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Individual and Automatic Recording of Laying Performance and Behaviour

Funnel Nest Box for Laying Hens in Group Housing Systems

The Funnel Nest Box system for the automatic registration of laying performance and laying behaviour has been developed and evaluated. Different test procedures showed that more than 95% of the eggs could be correctly assigned to the individual laying hen. As an example, the laying behaviour of one hen over a period of 140 days is presented. The technique presented allows for specific selection in group housing and for diverse ethological investigations.

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Keywords

Electronic animal identification, laying hen performance, laying behaviour, laying hens, group housing systems, automated data recording

Literature

Literature references can be called up under LT 05517 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur.htm.

For turkey breeder farms a commercial automatic nest system has existed for a long time from the company M.G.H. [1] allowing individual laying performance recording. With the Flock Management System (FMS) the number of eggs and nest visits per day and hen can be monitored. For laying hens in group housing systems such a system was not available up to now. Different automatic nests from [2] and [3] can be found in literature, but they have been evaluated only with small groups of laying hens and over a short period of time. With the Funnel Nest Box (FNB), a further development of the Auto Nest described by [3], a prototype was first tested with a normal sized flock of laying hens over a long period of time.

Material and Method

The FNB (*Fig. 1*) is a single nest box, which can be separated in three different areas, the approaching slat, the nest box and the egg collecting device. The hens enter the nest box through the trap device, which is responsible for separating the hens and locking the occupied nest box. The funnel shaped nest floor is well accepted by the hens, they are mostly positioned with their heads towards the nest exit and this assures that every egg rolls out of the nest immediately after laying. A trapezium shaped antenna, which reads the glass transponder (23 mm, HDX, Texas Instruments, ISO 11784/11785) fixed to the leg of each hen with a leg ring (RoxanID, LegBand, adjusted), is embedded in the nest floor. The eggs are directly detected with a mechanical seesaw egg sensor when they leave the funnel floor. During the day the eggs are collected in the egg collecting tube in the same order as they were detected. Each antenna is powered by a single, synchronised RFID-module. Four RFID-modules together with four input channels for the seesaw egg sensor are combined to a fourfold reader unit. The reader units are connected via a RS485 bus-system to a PC. The PC controls the reader units, collects the data and analyses the data with a developed software package (HID). The time of the seesaw egg sensor signal together with the transponder signal and the sequence of the eggs in the egg collecting tube allows the assignment of each egg to the individual hen. A high polling frequency enables to register the nest entrances and exits in a resolution of one second. Therefore exact information about the nest exploration behaviour and laying behaviour are available. The developed FNB was first tested for 19 days in a test unit with four nest boxes, 40 laying hens (Lohmann Tradi-

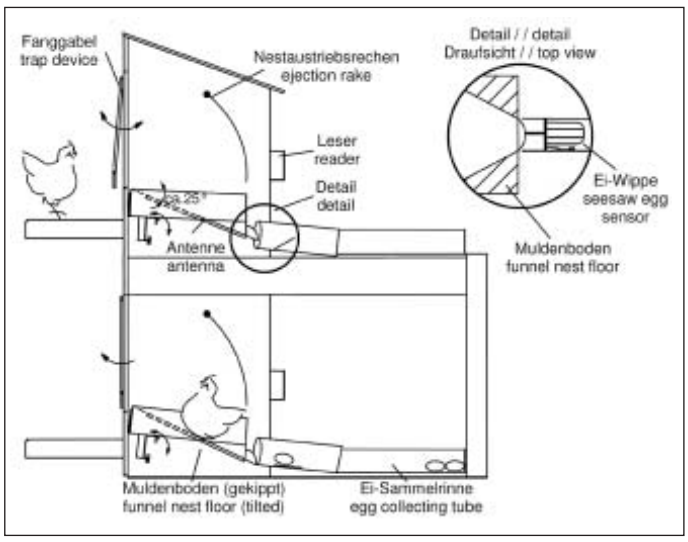

Fig. 1: Sketch of the funnel nest box

tion, LT) and video surveillance. Since December 2004 the FNB is tested in a pilot unit with 48 nest boxes and a flock of 337 Lohmann Silver hens (LS, brown layers) and 29 Lohmann Selected Leghorn hens (LSL, white layers). The rate of correct assignments "egg to hen" was determined on one side with video surveillance in the test unit and on the other side with the 29 white layers in the pilot unit. The video surveillance in the test unit was done with five digital CCD cameras (Panasonic, type WV-BP550 and WV-BP510; four cameras monitoring the nest interior and one camera observing the egg collecting tubes) and a digital video recorder (Dallmeier, type DLS 6 S1-edition). In the pilot unit, the correct assignment "hen to egg" was proven by verifying if the white eggs from the LSL, which were scattered between the numerous brown eggs (from the brown layers) in the egg collecting tube, were assigned correctly to a white layer.

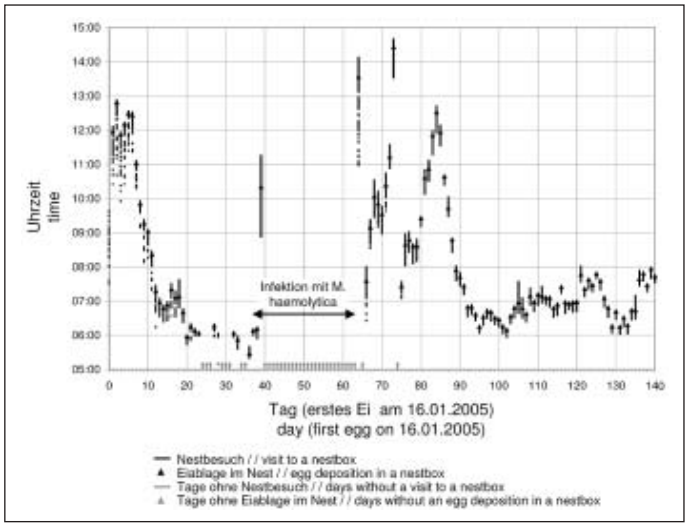

Fig.2: Laying behaviour and performance of hen C88 for 140 days

Results concerning the rate of correct assignments "hen to egg"

During the video surveillance 441 laying acts respectively eggs were visually evaluated (*Table 1*). A total of 423 eggs (95.9 %) could be assigned to the right hen. Errors at the seesaw egg sensor were responsible for 2.7 % of incorrect identified eggs. These errors can occur due to big hen droppings or due to an egg jam in the area of the seesaw egg sensor or due to eggs with an undeveloped or incomplete developed egg shell. A double nest occupation was found in 1.4 % of the laying acts and this fact was responsible that these eggs couldn't be clearly assigned to a hen. If two hens enter a nest box immediately in succession a double nest occupation can appear due to the fact that the trap device can not drop back between the two hens and the nest box is locked only after the second hen.

Versuchsanlage/Anzahl Nester Test facility/number of nestboxes	Versuchsstall/ 4 WMN Test plant/ 4 FNB	Pilotanlage/ 48 WMN Pilot plant/ 48 FNB
Tierzahlen und Herkunft Number of animals and breed	40 LT	337 - 328 LS and 29 LSL
Art des Tests auf Zuordnungssicherheit Test type for assignement reliability	Videoüberwachung Video surveillance	Weißleger + HID White layers + HID
Anzahl überprüfter Eier (n) Amount of evaluated eggs (n)	441	1257
Anteil richtig zugeordneter Eier [%] Eggs with correct assignment [%]	**95,9%**	**95,5%**
Eier mit Identifizierungsfehler [%] Eggs with incorrect identification [%]	2,7%	1,3%
Eier mit Problemen bei Plausibilitätstests [%] Eggs with plausibility problems [%]	-	1,6%
Eier mit doppelter Nestbelegung [%] Eggs with double nest occupation [%]	1,4%	0,9%
Eier mit unspezifischen Fehlern [%] Eggs with unspecific errors [%]	-	0,7%

WMN: Weihenstephaner Muldennest
FNB: Funnel nest box
LT: Lohmann Tradition (Braunleger / / brown layers)
LS: Lohmann Silver (Braunleger / / brown layers)
LSL: Lohmann Selected Leghorn (Weißleger / / white layers)
HID: Hühner Identifikation (Softwarepaket für Datenerfassung und Auswertung)
HID: Hen Identification (Software package for data logging and evaluation)

Table 1: Reliability of assignment hen - egg: test procedure with result

For the test of correct assignment "hen to egg" using the white eggs, a total number of 1257 eggs was checked and 95.5 % of the eggs could be assigned to a white layer. Errors with the registration at the seesaw egg sensor were responsible for 1.3 % and double nest occupation for 0.9 % of incorrect assigned eggs. Different plausibility checks with the software HID caused 1.6 % of the errors. For example, if one hen is assigned to two eggs at the same day, the plausibility checks do not assign this hen to any egg for that day and both eggs are classified as flock eggs. Unspecific errors, which can be e.g. manual writing errors, caused 0.7 % of the errors. Both test procedures show that the FNB is able to assign more than 95 % of the eggs laid in the nest box to the right hen.

Results showing the laying behaviour of a hen

The laying behaviour of one hen is illustrated in *Figure 2*. First explorative visits to the nest box were undertaken by the hen one day before she laid her first egg. The duration of the nest visits was the longest at the beginning of the laying activity and during an infection with *M. haemolytica*, with the longest uninterrupted nest visit lasting for two hours, 22 minutes and eleven seconds (day 39). At the beginning of the laying activity the hen visited several nest boxes before the laying act took place, in contrast at "usual" days, the hen selected and visited only one nest, sporadically two and hardly ever three. The duration of the nest visits at "usual" days varied roughly between ten minutes and one hour. In most of the cases the laying act took place just before the hen left the nest box, only sometimes the hen stayed in the nest box for some more time after the egg was laid. Despite the finding from [4], saying that the development of a hen's egg takes just under 25 hours, the found time difference from one egg to the following egg was for the observed hen from the days 6 till 13 and 84 till 92 under 24 hours, partly even under 23 hours.

Conclusions and prospects

It is the first time that with the FNB a reliable technique is available to register the laying performance and laying behaviour of laying hens in group housing systems. The results presented are only a part of possible analyses that can be done with the FNB, further results are described by [5]. The use of the FNB for the selection of laying hens for group housing systems promises origins that are better adapted to alternative housing systems and therefore they might have lower demands on flock management and herdsmen. Besides the recording the number of laid eggs, the egg quality can be investigated individually for each hen in group housing systems, without the restriction of movement, too. Furthermore the FNB can be used to answer various questions (nest exploration, laying behaviour, laying rhythm) in the area of ethology. The transponder can alternatively be attached to the wing of the hen using a wing tag, hence in a further step a second FNB will be developed for hens with wing tags.