

# Hoof health and fertility

## The importance of special loose housing design

*Hoof and fertility problems are increasingly apparent in loose housed dairy cattle. This has meant that altogether the annual culling rate can be up to 45%. Much information indicates that the quality of the housing environment exerts a positive as well as a negative effect here. For this reason, the condition of the cattle and form of housing is recorded here in detail in order to establish starting points for the improvement of housing. It is shown that hoof health and fertility can be positively influenced by walkway and lying area design according to the requirements of the animals.*

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### Keywords

Traffic areas, keeping techniques, claw health, fertility, dairy loose housing systems

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Loose housing for dairy cows is open to improvement from the point of view of animal health – in particular with reference to hoof condition and fertility status. According to various present-day sources culling through hoof problems can be up to 10%; the proportion of culling through fertility problems can reach up to 35%. Because of this it must be asked whether housing systems have influence on these parameters. If this can be proved, then housing systems should be designed to offer solutions for the given problems. Should this be possible, then in most cases economic advantages such as reduced veterinary costs, extended productive life for the animals, reduced culling rates and increased milk production can be expected.

### Methods

For the assessment and development of floor design in loose housing a comprehensive, systematic and repeated inspection of hoofs is an absolute requirement [1, 2, 3, 4]. The differentiation of a variety of changes and degrees of intensity permit appropriate statistical analyses according to the collated data (comparison of averages, regression analyses, cluster analyses). In an investigation from [2] into walkway design in cubicle housing three types of floor were inspected on a total of 19 farms. In further work [3, 4] four variations of loose houses without cubicles were investigated in a total of 29 farms. The assessment in each case was carried out under comparable conditions. Regarding housing environment influence on fertility status, a differentiated field data assessment, among other aspects, was carried out on around 140 farms [5]. In that a multi-factorial influence factor structure had to be taken account of here, there was cooperation with several disciplines (Physiology and Pathology of Livestock Reproduction, JLU Gießen and the Livestock Feed Advisory Service in Hessa). The data so collected were then assessed via the appropriate statistical procedure.

### Results

Currently there are many investigational results available from assessments of walk area floor design with regard to hoof health in cubicle housing. Thus [2] established that, in the assessment of sole wear in connection with walkway design in cubicle house construction, slatted flooring elements (functional measurements: slat width (8.3 cm; slit width ~3.5 cm) showed the highest proportion of unaltered hoofs. In second place here came solid flooring (*fig. 1*). Furthermore, skid resistance of flooring was investigated via SRT values (dimension-less unit of friction resistance) in this work, independently of the design variants of walkways. This research was divided into four groups. With an increasing SRT value, it can be assumed that with that, the grip or roughness of the assessed surface also increased. It is therefore tendential with higher SRT values – according to present knowledge – that a superior footsureness is to be expected. In this respect the isolated sole alterations are, for example, to be observed in association with the SRT value of the floor design (*figure 2*). It is clearly noticeable that, with an increasing SRT value, the proportion of cows with no changes in their hooves increased. In the case of the medium or intensive degrees of change the tendency is, however, not so uniform. Nevertheless, the proportion of animals with medium or intensive changes on their soles tends to be reduced in the presence of higher SRT values.

Investigations into the loose housing without cubicles [3, 4] also showed definite associations between the design of housing flooring and hoof conditions. Thus, according to [3] in one-level bedded loose housing there were substantially more animals to be found with 'wedge soles' than in two-level bedded loose housing where the walkways are solid floored (*table 1*). Within the two-level variants with deep-bedded lying areas and slatted walkways a clearly lower proportion of altered hoofs was apparent, according to [4], when the walkways were designed

*Table 1: Percentage distribution of "wedge sole claws" of investigated keeping systems "one area deep bed loose housing" (EF-TF) and two-area deep bed loose housing with solid flooring exercise alleys (ZF-TF pl. L)*

Housing system	Cows n	Wedged hoofs in %
1st trial		
EF-TF	168	25,0
ZF-TF pl.L	292	10,6
2nd trial		
EF-TF	141	12,1
ZF-TF pl.L	190	3,2

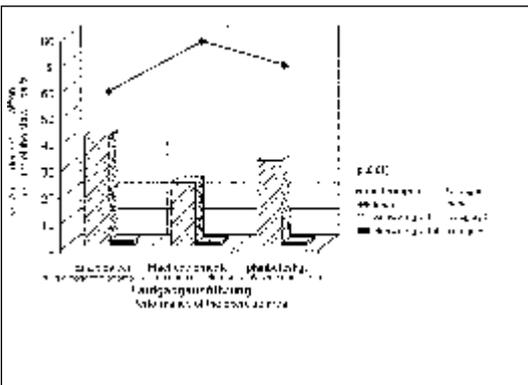


Fig. 1: Sole exceeding depending on type of exercise area (n = 8728 claw halves) acc. to [2]

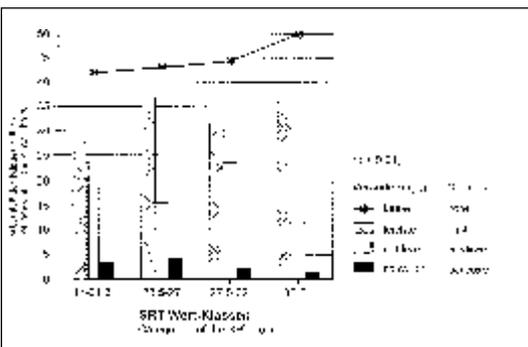


Fig. 2: Isolated sole changes depending on SRT-value of exercise area acc. [2]

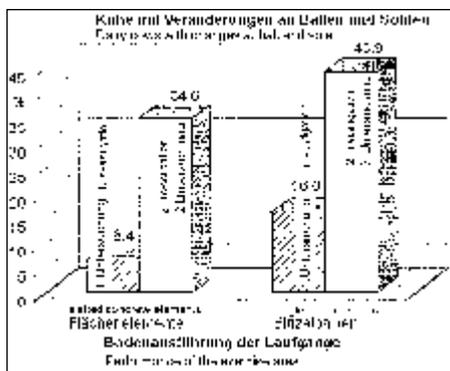


Fig. 3: Occurrence of interdigital hyperplasia in two area deep bed loose housing with perforated exercise alleys (1<sup>st</sup> investigation: n = 332 cows, 2<sup>nd</sup> investigation: n = 262 cows) acc. to [4]

with surface elements and functional measurements suited to the animals (figure 3). In the case of the hoof disorder limax comparative associations were determined. In this case, the proportion was also clearly lower with floor elements. This result also confirms the data collected in the investigation of [2] in cubicle housing and vice versa.

With regard to fertility status, [5] investigated associations between hoof conditions and criteria for the determination of signs of oestrus (figure 4). In this case, display of oestrus signs decreased where the hoof condition was intensively changed. Moreover, it is

known that the milking performance also is reduced in the presence of increased hoof alterations. Influences of type of housing on fertility status also become apparent when cubicle width per herd was observed. In such cases, where the average lying area width is too small, the expression of oestrus within the group concerning 'problem animals' is reduced or hardly identifiable (figure 5). Because of the required multifactorial analyses of housing-technological factors such as individual lying area suitability and housing volume per adult animal unit, these have a significant influence as co-variants on the reproduction parameters. This approximately means that, in the case of comparatively higher housing volume per adult animal unit and animal-suited lying areas, the period between calvings will be reduced.

### Conclusion

Regarding the design of the walkways the investigations carried out here show that, according to present knowledge, slatted flooring as area elements with measurements suited to the animals [7 – 8 cm slat width and 3 cm (± 0.5 cm) slit width) result in the highest proportion of non-altered hoofs. This applies to cubicle houses as well as to the two-level housing with solid-floor walkways. The necessary achievement of a good hoof condition is further supported by the fact that there are clear associations between the condition of hoofs and the criteria on fertility status. Regarding the achievement of good reproduction parameters with dairy cattle a good individual animal suitability of cubicles is required. This special problem area is not present in multi-level loose housing. However in such cases the lying area should allow at least 6 to 7 m<sup>2</sup> per animal. Further differentiated analyses, as well as results regarding the total problem area, are to be found in the presented literature. There still exists a necessity for research on cleaning frequency effect with regard to design of walkways and standing areas in loose housing with slatted and solid floor walkways. Currently, investigations on this subject are being carried out in our institute. Research indicates that, in part, sometimes complicated constructional solutions are necessary in order to achieve good hoof condition and reproduction performance. Thus the effect of constructional variants should be tested so that these can be economically classified.

### Literatur

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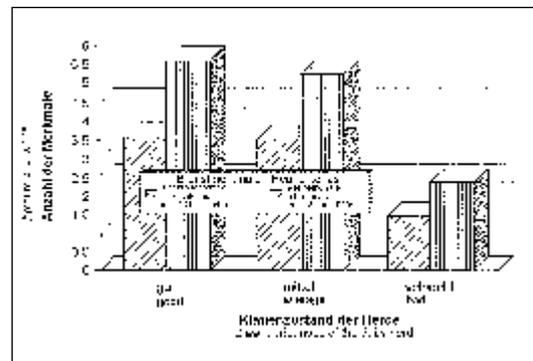


Fig. 4: Number of certain and of all heat criteria, depending on assessment of claw health status of the respective herd (n = number of farms) acc. to [5]

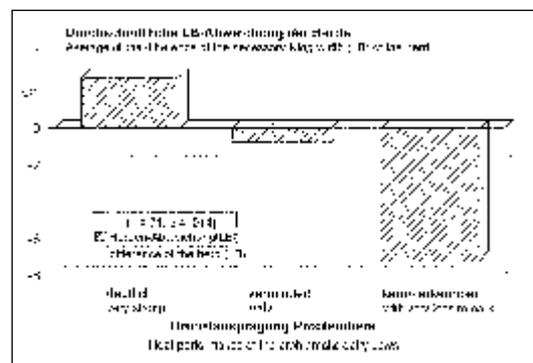


Fig. 5: Degree of heat with problem cows (with respect to fertility status), depending on individual adjustment of lying area with (n = number of farms) acc. to [5]