Differences in nest preference of laying hens and their motivation to work for access to the nest

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In previous experiments we repeatedly found a small number of hens constantly choosing litter (wood shavings) for laying. We were interested in whether there are differences in prelaying behaviour between these hens (litter-layers) and hens laying in nest-boxes (nest-layers). We hypothesized that litter-layers will be more frustrated than nest-layers because they might not be able to find an appropriate nest site. The experiment was carried out with 21 LSL-laying hens which were individually housed from week 19 on. In each pen two trays with litter served as potential nest sites whereas one tray was complemented with a wooden nest-box. Eggs were collected daily and their position was noted. A push-door was placed in front of each potential nest site so that the hen had to push the door open to gain access to the respective nest site, but was left open until the 15th egg laid. Then a minimal resistance of 350 mN was set to push the door open. On the day of the 19th egg the behaviour in the last hour before oviposition was video-recorded for analysis of the following elements: foraging, resting, exploring, nest-inspection and nesting. The mean time spent on each behaviour was calculated and analysed for differences between nest- and litter-layers using a Kolmogorov-Smirnoff-two-sample-test. Nest-layers spent significantly more time resting than litter-layers (28.5% ± 13.3 vs. 12.6% ± 10.4; p<0.05) whereas litter-layers spent more time with exploring (24.9% ± 14.0 vs. 11.9% ± 7.8, p<0.05) and nest-inspections than nest-layers (17.2% ± 2.9 vs. 8.0% ± 6.5; p<0.05). No significant differences (p>0.05) were found for foraging (13.9% ± 7.0 vs. 14.6% ± 10.9) and nesting behaviour (34.2% ± 15.7 vs. 30.6% ± 16.5). As a high level of exploring suggests restlessness and may be regarded as an indicator for frustration, we conclude that in our experiment litter-layers had difficulties to find a suitable nest site and therefore continued searching throughout the last hour before oviposition. We conclude that mislaid eggs in commercially housed flocks may be due to a number of consistent floor-layers which do not perceive the offered nests as appropriate nest sites. In respect to the welfare of these hens as well as to the economic losses due to floor eggs we strongly suggest further studies on how nest sites have to be designed to fulfil the expectations of litter-layers.

Keywords: laying hens; nest-layers; litter-layers; welfare; mislaid eggs

Introduction

In Switzerland the Swiss Aimal Welfare Act (1978) and the Swiss Animal Protection Regulations (1981) prescribe that all standard housing systems or their components which are commercially sold need to be approved if they meet the needs of the animals. As also nests are part of these housing systems they need to be tested on their animal friendliness. Until now no guideline exists how ideal nests for laying hens should look like. Therefore our project is aimed at the development of a method...
to test the appropriateness of nests for laying hens and to analyse the hens motivation to visit these nests.

Egg-laying plays an important role in a hen’s life and the design of a nest site might have an influence on the behaviour of a hen and the choice of nest site (Appleby and McRae, 1986; Appleby et al., 1988; Brantas, 1980; Cooper and Appleby, 1996).

In commercial housing systems for laying hens, eggs not laid in the offered nests can cause high economic losses as these eggs need to be collected by hand and often have to be cleaned. Furthermore hens laying outside a secluded nest are more exposed. As after egg laying the tissue of the cloaca is visible for a short time, its shiny and red surface might be a stimulus for the other hens to peck at it. This can cause severe injury which might even lead to death. Therefore it is important for the hen’s welfare to offer appropriate nest sites.

Two potential nest sites, a tray with wood-shavings as a very basic nest, and a tray with a wooden nest-box was offered to each hen. The access to both nest sites was only possible via push-doors based on the design of previous studies (Duncan and Kite, 1987; Petherick and Rutter, 1990; Olsson and Keeling, 2002; Olsson et al, 2002) so that the hens had to work for the nest entry. We hypothesized that hens laying their eggs in the nest-box will show less signs of frustration or restlessness and will work more for nest access than hens laying in the tray with wood-shavings. We assumed that the litter-tray is not an ideal nest site for a hen as fundamental elements of seclusion are missing in that nest.

Materials and Methods

A group of 35 Lohmann Selected Leghorn (LSL) laying hens were commercially housed in a pen of 3.00 x 3.60 m. The pen contained a 3.60 m long perch and was littered with wood-shavings and some straw. Mashed food and water were available ad libitum. The light schedule started with 21 hours a day in the first week and slowly decreased until 8 hours in week 12.

With 19 weeks of age 21 hens of the group were randomly chosen and brought into the test shed. This test shed contained pens of 2 x 2 m in which the hens were individually housed. Each pen had a slatted floor. In the middle of the pen parallel to the entrance door a 2 m long perch with nipple drinkers underneath ran across the pen. Mashed food was available ad libitum in a food trough. To enable social contact between the neighboured hens, a window (0.50 x 0.35 m, with 0.15 m height from the floor) covered with wire mesh was cut in every second wall.

In the rear third of each pen a wooden frame across the whole length of the pen was installed. This frame was covered with wire mesh and only a small part in the middle of the frame was left open to enable access to the rear third of the pen. In each of the back corners a tray (0.40 x 0.40 m, height 0.09 m) filled with litter (wood shavings) served as a potential nest site. One of the trays was complemented with a wooden nest-box (0.33 x 0.28 x 0.37 m) open on one side (entrance) and at the bottom (litter forming the floor). The position (left or right corner) of the tray with the nest-box and the tray with litter was randomly and equally distributed over all pens.

Hens had free access to both trays. Eggs were collected daily and their position was noted. After a hen had laid her 15th egg, a push-door was installed into the wooden frame in front of each potential nest site in a way that the hen had to push the door open to gain access to the respective nest site.

A push-door consisted of a metall frame in which two wooden door wings were installed. A hen could open the door like a saloon door by pushing with their shoulders at the door wings. At each door an electronic unit registered each movement of the door with time and direction of the door opening and the aperture angle. With two spring scales at the push-door the resistance of the door opening could be regulated.

The resistance a hen had to push to lay her 16th egg in the favoured nest site was 3.5 N. After the 19th egg laid in the same nest site, resistance of the push-door was increased up to 4.5 N. After another two eggs, 1 N was added to the resistance. From this level on the resistance was increased in steps of 0.5 N each time a hen had laid two eggs in her usual nest at the given resistance. The experiment ended when a hen stopped laying or laid at a site which was not her usual nest-site for four consecutive days. The maximal resistance at the push-door at the end of the experiment was compared between nest- and litter-layers using Mann-Whitney-U-test. The morning a hen laid her 19th egg, the behaviour in the last hour before oviposition was recorded on video tape for analysis (scan sampling
every 15 seconds). The following elements were recorded: foraging (standing, sitting or locomotion with head held down), resting (standing or sitting with grooming), exploring (standing or locomotion with raised head), nest-inspecting (standing or walking in front of the wooden frame or standing in front of the nest with head raised or put into the nest) and nesting (all behaviour performed in the nest). The mean time spent on each behaviour was calculated and then analysed for differences between nest- and litter-layers using a Kolmogorov-Smirnoff two-sample-test. The data of one hen had to be excluded from the analysis because due to early lay not the full hour before oviposition could be observed.

**Results and discussion**

All hens successfully learnt to open the push-doors. Nearly all hens showed a very consistent choice of nest site from the beginning on. 15 hens constantly layed into the nest-box and 4 hens into the litter-tray. Only 2 hens revised their first choice within three days and changed from the tray with wood-shaving or from laying on the slats to the nest-box. The hens which laid their eggs into the nest-box were referred to as nest-layers, and hens laying into the litter-tray as litter-layers.

All but one hen, which was only pushing 7.5 N at maximum, pushed maximum resistances between 11.5 N and 18.0 N with no significant differences between nest- and litter-layers (U1 = 22.5; U2 = 37.5, p>0.05).

Nest-layers spent significantly more time resting than litter-layers (28.5 % ± 13.3 vs. 12.6 % ± 10.4; p<0.02) whereas litter-layers spent more time exploring (24.9 % ± 14.0 vs. 11.9 % ± 7.8, p<0.01) and performed significantly more nest-inspecting than nest-layers (17.2 % ± 2.9 vs. 8.0 % ± 6.5; p<0.05). No significant differences (p>0.05) were found for foraging (13.9 % ± 7.0 vs. 14.6 % ± 10.9) and nesting (34.2 % ± 15.7 vs. 30.6 % ± 16.5).

Even though we expected a higher motivation to access the nest-box and therefore higher maximum levels of resistance for nest-layers, no significant differences between both layer-types could be found regarding the maximum levels of resistance. We suggest that litter-layers were as motivated to lay in their nest-site as nest-layers but had more difficulties to choose a nest-site. Apparently, a small percentage of the hen’s population is determined to be litter-layers (Appleby et al,

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**Figure 1** Behaviour of litter-layers versus nest-layers at the 19th egg.

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As hypothesized, nest- and litter-layers showed significant differences in prelaying behaviour. As a high level of exploring behaviour suggests restlessness and may be regarded as an indicator for frustration, we conclude that in our experiment litter-layers had difficulties to find a suitable nest site and therefore continued searching throughout the last hour before oviposition. Apparently, the offered nest-boxes came closer up to the nest-layers’ expectation of an appropriate nest site. They showed less agitation and more resting during pre-laying.

From our results we conclude that the mislaid eggs in commercially housed flocks may be due to a number of consistent floor-layers which do not perceive the offered nests as appropriate nest sites. In respect to the welfare of these hens as well as to the economic losses due to floor eggs we suggest further studies on how nest sites have to be designed to fulfil the expectations of litter-layers. To reduce the negative effects of mislaid eggs it might be necessary to offer more than one nest type to a commercially housed flock of laying hens, at least one type for nest-layers and one for litter-layers.

References


SWISS ANIMAL PROTECTION REGULATIONS, 27. May 1981. Art. 27 (1), (2)e.