Georg Wendl, Stefan Thurner, Georg Fröhlich, Stephan Böck and Robert Weinfurtner, Freising

Devices to Individually and Automatically Record the Performance and Behaviour Parameters of Laying Hens in Group Housing Systems

To automatically record the ranging and laying behaviour, as well as the laying performance, an electronic pop hole and an electronic laying nest box were developed and evaluated. Both systems make it possible to gather data exactly from each individual animal over longer periods of time with low labour input. Through this, data on various behaviour and performance parameters during the whole laying time has become available for the first time. It can be used to optimise group housing systems and to breed hybrids, which are better adapted for group housing systems.

Dr. agr. Georg Wendl is director and M.Sc. Stefan Thurner, Dr.-Ing. Georg Fröhlich, Stephan Böck as well as Dipl. Ing. (FH) Robert Weinfurtner are staff members of the Institute for Agricultural Engineering and Animal Husbandry of the Bavarian State Research Centre for Agriculture, Vöttinger Str. 36, D-85354 Freising;
e-mail: *Georg.Wendl@LfL.bayern.de*

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Keywords

Electronic animal identification, laying performance and behaviour, ranging behaviour, laying hens, automated data recording

Literature

Literature references can be called up under LT 07SH01 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur.htm.

Currently the laying hen husbandry is facing a change. Due to the new husbandry directives, according to the regulations at the federal and EU-level [5, 7], increasingly floor and free-range systems are in operation. Besides the social behaviour, which is also important for enriched cages, nest box and free range acceptance gain more importance in floor and free-range husbandry systems. So far information according to this context has been or could only be collected for the whole flock, but not for the individual hen [1, 6]. However, data related to individuals are necessary, because they are the basis for calculating breeding parameters and thus needed for a selection of adapted hybrids [3]. Therefore the objectives of the project were to develop and evaluate systems for an automatic and individual recording of the ranging behaviour, the laying behaviour and the laying performance of all hens in a flock, using the RFID-technology.

Material and methods

For the recording of the free-range behaviour the Electronic Pop Hole (EPH) and for the recording of the laying behaviour and performance the Funnel Nest Box (FNB) were developed. Both systems are based on the individual electronic animal identification with low frequency glass transponders (according to ISO 11784/11785), which were inserted into a leg ring. The EPH (*Fig. 1*) was designed in a way that only single hens, one after the other, could pass through the pop hole. During the passage the hens are registered at two antennas, embedded in the approaching board. With the chronology of the readings, the direction of the passage can be determined.

The FNB (*Fig. 2*) was designed as a single nest box, which can be divided in three major areas, the approaching slat, the nest box and the egg collecting device. The hens enter the nest box from the approaching slat through the trap device, which separates the hens and locks the occupied nest box. The antenna, which reads the transponder at the hen's leg, is embedded in the funnel nest floor. Furthermore the funnel shaped nest floor guarantees that every egg rolls out of the nest box and can be registered at the mechanical egg sensor behind the nest immediately after laying. Thereafter the eggs are collected in the order of laying in the egg collecting tube throughout the day. The assignment "hen - egg" can be achieved by combining the position of the egg with the egg sensor signal and the transponder signal. Each antenna in the pop hole and nest box is connected to a single RFID-module, whereas all RFID-modules are synchronised. Four antennas respectively four RFID-modules are integrated in a fourfold reader unit [2]. All reader units consist of eight sensor inputs, where the signals of the seesaw egg sensors are registered. Via a RS485 bus-system, up to 50 reader units can be connected

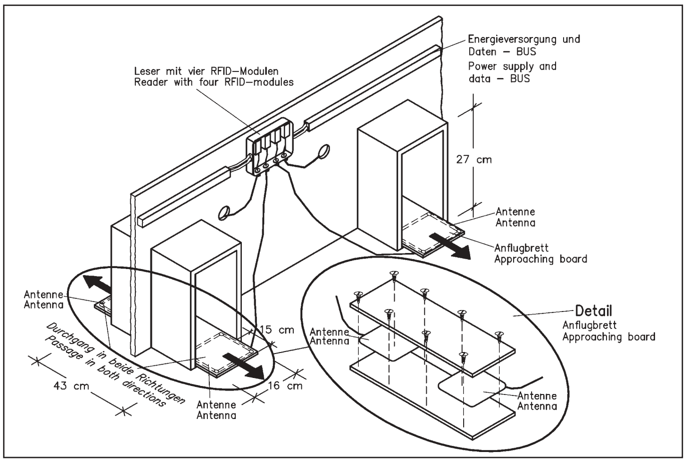

Fig. 1: Sketch of the Electronic Pop Hole

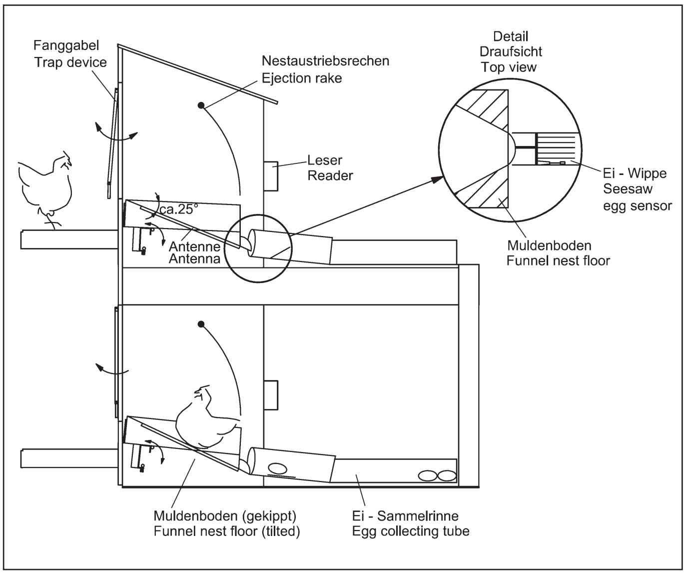

Fig. 2: Sketch of the Funnel Nest Box

to a PC, which is responsible for reader control, data recording and data evaluation. By means of a high polling frequency the starts and stops of nest box visits of the hens, the time of oviposition as well as the passage time through the pop hole can be recorded every second.

At the experimental station Thalhausen of the Technical University of Munich a pilot installation with 48 FNB and 4 EPH was installed in a section with an aviary and a winter garden. Both systems have been tested with several flocks and data were recorded for each flock over the whole laying time (for 8 – 14 months). The results show an assignment reliability "hen – egg" of usually more than 95 % [10], respectively an identification reliability of the hens at both antennas of the EPH of usually more than 97 % [8]. At this point of time, the major reason for errors with the assignment "hen – egg" are sporadic double nest occupations of the single nest boxes.

Results about the nest occupancy times before and after oviposition

Consecutively exemplary results about the laying behaviour are presented for the tested breeds Lohmann Silver (LS) and Lohmann Selected Leghorn (LSL). Flock LS12 and LS14A had a high stocking rate with more than seven hens per nest, whereas flock LS14B (flock LS14A was reduced) and LSL16 had a lower stocking rate. Data were evaluated for all hens, which had been in the flock until the end of lay respectively until the reduction of the flock.

For the high stocking rates the duration of nest visits was on average about 30 minutes (LS12: 29.45 min; LS14A: 30.35 min) and therefore around 6 – 10 min shorter as for the lower stocking rates (LS14B: 36.56 min; LSL16: 41.86 min). The distribution of the nest visit times shows that for the LS-hens the number of hens, which were up to 30 min in the nest box, was between 50 and 60 %, whereas for the LSL-hens this value was only at 30 %. For the lower stocking rates the share of hens that stayed longer than 50 min in a nest box to lay an egg was increased, for flock LSL16 this share was even more than 30 % (*Fig. 3*). Generally it could be shown that hens, which stayed longer in a nest box to lay an egg, also spent a higher share of the nest visit time in the nest box after oviposition. On average this share of the nest visit time was 27.6 % for flock LS12. For flock LS14 this share of the nest visit time was slightly higher but did not change due to the reduction of the stocking rate (LS14A: 34.9 %; LS14B: 36.5 %). In contrast the hens of flock LSL16 spent more than half of the total nest visit time in the nest box after oviposition (55.8 %). For the low stocking rates it was remarkable that hens, which were up to 15 min in the nest box, had a very high share of the nest visit time after oviposition (> 50 %).

Conclusions and prospects

For the first time, reliable techniques (EPH and FNB) are available to record different behaviour and performance parameters of laying hens in group housing systems. The automatic recording of parameters from every single animal provides detailed data over a long period of time, which can be used for a systematic assessment of the husbandry systems and the suitability of single breeds for these husbandry systems. The presented results show only a marginal part of the possible evaluations with the FNB, further results for EPH and FNB can be found in literature [9]. The application of these techniques for the selection of laying hens for group housing systems helps to breed hens, which are better adapted to alternative husbandry systems. Therefore they should have lower need for flock management as well a lower labour input [4]. Further systems, based on high frequency transponders, which allow the simultaneous identification of several hens at the pop hole or in the nest box at the same time by means of an anti-collision system, are currently under development. Thus a wide electronic pop hole and the implementation of this system into a conventional group nest are possible. So the free-range and laying behaviour can be monitored in more commercial environments. Therefore possible differences between the behaviour with the EPH and FNB can be taken into account for breeding or the design of alternative group housing systems.

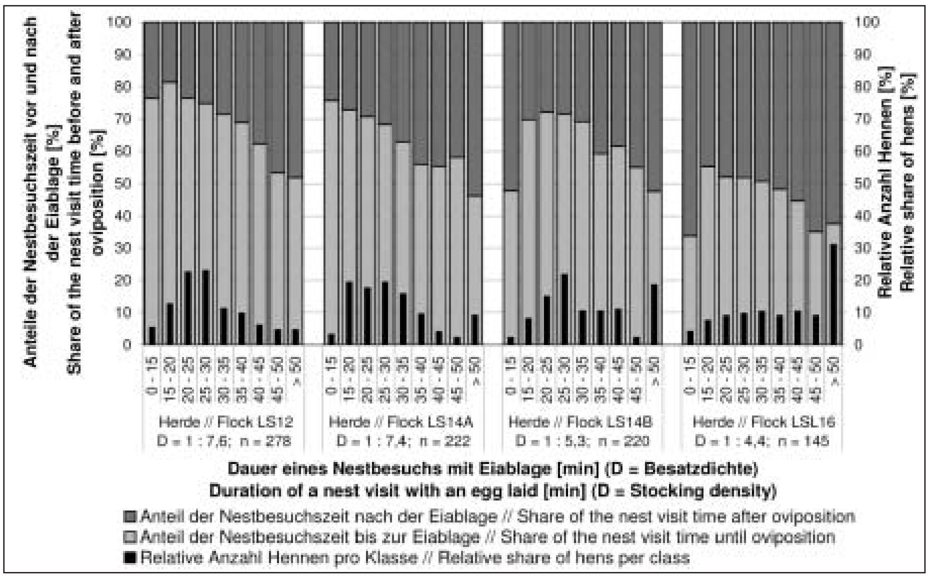

Fig. 3: Share of the duration of nest visits before and after oviposition for three flocks of different breeds and stocking densities