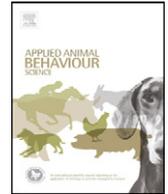




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Influence of nest-floor slope on the nest choice of laying hens

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ABSTRACT

Group nests in alternative housing systems for laying hens primarily fulfil the hen's needs for seclusion and protection. Commercial nests used in Switzerland are built according to the provisions of the Swiss Animal Welfare Legislation. However, nest types can differ in aspects, such as floor slope, that could have an impact on egg-laying behaviour. Floor slope has to be designed so that eggs roll away without breaking and so that hens feel comfortable laying their eggs. In commercial nests, the slope is usually between 12% and 18%. The aim of this study was to investigate the effect of floor slope on the hen's nest preference and laying behaviour. We predicted that hens would prefer nests with a lower sloped floor for evolutionary reasons and for reasons related to comfort.

Eight pens, each with 17–18 white laying hens (LSL), were equipped with two roll-away nests (0.54 m²) having different floor slopes (12% and 18%). Eggs were collected each day (from approximately 20 weeks of age until 28 weeks of age); the number of eggs in each nest and on the floor of the pens was recorded. Behaviour inside the nest was filmed for two consecutive days during the main egg-laying time from the second hour to the fifth hour (4 h) after lights came on in week 27/28. The following data were recorded: number of hens in each nest, the nest visits/egg number ratio, the number of sitting events, the body alignment of hens sitting in the nest and the number and duration of nest visits. Data were analysed with a repeated-measures ANOVA. There was no difference between the numbers of eggs in the two nests, but more hens were counted in nests with a 12% slope ($p = 0.027$). The ratio between the number of nest visits and number of eggs did not differ significantly between the nests. However, we counted more sitting events in the nest with 12% slope ($p = 0.007$). The percentage of body alignment towards the back ($p = 0.044$) and towards the front ($p = 0.028$) of the nest differed between the nests. Furthermore, for nest visits lasting between 10 and 90 min, we found significant differences in the total number of nest visits ($p = 0.039$). For visits in this range of duration, we also found significant differences for nest visits with sitting ($p = 0.025$) and for the number of nest visits with egg laying ($p = 0.049$). All of these differences favoured the 12% nest.

Both nests were generally accepted by the hens. However, because of the higher number of hens counted in the 12% nest and the higher amounts of nest visits and sitting events found in these nests, we recommend to use nests with a floor slope of 12% rather than 18%.

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1. Introduction

In all housing systems for laying hens, a protected and suitable single or group nest with litter or soft flooring is prescribed by the [Swiss Animal Protection Regulations \(2008\)](#). According to the [Swiss Animal Welfare Act](#) and the [Swiss Animal Protection Regulations](#), such nests for laying

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hens need to pass an authorisation procedure (Wechsler, 2005). For that purpose, the Swiss Centre for Proper Housing of Poultry and Rabbits (Zollikofen, Switzerland) developed a method based on a preference test. For having a reference nest in the test procedure, a so-called “minimalnest” was developed and its acceptance was subsequently taken as a benchmark for the commercial nests (Buchwalder and Fröhlich, 2011; Zupan et al., 2008). In these experiments, only the nest as a unit was considered, no attention was paid to specific nest characteristics. Hence, it remains unclear which ones were responsible for the preference decisions of the hens especially in those cases, where the commercial nests failed to pass the authorisation procedure. This question motivated the present study and the results will be used as a basis for future decisions in the authorisation procedure for nests. In this paper, we present our investigations of the effect of the slope of the nest floor on nest acceptance and laying behaviour.

Group nests in Switzerland are closed on three sides, covered by a roof or by the bottom of an upper nest and have plastic front curtains and a plastic grid or perches in the front of the nests for easy access. The floor is usually covered with “Astroturf®” or rubber pimple mats. Despite the relatively low ratio of mislaid eggs in aviary systems (Häne et al., 1999), a certain number of eggs are always laid outside the nests provided. Some hens may perceive the nests as an inadequate place for laying or may prefer open nest sites (Cooper and Appleby, 1996; Zupan et al., 2008). Mislaid eggs constitute an economic problem, because they are often broken or dirty and thus can no longer be sold. Additionally, a larger amount of work is required to collect eggs on the floor or in the aviary system (Appleby, 1984). Furthermore, laying eggs outside the nest could lead to cloacal cannibalism (Savory, 1995), a welfare problem.

The floors in commercial group nests are sloped, to make the eggs roll onto a collecting belt to allow automated and efficient egg collection. The slope should be built in such a way that eggs roll away without breaking but the hens should still feel comfortable standing and sitting on the sloped floor and laying their eggs on it. We assume that a steeper nest floor reduces nest attractiveness and comfort. In the wild, a hen is not likely to lay her eggs on a sloped ground, because if she does, the eggs will roll away and will be lost. However, floors with only a slight slope should not be a problem because the hen usually makes a shallow scrape in the ground and thereby prevents eggs from rolling away (Duncan et al., 1978). Thus, a nest floor slope with a too excessive slope may motivate hens to lay elsewhere. We assume that hens could be sensitive to floor slopes and should be able to distinguish between different floor slopes. Moreover, after laying, a hen often sits in the nest to rest (Icken et al., 2009). Sitting on an excessively sloped floor could be uncomfortable. Therefore, we also investigated the effect of the nest floor slope on the prelaying behaviour of laying hens as well. In commercial group nests the slope is usually between 12% and 18%.

We predicted that hens would prefer to lay in nests with a low-pitched floor because of the reasons mentioned above. Even though eggs will roll away on both slopes, they will do so much quicker on the steeper slope whereas on a softer slope, the eggs may probably remain in the nest for a

moment after being laid. This may be enough for the hen to accept it as an appropriate laying place. We assumed that a nest is preferred if hens show a more settled prelaying behaviour, defined as fewer nest visits without sitting and without laying an egg. In the 12% nest, we expected more nest visits, more eggs and more hens sitting in the nest, a smaller ratio of nest visits/egg number and fewer nest entries without sitting or egg laying.

Furthermore, the slope of the nest floor may have an impact on the body alignment of hens whilst sitting in the nest. Hens will probably sit with their head upwards rather than downwards for comfort reasons if the slope of the nest floor is steep. Thus, body alignment could be used as an indicator of excessive steepness of nest floors. In our case, we expected that more hens would sit with their head towards the back of the nest in the 18% nest. The findings of this study will be used as a basis for future decisions on the authorisation procedure for nests.

2. Materials and methods

2.1. Animals and husbandry

A total of 140 non-beak-trimmed white leghorn layers (LSL) were used for this experiment. They were housed in the rearing facility of the Centre with access to perches on different heights but without access to nests. The rearing pen was littered with wood shavings. Feed and water were offered ad libitum in circular troughs. To control the light regime and to prevent seasonal influences, the pen was illuminated only with artificial light, the light period followed the recommendations of Lohmann Tierzucht for LSL pullets. At 18 weeks of age, the hens were transferred to the test facility and randomly assigned to 8 test pens in groups of 17 or 18 individuals. The hens were in the test pens for 11 weeks and were subsequently sold to local farmers.

The eight test pens were identical in size ($3 \times 3 \times 2$ m, length \times width \times height; Fig. 1), shape and equipment. Test pens were arranged in two rows of three pens each and one row of two pens. They were littered with wood shavings and long cut straw, furnished with two perches at different heights above the floor (50 cm, 150 cm), two group nests, a round feeder (diameter 30 cm) and a bell drinker. Feed and water provision was ad libitum. A net covered the top of the pens to prevent birds from escaping. There was no visual contact between groups to exclude social effects and inter-group influences on nest choice. No daylight was provided for the same reasons as mentioned above. Each pen was therefore equipped with artificial daylight bulbs (Osram 72-965 Biolux, 36W). According to the standard lighting schedule in commercial egg production, day length was successively increased from 10 h in the 18th week of age to 15 h at the 25th week of age, with a twilight period of 20 min at the beginning and end of each light period. At 19 and 20 weeks of age, the beginning of the twilight phase in the morning was set back an hour, from the 21st week of age to the 25th week of age, the beginning was set back in intervals of 30 min per week. As a result, the twilight phase began at 01:45 h and ended at 16:45 at week 25, when the experiment started. The average daily temperature in the test stable was 15.8 °C (min 11.4 °C, max. 21.3 °C), and the

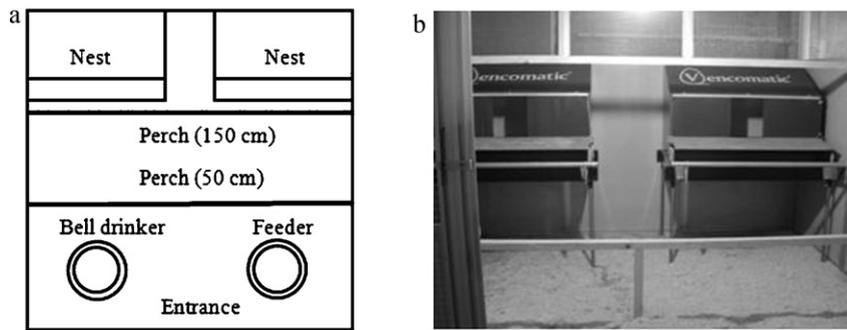


Fig. 1. (a) Model of an experimental pen: Nest = Vencomatic-Nests, two wooden perches (50 cm and 150 cm above ground, \varnothing 4.5 cm), entrance = entrance to pen. (b) View into an experimental pen.

mean light intensity was approximately 12 lux, measured in six directions (top, down, left, right, back, front) at the height of the animals in the middle of each pen.

In a preference test, the hens were given a choice between two identical group nests (width = 49 cm, length = 114 cm, height = 70 cm) that differed only in the slope of the nest floor, 12% ($\alpha = 5.86^\circ$) and 18% ($\alpha = 10.35^\circ$) respectively. See Fig. 2 for details. The nest floors were covered with mats of rubber pimples. The fronts of the nests were closed with two plastic curtains with an entrance space in between. Platforms (29.5 \times 114 cm) in front of the nests allowed the hens to access and inspect the nests. Vencomatic-Nests from Rihs Agro (Seon, Switzerland) were used for this experiment because these nests were well-accepted by hens in an experiment conducted by Buchwalder and Fröhlich (2011) in the context of the authorisation procedure for group nests in Switzerland. The light intensity was on average 16 lux (28.2 lux in one direction) on the nest access and 1.4 lux (2.5 lux in one direction) inside the nests (at the back), measured in six directions (top, down, left, right, back, front) at the height of the animals.

Both types of nests were placed half left and half right on the back corners of the pens, equally distributed over the pens, in such a way that hens could easily see and inspect

both nests. This treatment was assigned randomly to the pens.

2.2. Data collection

Collection of data on egg number in each nest and on the number of floor eggs started when the first egg was laid and lasted for 11 weeks. Video sampling started at 27 weeks of age to give hens enough time to habituate to both nests and to become used to the laying process. Video sampling was conducted on two subsequent days during the main egg laying period from the 2nd to the 5th hour (total 4 h) after the lights were switched on. Several studies have shown that most eggs are laid during the first 4–5 h (Appleby and Smith, 1991; Riber, 2010). The hens were filmed in the nests so that we could record and observe a hen's behaviour before, during and after egg laying. Two cameras in the front corners of each nest were used for video sampling. All cameras were furnished with an infrared light source.

We recorded the number of hens in each nest every 10 min during the 4 h by using a scan sampling method. We also recorded the behaviour of every hen from the moment she entered the nest until she left the nest. The duration of the following behaviours was measured: nest visit (with

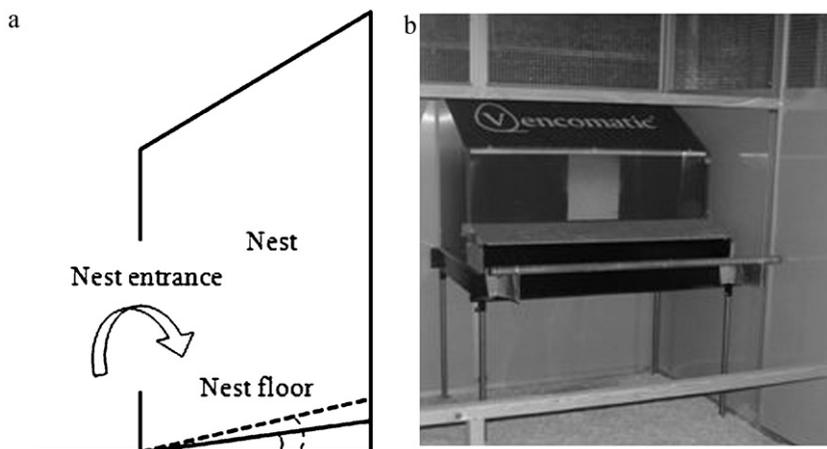


Fig. 2. (a) A cross section of the nest, left side = front of the nest, right side = back of the nest. – Nest floor with 12% slope, $\alpha = 5.86^\circ$ nest floor with 18% slope, $\alpha = 10.35^\circ$. (b) Photo of the group nest used in the experiment.

Table 1

Ethogram for individual observations.

Behaviours	Definition	Recording
Sitting	The hen sits down, the keel bone touches the nest floor, legs are situated beneath or under the hen, the hen does not move or rotate	Duration, recording started when the keel bone touched the nest floor and stopped when this was not the case anymore. Every event lasting for at least 10 s was considered as a sitting event. If a hen changed body alignment during sitting, it was treated as a new event
Upright position	All postures and whole-body movements except for sitting; the keel bone does not touch the floor; standing, walking, crouching	Duration, recording started when a hen entered the nest or a sitting event ended and stopped when the hen left the nest or sat down
Egg laying	The hen shows the so-called penguin-position during egg laying	Duration, recording started when the penguin-position was clearly visible and stopped when the hen moved a leg or sat down after the egg was laid
Nest entrance	The head and one leg are inside the nest	Event, every observed event is counted
Nest exit	Both legs are outside the nest	Event, every observed event is counted
Body alignment		
Forward	The hen sits with her head towards the front of the nest	Event, every observed event is counted
Backward	The hen sits with her head towards the back of nest	Event, every observed event is counted
Lateral	The hen sits parallel to the front/back of the nest	Event, every observed event is counted

entrance and exit), sitting, upright position and egg laying. For nest visits, following distinctions were made: (i) nest visits without sitting; (ii) nest visits with sitting; (iii) nest visits without egg laying; (iv) nest visits with egg laying. We assumed that nest visits without sitting are rather short and may serve as nest inspections. We also noted the body alignment (forward, backward and lateral) during sitting. The definitions of all recorded behaviours are summarised in Table 1. The hens were not marked individually.

2.3. Statistical analysis

The following parameters were used for statistical analysis, all recorded during 4 h/d in each nest, if not mentioned otherwise: (i) the total number of eggs laid in each nest and

on the floor, counted every day (~22nd week of age when the laying performance per pen was always 50% or higher) to the 28th week of age; (ii) the total number of hens in the nest (scan sampling every 10 min during 4 h/d); (iii) the total number of nest visits in relation to the number of eggs laid in the nest (ratio of nest visits to egg number); (iv) the total number of sitting events; (v) the percentage of body alignment towards the front or the back of the nest or lateral; (vi) the total number of nest visits; (vii) the number of nest visits divided into events with/without sitting, and with/without egg laying.

For analysis, we assigned nest visits to duration categories and counted the total number of nest visits that occurred within a category: (a) nest visits lasting less than 1 (<1) min: during this time interval, most hens entered the nest for a short nest inspection; they did not sit down or lay an egg; (b) nest visits lasting 1–10 min: in this time interval we found that most hens stood or walked around in the nest without sitting; some hens sat down, but few of them laid an egg; (c) nest visits lasting 10–90 min: almost every hen sat down during this time interval, and most of the eggs were laid between 10 and 90 min; (d) nest visits lasting more than 90 (>90) min: some hens were in the nest longer than 90 min; all of them sat down and most of them laid an egg during the visit.

Data analysis was conducted with NCSS (Version 07.1.8, Hintze, 2006). Data were averaged at the pen level, and their residuals were checked for normality. The following parameters did not show a normal distribution and had to be log-transformed to meet the requirement of normality: the ratio of nest visits/egg number and the nest visits, categories <1 min and 1–10 min, and for nest visits without sitting, categories <1 min and 1–10 min. After transformation, all parameters were compared using repeated-measures ANOVA.

2.4. Ethical note

This study was approved by the cantonal Agricultural Office of Bern, Switzerland. The ethical guidelines were fulfilled.

3. Results

Table 2 shows the results of the analysis: the mean and standard error of the parameters for each nest, and the *F*-statistics and *p*-values for each parameter are shown.

3.1. Number of eggs

The first egg was laid during the 20th week of age. The nest boxes provided were well used by the hens: the total number of eggs laid during the experiment was 7661. Most eggs were laid in the two nests, 58.22 ± 5.48% in the 12% nest and 41.01 ± 5.63% in the 18% nest. Only a few eggs were laid on the floor (0.77 ± 0.34%). Owing to their low number, these floor eggs were excluded from statistical analysis. Laying performance was on average 93.69 ± 2.83% at week 27/28, when video recording started. We did not find a difference in egg number between the nests. The

Table 2

Results of the analysis of the parameters studied. The means per day and four hours observation are presented. Due to an insufficient number of nest visits (nv), following categories were excluded from analysis: nv with sitting, <1 min; nv without sitting, 10–90 min and >90 min; nv with egg laying, <1 min and 1–10 min; nv without egg laying, <1 min and >90 min.

	Nest		F-statistics	p-Value
	12%	18%		
Number of eggs	9.8 ± 1.3	6.9 ± 1.3	$F_{1,7} = 2.46$	0.160
Number of hens	3.0 ± 0.2	2.0 ± 0.2	$F_{1,7} = 7.80$	0.027
Ratio nest visit/egg	12.7 ± 2.8	14.6 ± 2.8	$F_{1,7} = 1.15$	0.319
Number of sitting events	46.0 ± 3.6	26.4 ± 3.6	$F_{1,7} = 16.63$	0.007
Body alignment				
% Back	22.7 ± 2.2	30.3 ± 2.2	$F_{1,7} = 6.01$	0.044
% Front	40.5 ± 2.9	29.1 ± 2.9	$F_{1,7} = 7.59$	0.028
% Lateral	36.8 ± 1.4	40.6 ± 1.4	$F_{1,7} = 3.77$	0.093
Number of nest visits				
<1 min	74.9 ± 7.0	59.2 ± 7.0	$F_{1,7} = 2.30$	0.172
1–10 min	22.5 ± 3.1	21.5 ± 2.3	$F_{1,7} = 0.00$	0.961
10–90 min	12.4 ± 1.4	7.6 ± 1.4	$F_{1,7} = 6.36$	0.039
>90 min	1.5 ± 0.3	1.1 ± 0.3	$F_{1,7} = 1.15$	0.320
Number of nest visits with sitting				
<1 min	0.0 ± 0.0	0.0 ± 0.0	–	–
1–10 min	4.6 ± 0.5	4.4 ± 0.5	$F_{1,7} = 0.15$	0.713
10–90 min	12.4 ± 1.3	7.2 ± 1.3	$F_{1,7} = 8.17$	0.025
>90 min	1.4 ± 0.3	1.3 ± 0.3	$F_{1,7} = 0.10$	0.756
Number of nest visits without sitting				
<1 min	74.9 ± 16.5	59.0 ± 14.3	$F_{1,7} = 2.35$	0.169
1–10 min	17.8 ± 2.6	17.2 ± 1.8	$F_{1,7} = 0.05$	0.829
10–90 min	0.3 ± 0.1	0.3 ± 0.1	–	–
>90 min	0.0 ± 0.0	0.0 ± 0.0	–	–
Number of nest visits with egg laying				
<1 min	0.0 ± 0.0	0.0 ± 0.0	–	–
1–10 min	1.0 ± 0.3	1.0 ± 0.3	–	–
10–90 min	7.4 ± 1.1	3.7 ± 1.1	$F_{1,7} = 5.68$	0.049
>90 min	1.4 ± 0.1	1.3 ± 0.1	$F_{1,7} = 0.09$	0.769
Number of nest visits without egg laying				
<1 min	0.0 ± 0.0	0.2 ± 0.1	–	–
1–10 min	3.9 ± 0.6	3.3 ± 0.6	$F_{1,7} = 0.56$	0.478
10–90 min	4.8 ± 0.8	3.4 ± 0.8	$F_{1,7} = 1.60$	0.246
>90 min	0.1 ± 8.5	0.1 ± 0.1	–	–

percentage of eggs laid into the nests was different from pen to pen, see Fig. 3 for details.

3.2. Number of hens, nest visit/egg ratio, number of sitting events and body alignment

More hens were counted in nests with 12% slope in the scans (average per pen, nest and 10 min), but the nest

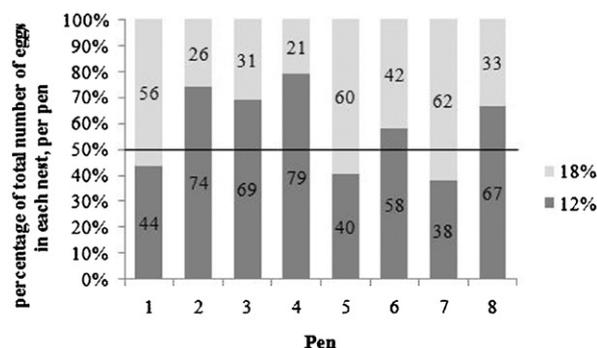


Fig. 3. Percentage of total number of eggs laid in each nest per pen. More eggs were laid in the 12% nest in pens 2, 3, 4, 6, and 8. In pens 1, 5, and 7, more eggs were counted in the 18% nest. For each nest, the percentage of eggs is given in the corresponding bar.

visits/egg ratio did not differ significantly between nests. We observed more sitting events in the nest with the 12%-sloped nest floor. The percentage of body alignment towards the back and front of the nest differed between the nest types. We found a higher percentage of hens sitting towards the back of the nest in the 18% nest and a higher percentage of hens sitting towards the front in the 12% nest.

3.3. Nest visits

Overall, we counted 1783 nest visits in the 12% nest and 1428 nest visits in the 18% nest. 2145 nest visits lasted less than 1 min, 705 between 1 and 10 min, 316 between 10 and 90 min, and 45 90 min or more. See Fig. 4 for details. If a hen visited a nest and laid an egg, she stayed an average of 51.69 ± 15.03 min in the 12% nest and 54.37 ± 16.26 min in the 18% nest. Nest visits with sitting (but without egg laying) lasted an average of 35.88 ± 13.25 min in the 12% nest and 33.63 ± 13.66 min in the 18% nest. Nest visits without sitting were short and lasted approximately 0.78 ± 0.52 min in the 12% nest and 0.80 ± 0.51 min in the 18% nest.

For the categories <1 min, 1–10 min and >90 min, we found no significant differences between the nests. In the category 10–90 min, we found a higher amount of total nest

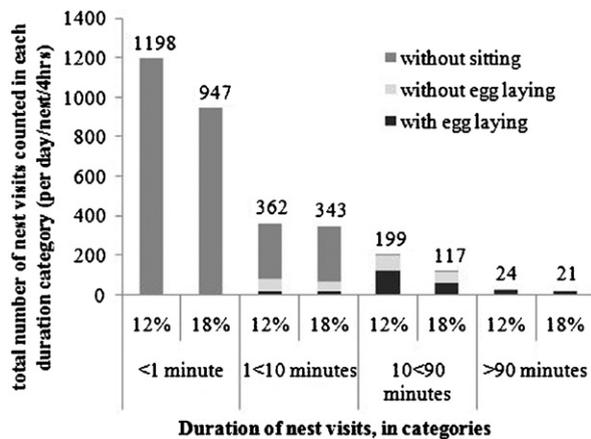


Fig. 4. Number of nest visits without sitting, without egg laying and with egg laying counted in the 12% and 18% nests for each nest visit duration category, per day and per 4 h observation time. The total number of nest visits per nest and category is given above the corresponding bar.

visits in the 12% nest. For nest visits with sitting and nest visits with egg laying, there was also a significant difference between the nests in the category 10–90 min; more nest visits were counted in the 12% nest. No other significant differences were found.

4. Discussion

The hens started to lay at the expected age of 20 weeks. The first eggs were all laid in one of the nest boxes provided. We therefore conclude that the nest type we used for this experiment was well accepted by the hens. The slopes, 12% and 18%, are within the range of slopes used in commercial nest boxes, with 12% representing the lower limit and 18% representing the upper limit. A slope of at least 12% is necessary to allow eggs to roll away on the collecting belt, whereas a slope of more than 18% is likely to cause egg breaking and to reduce nest acceptance by the hens.

Our findings indicate that both slopes tested (12% and 18%) were widely accepted, judging from the numbers of eggs laid in each nest. However, because we found significant differences in the number of hens, the number of sitting events and the number of nest visits with sitting/egg laying, and because these differences all favoured the 12% nest, we inferred that hens may prefer nests with a lower-pitched floor.

In addition, we found twice as many hens sitting with the head downwards towards the front of the nest in the 12% nest. In this experiment, no distinction could be made between the direction of the slope and the opening of the nests. The entire nest floor sloped in direction to the nest entry, thus, we had to assume that, for this experiment, the differences found in the direction of body alignment must be a consequence of the degree of the slope. We assume that hens appreciate sitting with their heads towards the openings of the nests more likely than to the back of the nest, if they had the possibility to choose. If this is true, our results suggested that the 12%-slope did not affect the body alignment of the hens in such a way that they tended to lie with the head upwards for comfort-related reasons. In

contrast, in the 18% nest, a significantly larger number of hens were observed to sit with the head upwards. This finding indicates that the slope in these nests is steep enough to force the hens to sit with the head upwards, and in this case towards the back of the nest.

In contrast to our hypothesis, we found that egg number did not differ between the nests. In some pens, the variation in egg number shows that the hens were, in contrast to the findings of other studies (Riber, 2010; Rietveld-Piepers et al., 1985), inconsistent in nest choice. Eggs were sometimes laid in one nest and sometimes in the other. Given that eggs roll away and will be lost in both nests, it is possible that for some hens, the fact that the egg rolled away was more important than the slope of the nest floor, therefore they did not distinguish between the nest slopes and valued both nests equally. In both nests, we found that some hens tried to prevent eggs from rolling away. They attempted to use the beak to roll the egg back into the nest. A few hens even tried to retrieve eggs from the egg collection band, indicating that the loss of eggs did influence the hens behaviour in a certain way. This behaviour could be altered if the nest floor was flat and eggs would not roll away. Icken et al. (2009) found that hens are likely to stay in the nests and rest after egg laying, this may be increased if the eggs are not removed from the nest. In the current study, we decided not use a flat nest floor, because the aim was to compare floor with slopes usually used in commercial nests, where flat floors are not used. Another reason that egg number did not differ between the nests could be that laying hens are gregarious in egg laying and choose to lay their eggs in the company of other hens rather than alone (Appleby et al., 1984). Thus, a hen may prefer an already occupied nest over an empty nest. In this study, we often found hens sitting together in a corner of the nest, even if there was enough space in the other corner of the same nest. The presence of sitting hens in the nests seemed to be a strong stimulus for other hens to sit in the same place. One hen sometimes tried to creep under or to sit on top of another hen. For the sake of gregariousness and body contact, some hens even took the risk of being pecked by others. Another reason for the gregarious nesting we observed may be a consequence of overlapping prelaying and resting periods. This routine may cause more hens to sit together in the nest (Riber, 2010). Hens need a certain amount of time to lay eggs. This time is usually at least 10 min and includes prelaying behaviour, egg laying and resting after the egg is laid. Our hens needed on average 52 min in the 12% nest and 54 min in the 18% nest for the entire egg-laying process. This length of time is somewhat longer than the time values reported in other studies (Icken et al., 2009; Sherwin and Nicol, 1993; Zupan et al., 2008). If a hen decided to sit in the nest, she usually did so within a minute of entering the nest, regardless of which nest she entered. A few hens stayed in the nest for more than 90 min, and almost all of them laid an egg during the nest visit. For some hens, the egg laying process was short (less than 10 min). Those hens were either disturbed by hens inspecting the nest or were harassed by other hens in the nest. In addition to the nest visits with egg laying, we observed that a number of hens visited the nests provided and sat down without laying an egg. Those nest visits were

of shorter mean duration than nest visits with egg laying. This result is in accordance with the findings of Icken et al. (2009), who found a longer mean duration of nest visits in the nest that was associated with egg laying.

In the category 10–90 min, we found more hens visiting the 12%-nest for sitting and egg laying. This finding indicates that hens may prefer the 12%-nest for resting. We also found some hens in the 12% nest sitting on their egg after laying (only a few occurrences that were not included in the analysis), which could be a stimulus for the hens to remain in the nests for a longer time. However, a few hens were found sitting on eggs in the 18% nest as well, thus the possibility to sit on eggs could not be the only explanation why more hens stayed in the 12% nests between 10 and 90 min. We assume that the higher amount of hens doing nest visits between 10 and 90 min in the 12% nest is mainly caused by the lower slope. It is more comfortable to sit on a lower sloped floor for a longer time. Nest visits without sitting/egg laying were short and rarely lasted for longer than 10 min. Those visits were usually made by hens exploring the nests.

A specific single property like floor slope may provide information on the suitability of a nest. Nevertheless, it is likely that not only one property but the combination of different properties is crucial to produce high nest acceptance. Therefore, further investigations will be carried out such as on the effect of the design of front curtains and the design of access grids or perches in front of the nests.

5. Conclusion

These data indicate that nest floor slopes between 12% and 18%, commonly used in commercial housing systems for laying hens, are widely accepted by the hens. Contrary to our expectations, we did not find a difference between egg number in the nests. However, we conclude that hens may prefer a 12% nest floor, based on the fact that more hens were counted in the 12% nest and because we observed higher amounts of sitting events and of nest visits with sitting and egg laying for the 12% nest. This knowledge, together with the results of other experiments on nest properties such as the design of front curtains or the

design of access grids or perches in front of the nests, will be applied to the authorisation procedure for group nests to evaluate the suitability of nests.

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