

The studies on the factors which are deciding on the choice of nests by broody hens

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The purpose of the work was to try to unify the opinions about the preference of nests that were kept by laying hens in floor systems. Long-term studies confirmed the large impact of genetic factors on diversified behaviors of hens of broody types: Astra S, Isa Brown, Tetra SL, ROSS. The opinions that hens are laying the eggs more willingly in the less-lightened nests have not been confirmed. On the other hand, an influence of the colour of nests on the decision on the selection of nesting site was confirmed – the hens chose colours similar to those ones, appearing in nature; similar situation concerned a type of floor, resembling the natural environment. It was not possible to standardize the viewpoints concerning the preference of the storey of nests in sections – a part of hens chose lower nests, however the recent surveys showed by 50-% greater interest in nests situated on the second floor. It was not possible also to establish whether the temperature affected the site selection for laying of eggs by the hens.

KEY WORDS: broody hens / nests / litter breeding / litterless breeding

Studies on preferences of layer hens for various nest types in the barn floor housing system have been conducted for many years. They ceased to be of practical importance when the battery cage system was introduced on a mass scale. Breeding work focused on maximum egg production by layer hens and adaptation of layer hens to living in battery cages, ensured e.g. by their docile temperament and limited mobility. Due to the very good productivity of hens in the battery cage system, it became the dominant technology for the production of table eggs. Approximately 90% commercial layer hens were kept in multi-tier battery cages.

The EU directive of July 1999 (1999/74/EC) concerning welfare of laying hens raised interest of egg producers in keeping hens in alternative systems instead of battery cages. This was determined by legal regulations, necessity to eliminate battery cages and lower costs of adapting poultry houses to the litter housing system in comparison to the costs of enriched cages. For this reason, in view of the renewed interest in barn floor and free range management of layer hens some of the previously unsolved problems need to be investigated again. Selection of materials for nests is of lesser importance, whether it is wood,

plastic or metal, thanks to the highly advanced production technologies. Nevertheless, we may still observe a rather characteristic phenomenon: despite their similar design and location hens use some nests willingly and avoid others. Despite the fact that the number of nests is correlated with the bird stocking rate in the poultry house, a large proportion of eggs with damaged shells or eggs laid outside nests is reported. The above-mentioned preferences are observed in poultry houses, in which both manual and mechanical egg collection is used. Increased occurrence of these phenomena may determine the economic effects of egg production [13].

This study is an attempt at clarifying opinions concerning nest preferences in layer hens, as an aspect directly affecting production results.

Material and methods

The investigations concerning technical and organisational solutions in egg collection were conducted at the Poznań branch of IBMER in the years 1991-2005 [4, 6, 11] and 2010-2012. They concerned nests with various substrates used in the manual egg collection system. Observations and analyses were started several weeks after the introduction of pullets, approximately 1 month after they started laying eggs. The preceding period was considered as the time for them to adapt and familiarise with the facilities, environmental conditions and the cycle of operations during the day time. A varied number of birds was analysed – from 3000 to 20 – depending on the investigated factor. The investigations were conducted as direct observations or using devices – video and thermographic cameras. Documentation of recorded numbers was prepared depending on the investigated factors.

The following factors determining on nesting were investigated:

- Nest colour – observations were conducted on white, yellow, red, blue and green nests (flock size 20 layer hens; data collection period – 10 days);
- Type of nest substrate – observations were conducted on nests with traditional straw litter, with the floor of hardboard, PCV and smooth carpet lining (flock size 20 layer hens; data collection period – 10 days);
- The effect of nest lighting – analyses were conducted in a poultry house at a standard artificial lighting of approx. 15 lx, in two-tier nests supplied with shading frames Ø 200 and Ø 240 mm, additionally covered with plastic film strips (flock size 75 layer hens, data collection period – 15 days);
- Temperature in the nest – observations were conducted using a thermographic camera with the image recording system and TESTO IR SOFT software (flock size 270 layer hens).

Analyses were conducted on layer hens of the Astra S, Isa Brown, Tetra SL and ROSS commercial sets at the experimental station of the Institute, housing varying numbers of birds in individual years. Depending on specific analyses, smaller flocks were used.

Results and discussion

Results of investigations concerning nesting of layer hens were collected over a period of more than a decade. They also come from experiments and monitoring of other pro-

blems, such as e.g. technical, environmental or nutritional studies, which are presented in the Material and methods chapter.

Nest colour. Observations were conducted on 20 layer hens, in nests made from wood and hardboard, painted in 5 colours (white, yellow, red, blue and green), which were placed at one level.

Collected results confirm the findings presented in a report of Wężyk [12] from studies conducted in Canada, in which hens definitely most willingly selected grey-coloured nests. In the presented study they were green and blue nests (Table 1). Hens were least willing to use white and yellow nests. A situation may occur when a large proportion of eggs is laid on the floor and according to the binding regulations floor eggs are less valuable for the producer.

Table 1
Number of eggs (pcs) laid in colourful nests (Isa Brown hens)

Colour of the nest	Day of observation										
	1	2	3	4	5	6	7	8	9	10	PG
White	2	1	0	1	1	1	1	0	0	1	0
Yellow	2	2	1	1	2	0	1	1	0	1	1
Red	4	5	2	3	4	4	4	5	5	4	1
Blue	6	6	5	6	6	8	7	6	7	6	0
Green	4	4	9	7	5	5	5	6	6	5	0
∑ eggs	18	18	17	18	18	18	18	18	18	17	2

PG – eggs laid outside the nests

Substrate type in the nest. In this experiment typical litter nests (chopped chaff-filled) were used along with nests with floors made from hard fibreboard, PCV and smooth carper lining. It turned out that layer hens definitely preferred litter-lined nests – almost 75% laid eggs came from those nests (Photo 1).

Such results were recorded in the 3 weeks of observations (the group of 20 layer hens), for this reason in the second stage of the experiment litter nests were excluded from the observations. Direct observations conducted at the monitoring stations showed that layer hens were most reluctant to use nests with PCV floors (Table 2). Upon entering the nest this slippery material prevented hens from characteristic crouching movements and settling in the nest, as a result preparation for egg laying took longer and thus a smaller number of hens was able to use nests. In contrast, acceptance rates for the two other nest types were comparable. Direct observations confirmed that taking an egg-laying position by the hen lasted much shorter, thanks to which a larger number of birds was recorded to use the nests and consequently the number of eggs collected from nests with floors of hardboard and carper lining was greater (Table 2).



Photo 1. Hens crowding in litter nests

Table 2

Number of eggs (pcs) obtained from the nests with diversified floors (Tetra SL hens)

Type of substrate	Number of eggs in consecutive days of observation (pcs)									
	1	2	3	4	5	6	7	8	9	10
Hardboard	6	6	5	6	5	8	5	6	7	8
PCV panelling	4	4	5	3	4	3	4	3	3	2
Carpeting (smooth)	8	8	6	9	8	7	10	8	9	8
Σ eggs	18	18	16	18	17	18	19	17	19	18

Nest lighting. This aspect is difficult to assess, since egg-laying behaviour in hens is genetically determined [5] and as a consequence we may expect very high variability in its manifestation. In experiments conducted on Astra S hens kept in the litter system in a poultry house with south-facing windows the birds most willingly used nests located in the most lighted part of the poultry house. Over 40% all laid eggs were collected from those nests.

To verify common beliefs the analyses concerned the effectiveness of shading frames installed at the entrance to the nests in order to reduce the amount of light reaching the nest (Photo 2). Tables 3 and 4 present egg laying data for nests with shading frames (nest 1 –

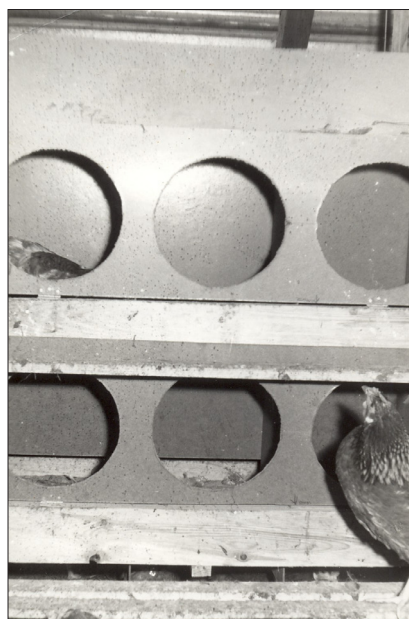


Photo 2. Shading frame of nest holes

control, with no shading frame). It turned out that hens when laying eggs most frequently selected lighted nests, with no additional shading frame (Table 3), which made it possible to reduce the second observation period to five days (Table 4). The results also indicate that layer hens most willingly chose nests on the first tier of the nest boxes. They showed least interest in nests, which entrances were additionally masked with plastic film strips (Table 4).

Based on these observations, nests were additionally lighted from the inside in order to encourage layer hens to use them, which was confirmed in studies conducted in Scotland [1]. Investigations conducted in recent years on nest preferences in ROSS layer hens kept in an alternative housing system (slate floor + gravel) showed that in two-tiered nest box sections hens preferred laying eggs at the upper tier, as approx. 50% more eggs were collected there (Table 5). In turn, in earlier studies [4] conducted in two-tier litter-lined nests layer hens preferred nests at the 1st tier.

Temperature. In 2011 a thermographic camera was used to monitor whether hens prefer nests with warmer inside temperatures, which in the common opinion provide intimate and cozy conditions for egg laying.

Results of measurements are given in Figs. 1-4. On the basis of observations conducted over several months and these images it is difficult to definitely state which is a secondary factor – whether hens select a given nest section because it is warm, or whether the temperature there is higher because many birds are staying in that nest section. Results showed that the differences in recorded temperature are approx. 1°C.

In the course of long-term studies on hen behaviour in relation to the environmental factors connected with nests, which have been conducted for many years, it could not be definitely clarified why some layer hens prefer perches in front of nests in the form of bars, while others prefer flat wide slats or round rods. Such studies have also been carried out in Germany [9].

Summing up it may be stated that the long-term studies on individual elements of technological processes in poultry management systems did not provide grounds for definite clarification of all disputed problems. The first difficulty was connected with the variation in hen behaviour, which is affected by genetic factors [5]. The factor determining selection of the egg laying site, which was confirmed in the observations recorded by the author, was the rearing system adopted for pullets. These observations, while not being the subject

Table 3

Laying performance of hens in the nests with shading frames (Astra S hens, experimental herd 75 heads)

Days of the collection of eggs	Tier	Number of eggs in nests		
		nest 1 (control)	nest 2 Ø 240 mm	nest 3 Ø 200 mm
1	II	6	3	2
	I	33	4	3
2	II	5	3	1
	I	42	6	2
3	II	10	3	0
	I	30	5	0
4	II	1	6	3
	I	45	2	0
5	II	4	1	5
	I	44	7	3
6	II	0	4	1
	I	41	4	2
7	II	1	6	2
	I	44	6	3
8	II	4	4	3
	I	45	5	4
9	II	3	4	3
	I	59	2	3
10	II	3	2	3
	I	46	1	3
Mean II		3.6	3.6	2.3
Mean I		42.4	4.2	2.3

of this study, reflected opinions published in many literature sources [10]. When keeping hens in the litter system we always need to consider the fact that several percent of eggs will be floor eggs. Young hens, even when they were reared under conditions comparable to those found in the commercial poultry house, in the initial period of egg laying have to learn to use nests. Otherwise a large percentage of eggs are those laid in the litter. Various techniques are used to teach hens to lay eggs in nests [8], but it is impossible in poultry houses with several thousand hens.

This study was started 1 month after pullets were introduced to the housing facility. This study did not confirm the common opinion that to lay eggs hens prefer nests in locations

Table 4

Laying performance of the hens in the nests with shading frames and additionally shielded with plastic film strips (Astra S hens, experimental herd 75 heads)

Days of the collection of eggs	Tier	Number of eggs in nests		
		nest 1 (control)	nest 2 Ø 240 mm	nest 3 Ø 200 mm
1	II	3	0	3
	I	41	0	2
2	II	6	1	0
	I	38	1	0
3	II	2	3	1
	I	43	2	0
4	II	7	1	0
	I	44	0	0
5	II	6	2	4
	I	43	2	2
Mean II		4.8	1.4	1.4
Mean I		41.8	1.0	0.8

Table 5

Number of eggs (pcs) collected in the two-tier nest section house of nests (ROSS hens, experimental herd 270 heads)

Days of egg collection	Tier II	Tier I
1	151	105
2	163	106
3	158	107
4	117	81
5	140	122
6	167	113
7	157	95
8	186	139
9	125	68
10	151	103
11	151	107
12	135	98
13	168	78
14	135	96
Mean	150.2	101.2

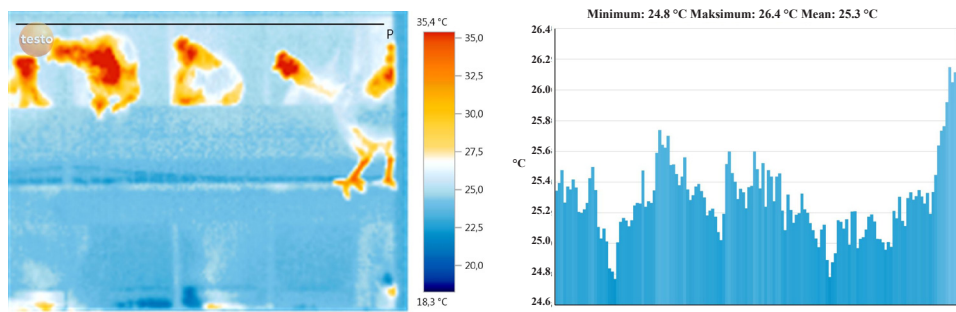


Fig. 1 and 2. Image recorded with thermographic camera and chart of temperature, measured at the level of the upper part of the top nest tier (experimental herd – ROSS hens, 270 heads; P – level of the measurement)

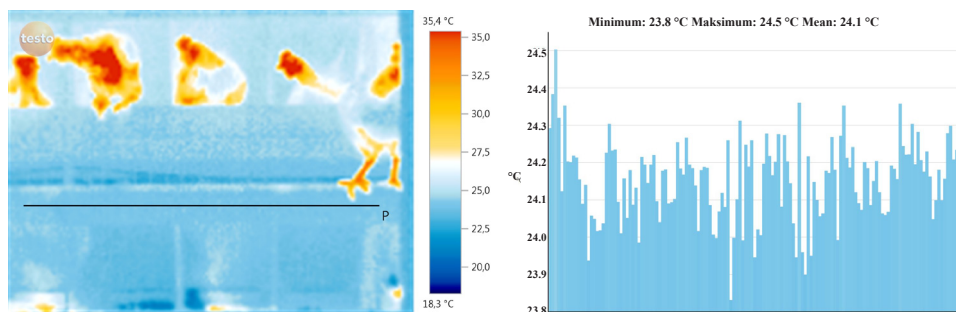


Fig. 3 and 4. Image recorded with thermographic camera and chart of temperature, measured at the level of the upper part of the lower nest tier (experimental herd – ROSS hens, 270 heads; P – level of the measurement)

with less light access (i.e. dimmer) [8]. The conducted experiments showed that at an identical level of lighting in nests birds selected those with shading frames letting more light into the nest. In contrast, they reluctantly used nests additionally shaded by plastic film strips.

It is difficult to comment on the results illustrating selection of nests located on two tiers by hens. In the experiments conducted in the 1990's (on Astra S hens) a larger number of eggs was laid on the lower tier, while the latest results indicate much great-

er, by approx. 50%, preference of nest located at the higher tier. Such preferences may be expected for ROSS layer hens, particularly since hens of the Astra line are lighter (on average by approx. 250 g, based on the author's measurements).

In contrast, the effect of nest colour on the decision selecting the nesting site was confirmed, as hens chose colours similar to those found in nature, similarly as it was the case with floor type resembling the natural environment.

It has not been possible to determine the effect of temperature on the selection of the egg laying site. We only know that hens do not like excessive air movement in their nests.

It results from observations conducted over many years, although not confirmed by numerical data, that in view of standardised temperatures in poultry houses this factor is of secondary importance [2, 3, 4]. The problem is very complex and although investigated by many researchers in multi-faceted studies [7], definite conclusions may hardly be reached.

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