness problems, and it has been claimed that dairy farmers can often underestimate the incidence of lameness in their herds. So the problematic issue is not so much about managing the causes of lameness, but identifying lameness among cows by stockmen, and then making informed decisions about changing management practices to minimize risk. Some methods to assist in identifying lameness are listed below, although there is no agreement on any particular gold standard for the detection of lameness.

Locomotion and Gait Scores

Camera recording of cows walking and estimations of gait scores have been proposed as a useful method to identify lameness. Actual locomotion, activity, is affected by lameness, but the causes of changes in activity score are multiple, including stage in the oestrous cycle, so on its own activity is an unreliable indicator of lameness. Work at Harper Adams in the UK has shown promise using an accelerometer (ICeCube) to estimate activity and body position changes to alert the farmer (through CowAlert, developed by Edinburgh university) to the possibility of lameness. The proposed solution consists of alerting the farmer to the possibility of lameness in an individual and flagging that animal for closer inspection by the stockperson. But if this method gives too many false positives farmers will be likely to disregard the alerts.

Accurate identification requires some training and practice, and recent work has suggested that there are doubts regarding the reliability of such methods, with significant variation between different assessors.

3D image based lameness monitor

An automatic method to assess lameness without assessor opinions would be able to eliminate this subjectivity. An automatic 3D image-based system for detection, based on the posture of the cow's back has been tested by our colleagues in Leuven, but there remains variability between individual cows and a correct identification rate of 76%, which does leave nearly a quarter of lame cows undetected. This system is still under development and is not commercially available yet.

Photo 2: *Set up of the automatic 3D image-based system developed by KU Leuven.*

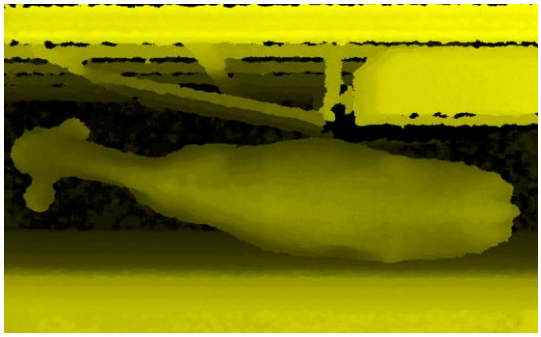

Photo 3: *Top 3D image of a cow walking under the camera*

Gaitwise

Colleagues at ILVO have developed the Gaitwise system, which consists of a pressure sensitive mat that records spatio-temporal and relative force information of two gait cycles of the cows that walk through it. Case studies have shown that the Gaitwise can classify 84% of the lame cows correctly as lame and that the measurements are highly repeatable within cows.

Photo 4: *Set up of the Gaitwise (Source: Veeteelt)*

Stepmatrix

This automated system, marketed by Boumatic of USA, estimates the lameness of cows based on the different pressure applied by each of the four hooves. The idea, which sounds encouraging, is that lame cows will put different pressure on the floor from an affected limb compared to their healthy limbs. Work from Cornell University has found this to be less effective at identifying lameness than a veterinarian, and there can also be problems when this device is run with some automatic milking systems.

Photo 5: *Set up of the Stepmatrix - sideview (H. Kiiver)*

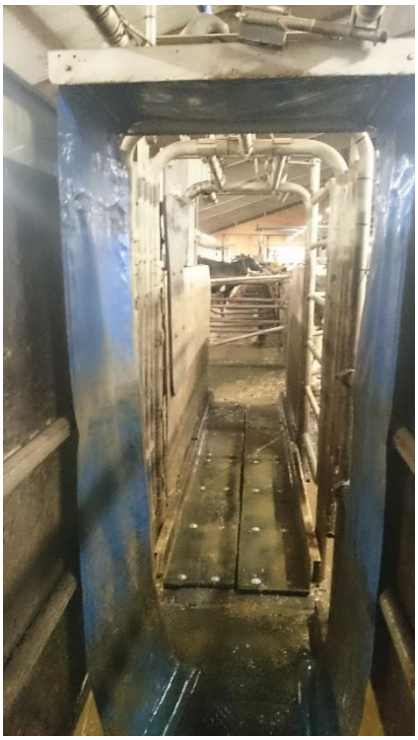

Photo 6: *Set up of the Stepmatrix – inside view (H. Kiiver)*

Data integration

Combining automatic records of a range of different behaviours and production parameters that are known to be affected by lameness within an analytical model has been tried. German work investigated the effectiveness of combining records for milk yield, dry matter intake, drinking, number of visits to feeders, time taken to feed and activity. They reported an encouraging success rate at identifying lameness in this way, but it was not considered sufficiently reliable for practical use by farmers.

Recording software for hoof care

Professional trimmers in the UK have been using specialized software to record disease as they trim. This software can either be installed on a local computer, or on robust rubber mounted tablets that can withstand the harsh environment of the dairy farm. When trimmers are taking care of a cow, they can indicate in the software what the problem is, where it is located and which treatment they will apply. This information is then available for reference next time the trimmer trims the cow, but can also be used for herd-level analyses. For example, if an excessive amount of trouble occurs on the same claw of the same hoof for different cows, this can imply that there is a problem regarding turning somewhere in the unit.

Photo 7: *Rubber mounted tablet with software to record hoof problems and treatments (Supervisor System™)*

Photo 8: *Hoof care recording system installed on a local computer (Hooftec)*

Thermal imaging

Thermal imaging cameras have been used in research to detect infections and lesions in the cows' legs. Poor accuracy of thermography systems has limited their application in practice. However, when combining thermal imaging with another technology, it can be a very valuable tool. A workshop, held at Bridge Farm Glastonbury (by kind permission of David Cotton, and Herdsman Steve Crowther) demonstrated how hand- held thermal imaging cameras (Miracle Tech) can provide diagnostic information about cows that appear on CowAlert's lameness action list.

CowAlert categorises cows into three groups: green, amber alert, and red alert. During the workshop, 7 cows that received a red or amber alert on the CowAlert action list were separated from the herd. 5 of these cows showed no visual signs of lameness. However, when visually inspecting the cows with a hand-held thermal imaging camera, foot issues and bruising inside the claw were revealed, motivating the stockman to look deeper into the claw, and resolving lameness issues at a much earlier time.

Photo 9: *Lesion detection in a claw by using a handheld thermal imaging camera (Miracle Tech)*

Summarised, the use of thermal imaging cameras in conjunction with CowAlert's lameness monitoring, can have a big impact on farm profitability and animal welfare. Cows that showed no visual sign of lameness were identified as lame by technology and treated much earlier and more accurately, than was possible before.

What should I buy?

Automated systems to detect lameness are either still under development (not available on the market) or are not accurate enough for practical use on the farm. In addition, systems such as Gaitwise and Stepmatrix are very expensive and difficult to integrate in the barn because of their sheer size. In anticipation of an accurate, affordable, easily implementable solution for automated detection of lameness, manual detection seems to be the most appropriate approach. However, it is important to ensure that the manual detection is carried out properly. For this purpose stockmen should be properly trained in identifying lameness and its causes. In addition, it is advisable to use an efficient logging system to record and manage lameness on the farm.

Useful links

More information about lameness in dairy cows, useful pictures and tutorial videos can be found on the following websites:

DeLaval
http://www.delavalcorporate.com/our-products-and-services/animal-welfare/cow-longevity/lameness-infographic/

AHDB Dairy
https://dairy.ahdb.org.uk/technical-information/animal-health-welfare/lameness/#.WK6yV2_hBpg

Zinpro
http://www.zinpro.com/lameness/dairy

Dairynz
https://www.dairynz.co.nz/animal/cow-health/lameness/

Supervisor System
http://www.supervisorsystems.com/software/category_4f5544ef0e7e/product_6090f5ebc81b/

Willows Farm Services
http://www.willowsfarmservices.co.uk/hoof-care/

All4feet
http://www.all4feet.uk/site/about-cow-recording-program/

Comfort Hoof Care
http://uk.comforthoofcare.com/accu-trim-hoof-analyzer/

Hooftec
http://www.hooftec.eu/software/

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