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Influence of floor surfaces on dairy cow hoof health

Hoof disease-caused dairy cow culling is an increasing problem. Alongside feed, hereditary faults and behaviour of the animals, the production environment is also to blame. Hooves are often in contact with wet and dirty flooring which leads to an increase in moisture content and a reduction in the wearing surface firmness of the hoof horn and can result in a high bacterial pressure, all resulting in poorer hoof disease resistance. Different forms of dairy cow feeding area flooring which could positively influence hoof horn properties were investigated.

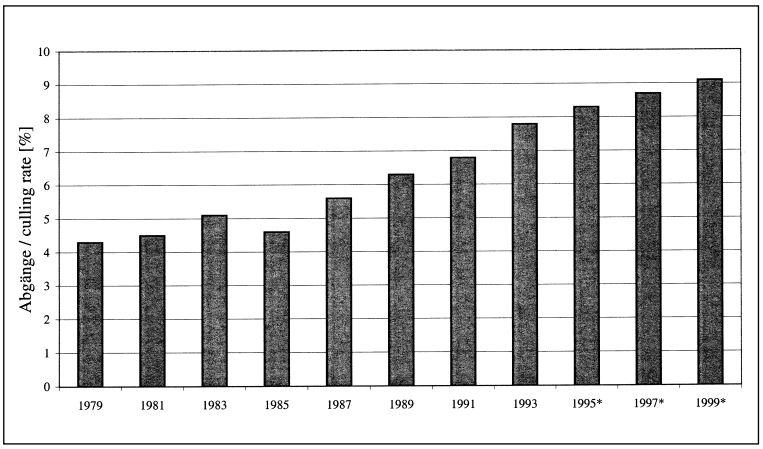

Fig. 1: Dairy Cow Culling rate in Germany, data from ADR

According to Arbeitsgemeinschaft Deutscher Rinderzücht e.V. (ADR) data in 1999, hoof and leg problems were the most common ground for cow culling at 9.5%. *Figure 1* demonstrates the development in Germany over the last two decades. Hoof diseases also represent a large cost factor. According to [2] the average cost per lameness case in Britain is DM 714. Laminitis plays an important role in this because it is not only a disease in its own right but also a predetermining factor for other hoof diseases [2, 5, 7].

There are many reasons for lameness [2, 1, 7]. Influential factors include hereditary susceptibility, nutrition, production system, animal behaviour and infection pressure on the hooves. The production environment for dairy cows in loose housing with cubicles has brought labour and economic efficiencies but hoof disease has at the same time become a problem for many farmers [3].

According to [4], major causes for cow and feeding bull hoof lesions are moisture and dirty standing and walking surfaces. According to [1] the moisture content of „normal" horn is around 15% but this can almost double when hooves are continually on wet surfaces. Similar values can be found in [6] with moisture content between 20.3% on the front hooves in byres and 30.4% on solid flooring in loose housing.

Investigation aim

The fundamental idea behind this investigation was based on the fact that cows stand in the feeding area for from 3 to 6 h whilst feeding, and during this time could achieve an improved hoof horn quality through an altered standing and movement area to give drier and cleaner surfaces. To this end, the concept of a drying „hoof bath" built into the solid flooring of the feeding area was investigated for its effects on hoof horn quality. The hoof bath was a depression in the last third of a feeding stand (right half of *fig. 2*) into which the animal automatically steps on reaching the feeding area. The hoof bath was filled with pelleted chopped straw which had a drying effect on the hoof horn and thus made the hoof horn „shoe" more resistant.

Fig. 2: Variant hoof trough (right part) and variant rubber mat on slatted floor (left part)

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Keywords

Cattle housing, flooring, hoof health

Literature details are available from the publishers under LT 01417e or via Internet at http://www.landwirtschaftsverlag.com/landtech/local/fliteratur.htm

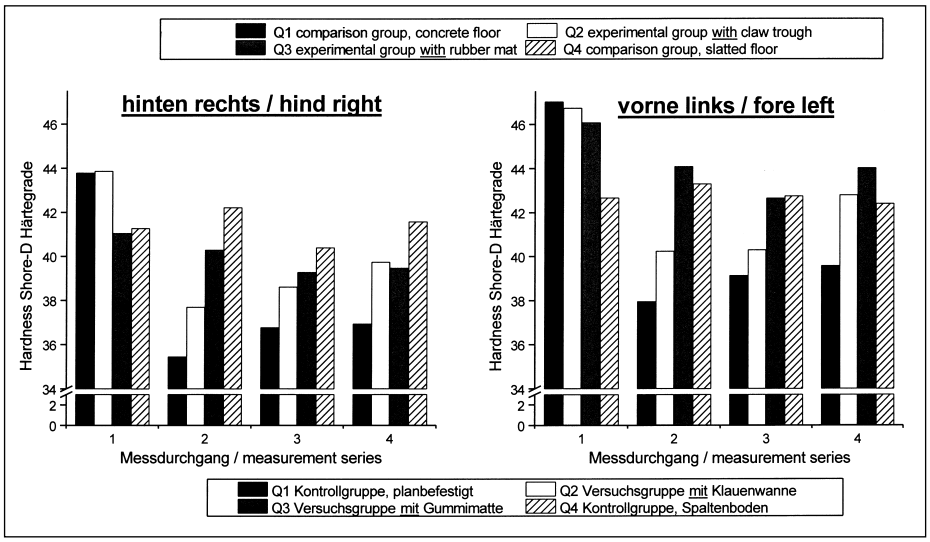

Fig. 3: Measurement of hoof hardness every six weeks during main experiment

Because hoof diseases especially affect the rear hooves, the hoof bath was situated in the rear section of the feeding stand. There was separation between individual feeding places to prevent animals standing at an angle to the feeding fence and thus making the hoof bath extremely dirty.

As further investigation variant a feeding area on slats featured the slats covered by rubber matting (left half, *fig. 2*). A disinfective substance was applied onto the rubber coated slatted flooring to give a drying and disinfecting effect. Through the insertion of the hoof bath and application of the rubber mat in the feeding stands, a long application period for the materials was guaranteed because the animals spent around 30% of the day in the area. A further advantage compared with the possible application of a hygiene material in the cubicles was that the animals stand in the feeding area so that a very close contact between hoof and materials is achieved, whilst contact with the udder is avoided.

Trial description and investigation parameters

The practical conducting of the trial was divided into a three and a half month pre-investigation, and a six-month main investigation, period. The former was to select the litter material and for testing the hoof-related investigation and recording systems as well as testing the functionality of the hoof bath and the rubber covered flooring of the feeding stand. In the main trial were featured four animal groups each with 12 milking cows. On the solid flooring, group 2 had a hoof bath and group 1 none, and on the slatted flooring group 3 had rubber matting and group 4 none.

The hoof baths and rubber matting in each case had the selected material applied. The following parameters were recorded with the 12 cows in each group:

Hoof-specific data:

1. Hoof horn moisture, sole and wall
2. Hoof horn firmness, sole and wall
3. Length measurements such as dorsal wall length and „trachten“ height
4. Dorsal wall angle
5. Sole area
6. Evaluation of leg positioning and hoof form and
7. Clinical inspection

Measurements were carried out four times at intervals of around six weeks with dividers, ruler, protractor, firmness-tester according to shore D and conductivity meter. Photographs were made for documentation to cover points 5 to 7.

Additionally recorded were general data such as body size and weight and BCS.

Regarding the flooring, recording and measurements included: SRT value of the solid flooring and thermographs of the slatted flooring.

Results

The construction of hoof bath and feeding stand was only slightly altered. The bath was made shallower in order to reduce material use, and to avoid the flooring of the stand being too angled with associated material movement. The length of the stands was shortened after the pre-investigations.

Figure 3 shows the results of hoof horn sole firmness measurements rear right and front left. These feature the average value of all 12 measurement point of a hoof pair, as shown in *figure 4*.

The hooves of animals on the slatted flooring side were dryer and harder than those on the solid flooring. This agreed with literature findings. Based on firmness values according to shore D, the animals with the hoof bath and straw pellets (group 2) had harder hoof soles than the control group (group 1). On the slatted flooring with rubber matting the cow front hooves (group 3) were harder and the rear ones were softer compared with the control group (group 4). A qualification that has to be made here is that the results from the different floorings were based only on a single parameter (hoof horn sole firmness) and therefore cannot be accepted as an absolute statement as to which variant is „better“ or „worse“. This is only possible after comprehensive evaluation of all parameters. According to the results it can, however, be proved that the characteristics of dairy cow hooves can be actively influenced through the altered surfaces in the feeding area. Still to be produced for a conclusive observation, however, is the direct relationship with the clinical investigation data.

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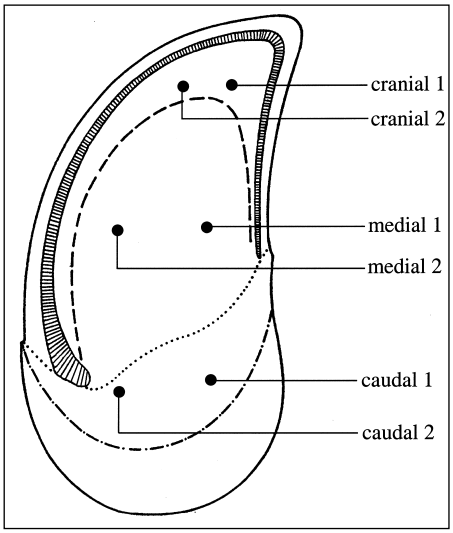

Fig. 4: Points of measurement for hardness according shore-D at the sole of the hoof