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Feeding Behaviour in Automatic Milking Systems

Influence of the Social Rank of Dairy Cows

The social rank of an animal greatly influences its behaviour; although in daily herd management it only plays a small role. In automatic milking systems animal behaviour increases in importance, because it can be decisive for the system capacity. Based on automatically recorded evaluations of social rank, its influence on feeding behaviour was analysed from various types of cow traffic. It could be shown that with improved access to the resources feeding area and milking box (from guided to free cow traffic), the differences between high and low ranked cows became smaller.

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Keywords

Automatic milking system, feeding behaviour, social rank

Literature

References can be retrieved under LT 05503 at http://www.landwirtschaftsverlag.com/landtech/local/fliteratur.htm.

According to Syme & Syme [6] the social rank of an animal is very important, when resources as feed or water are restricted. This restriction can be spatial or temporal. Normally high ranked animals have unhindered access to the restricted resources, while low ranked animals can not reach them or are displaced. When using automatic milking systems the feeding area represents such an restricted resource, depending on the chosen form of cow traffic. Therefore effects on feeding behaviour can be expected, depending of the rank of an animal.

Starting from this initial point, the aim of this investigation was, to determine the effects of different forms of cow traffic on feeding behaviour, regarding high and low ranked cows.

The investigation was carried out in two experimental farms, which used single box systems of Lemmer-Fullwood (farm 1) and DeLaval (farm 2). On both farms free, guided and selectively guided cow traffic was analysed (*Fig. 1*).

The rank indices of the cows were calculated based on the displacements at the feeding lane as described by many authors (e.g. Rutter et al.) [5], Kenwright & Forbes [2] or Olofsson [4]). These displacements were recorded automatically by electronic weighing troughs. Within one cow pair a cow was rated as dominant if she displaced the other cow twice as often as she was displaced by the same cow. According to the percentage of cow pairs that a cow dominated, she received a dominance value between 0 (subdominant to all cows) and 1 (dominant to all cows). Animals with a dominance value < 0.4 were classified as low ranked, animals with > 0.6 as high ranked.

When identifying the animals electronically at the roughage weighing troughs, only time and duration of staying at the feeding fence, but not in the feeding area, could be detected. Therefore, according to Tolkamp et al. [7,8], three critical intervals (30, 50, 82 min) were determined, which divided (short) intervals within a feeding period from (longer) intervals between feeding periods. Based on these intervals it was calculated whether an animal was within a feeding period. Assuming that animals do not leave the feeding area within a feeding period, this led to a calculated number of animals in the feeding area for each point in time. The results were verified by comparing them with video recordings on farm 1.

A more detailed description can be found in Harms [1].

Number of animals in the feeding area - observed and calculated values

In *Figure 2* the observed number of animals in the feeding area is compared with the calculated number. All in all, a good correlation

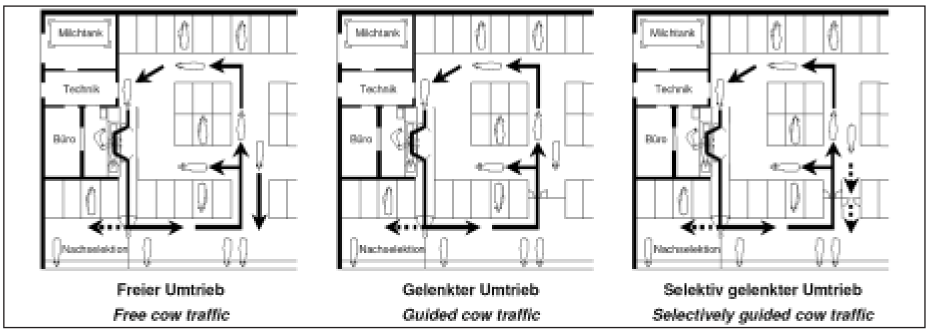

Fig. 1: Forms of cow traffic investigated

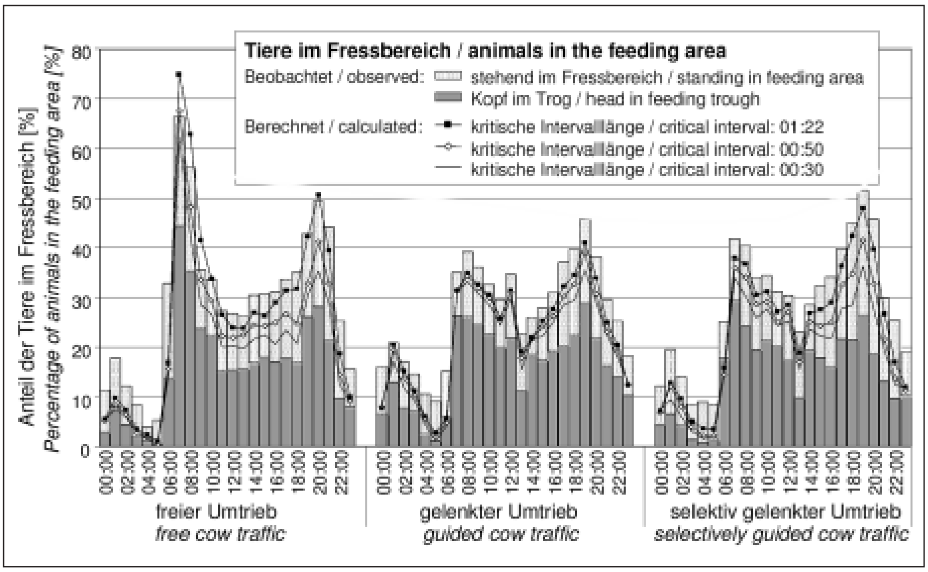

Fig. 2: Observed and calculated percentage of animals in the feeding area (farm 1)

between the observed and the calculated values was found. They matched best, when the calculation was based on the longest critical interval (82 min). However, it was obvious that the feeding behaviour cannot be described with one critical interval over the whole day. In free cow traffic the number of cows in the feeding area was overrated for about 10% between 7 and 9 a.m., whereas in the night hours it was underestimated in all forms of cow traffic.

Nevertheless this analysis showed that the chosen method leads to results (calculated number of animals) that can be used to compare different conditions. Due to the best congruence with the results of the video recordings, further analyses were done with a critical interval of 82 min.

Number of animals in the feeding area ñ influence of the social rank

On farm 1 in free cow traffic, only small differences between the two dominance groups were observed, as can be seen in *Figure 3*. In contrast to this, in guided cow traffic the two groups differed clearly. Between 6:30 and 9:30 a.m. a smaller part of the „low ranked“ cows than of the ìhigh rankedî ones stayed in the feeding area. Between 2:30 and 4:00 a.m. this ratio was inversed. Selectively guided cow traffic led to similar results. Apparently the reason for this effect is the restriction of the access to the feeding area in both forms of guided cow traffic. This was confirmed by the differences in the visits to the milking box. In both forms of guided cow traffic more „high ranked“ than „low ranked“ cows visited the milking box at the time of feeding.

On farm 2 all in all, the results were similar to farm 1, but the diurnal rhythm was less pronounced in all three forms of cow traffic. One reason for this might be the less restrictive feeding on farm 2, so the animals had more feed available in the early morning hours. The biggest difference compared to farm 1 was found in selectively guided cow traffic, which showed only a negligible difference between „high“ and „low ranked“ during feeding on farm 2. This effect was largely due to the use of active selection gates instead of passive ones between the resting and the feeding area. Cows adapted more easily to these gates and used them more frequently.

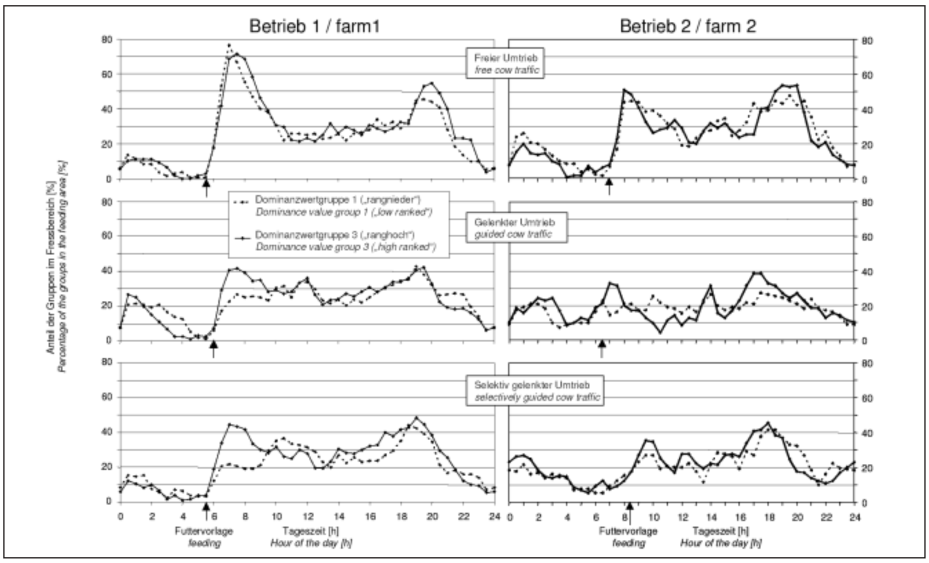

Fig. 3: Calculated percentage of high and low ranked animals in the feeding area [%] (critical interval = 82 min.)

Conclusions

It could be shown, that the number of animals in the feeding area can be estimated by calculating feeding periods based on the identifications at the feeding fence. The estimation was best, when using a critical interval of 82 min, which is in the upper range found in literature. The differences between calculated and observed values varied depending on the time of day. Possible reasons for this are the natural animal behaviour or external effects (e.g. feeding). A differentiated analysis of the intervals might improve the model.

The dominance values, which were determined automatically, led to plausible results for the daily rhythm of feed intake. At the time of feeding „low ranked“ animals had only limited access to the restricted resource feeding area compared to the „high ranked“ cows. Increasing this restriction (from free to guided cow traffic), the differences between high and low ranked animals increased. Comparing the two farms, it could be shown, that a restriction in the amount of feed probably lead to a more pronounced daily rhythm and increased the differences between high and low ranked animals.

It is reported by Olofsson [4] that dominance values can be calculated by using the order between two animals entering the milking box within a short period of time. Combined with the results presented in this investigation this can offer a method which allows the farmer to estimate the effects of different management strategies on high and low ranked animals without the need of investing in additional hardware.