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Nest Occupancy Rate in Automatic Single Nest Boxes for Laying Hens in Group Housing Systems

In group housing systems for laying hens laying performance and laying behaviour are decisive criteria in animal welfare regulations and breeding. The Weihenstephan Funnel Nest Box makes it possible to record these parameters. Data analyses of a flock over a period of nearly one year showed an average nest occupancy rate of 37 %. A nest occupancy rate of more than 80 % was observed during the main laying activity in the lower nest row for more than two hours and for approximately one hour in the upper nest row. The number of hens visiting the lower row was higher, whereas the duration of the nest visits was higher in the upper row.

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Keywords

Nest occupancy rate, laying behaviour, automated data recording

Literature

Literature references can be called up under LT 06311 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur.htm.

The needed number of nest boxes per hen was so far estimated by the number of floor eggs [1] or from investigations with small groups [2, 3]. Meanwhile the number of hens per single nest box as well as the number of hens per square meter in group nests is obliged for the housing of laying hens since the relevant regulations came into effect [4, 5]. The Weihenstephan Funnel Nest Box (FNB) [6] offered for the first time the opportunity, to investigate the nest occupancy times of single nest boxes continuously over 11 months on a highly accurate level.

Material and Method

The FNB offers the possibility to automatically register the laying performance and behaviour of every single hen in a flock. In a section of the experimental station Thalhausen (Technical University of Munich) 48 FNB (sketch and functional specifications were given by [6]) were installed in two rows with 24 single nest boxes per row (*Fig. 1*). It is known from literature that nest boxes on a higher level are less frequented by the hens [1]. Therefore the upper nest approaching board was built wider (~ 50 cm) than the lower board (~ 30 cm), in order to reduce the effort for the hens to reach the upper level. Furthermore additional nipple drinkers in front of the upper nest row and two bridges from the aviary to the upper nest approaching board were installed, to achieve an equal distribution of the hens on both levels. Every hen was tagged with a glass transponder (23 mm, HDX, Texas Instruments, ISO 11784/11785), which was tightened to one leg using a foot ring (RoxanID, LegBand, modified). Every single nest box was equipped with a trapezoid shaped antenna in the floor, where the hens were identified. Four single nest boxes were combined to one nest unit, and each nest unit was equipped with a reader unit with four RFID-modules. All reader units were connected to a PC using a RS485 bus-system. Two software packages, which were developed at the Institute for Agricultural Engineering, were used for reader control, data collection and data evaluation. Using a high polling frequency of one dataset per second, enabled an exact recording of hens entering or exiting the nest boxes and therefore an exact measurement of the nest loads. Video surveillance resulted in an identification reliability of hens entering or exiting the nest boxes of 97.8 % [7]. The evaluation of the nest load of single nest boxes was carried out with a mixed flock of Lohmann Silver (LS) and Lohmann Selected Leghorn (LSL) hens (initial flock size: 337 LS and 29 LSL hens). At the start the ratio hens : single nest boxes was at 7.6 : 1 and therefore at the upper limit. A total of twelve laying periods (each with 28 days) could be evaluated. Data recording started together with the first laying period at the 22. 1. 2005 and ended at the 20. 12. 2005. During this period data could be collected on 330 days. The start of the artificial light day varied due to the experimental set up, and started at 3 p.m. until the middle of the third laying period (22. 1. to 3. 4. 2005), thereafter at 6 p.m. (4. 4. to 13. 11. 2005) and from the middle of the 11th laying period at 5 p.m. (14. 11. to 20. 12. 2005).

Fig. 1: Arrangement of the nest unit 1 to 12 in the hen house

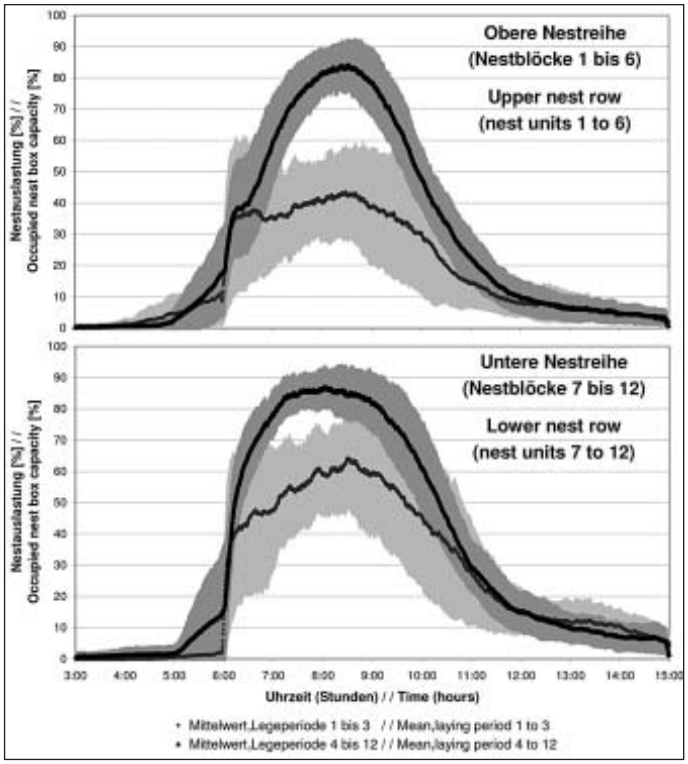

Fig. 2: Nest occupancy rate for the upper and for lower nest row

Nest occupation rates

The various actions for an equal distribution of the hens on the upper and lower nest row resulted in an amount of 45 % of all nest eggs being laid in the upper nest row. The number of floor eggs was on average around 4.5 %, which indicates a good acceptance of the nest boxes. Nevertheless the nest occupancy *(Fig. 2)* in the upper nest row was less than the nest occupancy in the lower nest row. The nest loads were considerably lower during laying period 1 to 3 and single values varied enormously, compared to the later laying periods. The low nest loads resulted on the one hand from the start of the laying activity and on the other hand from a reduced laying performance during an infection with *Mannheimia haemolytica* in March 2005 (laying periods 2 and 3), which also explains the high standard deviation. Due to the infection the nest loads during these laying periods are not exemplarily. From laying period 4 to 12 the nest boxes in the upper nest row had a nest load of more than 80 % for about 1 hour (7:53:00 to 8:54:30) and the highest average nest load was at 84.1 %. In contrast, the nest boxes in the lower nest row had for more than two hours a nest load of more than 80 % (7:04:15 to 9:11:00) and the maximum average nest load was 87.3 %. The low standard deviation emphasises similar nest loads during laying periods 4 to 12. The laying activity in the morning started synchronically to the artificial light day.

Number of hens per nest box and average duration of nest visits per hen

The number of visits and the duration of the visits to a nest box for the laying periods 4 to 12 are shown in *Figure 3*. The highest number of hens visited the four nest boxes of nest unit 12 (on average 10.2 hens per nest box) and the lowest number the four nest boxes of nest unit 2 (on average 5.8 hens per nest box). The average number of hens which visited the lower nest row was 8.7 hens per day and for the upper nest row 6.9 hens per day, respectively. Nest visits without an egg laid occurred more frequently in the lower nest row; on average every nest box of the lower nest row was visited from 4.2 hens that did not lay an egg, in the upper nest row there were only 2.9 hens, respectively. The number of nest visits without an egg laid showed again the maximum for nest unit 12 (6.8 hens) and the minimum for nest unit 2 (2.1 hens). Nest visits where an egg was laid, had an average duration of 29 minutes and 54 seconds. Nest visits without a laid egg were much shorter and lasted on average for only 10 minutes and 7 seconds. The average duration of all visits to the upper nest row (mean 30 minutes) was longer than to the lower nest row (mean 28 minutes and 36 seconds). Whereas the nest visits to nest unit 2, with the lowest number of visiting hens, had the highest average duration (32 minutes and 12 seconds), the visits to the next by nest unit 1 had the lowest average duration (27 minutes and 40 seconds).

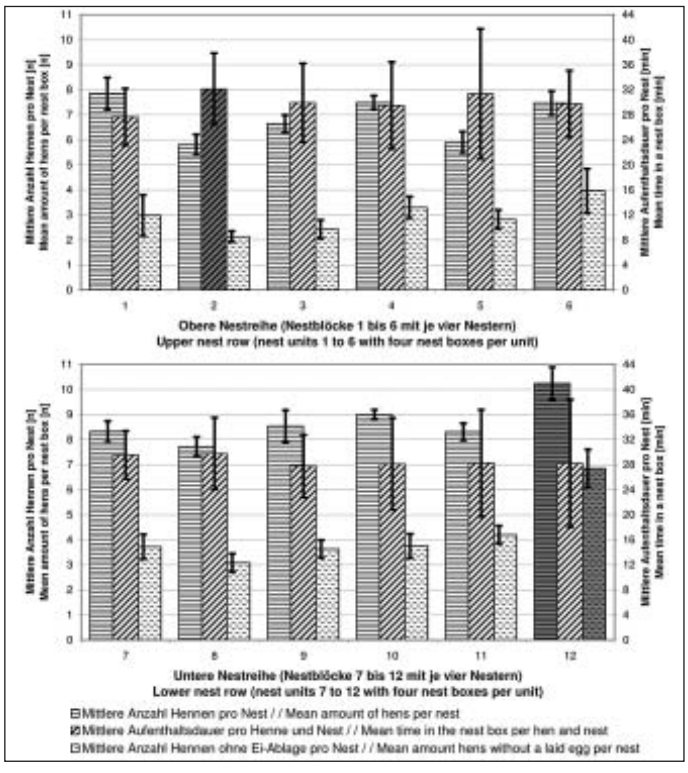

Fig. 3: Mean number of hens visiting nests (in total and without an egg laid) and mean duration of all nest visits during laying period 4 to 12

Conclusion

The amount of eggs laid in the upper and lower nest row show that the efforts for an equal distribution of the hens to all nest boxes were successful. Nevertheless the behaviour of the hens in the upper nest row, with longer nest visits and less visits without an egg laid, was different to the lower nest row. Shorter nest visits and higher changeover rates for the hens in the lower nest boxes approve the mentioned literature, which postulated preferences of the hens for lower nest boxes [1]. There was a tendency that the hens visited marginal- and centre- positioned nest boxes with a higher frequency and the duration of the visits was shorter in these nest boxes. The Weihenstephan Funnel Nest Box proved as a reliable working technique, which is capable of producing a substantiated and individual based data source for breeding and ethology.