Acceptance of nest box in furnished cage, litter system and IBMER alternative system for laying hens

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This experiment examined the level of nest box usage by hens kept in furnished cage (FC), litter housing system with no litter nest boxes (LS) and alternative system (AS) – fully automated spatial housing system with dust bath area, nest boxes and multilevel perches – IBMER patent. The experimental flocks of laying hens consisted of strains: Astra W, Astra Biala, Rhode Island Red and New Hampshire. The quantity of birds in particular flocks resulted from housing system density standards and the laboratory conditions. Thus the flock size was: FC – 20 birds, LS – 50 birds, AS – 150 and 175 birds. Production and laying rate in nest boxes were monitored during 2 laying periods of 98 days (14 weeks), commencing from 18 weeks of age. The beginning phase of laying eggs was chosen to assess how strong is the birds’ need to nest, depending on housing system, not on learning from other birds in the flock. The stands with examined systems were equipped with nest boxes of different construction, with no litter and assuring that eggs roll-out immediately after being laid. In these examined 3 housing systems for laying hens there was the same lighting regime, feed, water and microclimate conditions. Total egg production rate in examined periods was: FC – 72%, LS – 57%, AS – 65%. During these periods there were statistically significant differences observed in the share of nest eggs in particular systems (FC – 61,3%, LS – 16,9% and AS – 93,7%) confirmed with analysis of variance (P<0,001) and Tukey’s test. The most even nest-laying rate was in AS and in this system was the highest one in both periods. The high share of floor eggs in litter system was a result of hens preferences to lay eggs in litter instead of in no litter nest boxes. The share of egg production in nest box in furnished cage suggests generally the acceptance of that solution, however, the construction of floor requires some improvements.

Keywords: nest box; laying hen; alternative housing system; furnished cage

Introduction

Due to the economics of production connected with the selection of technological equipment producers of consumption eggs pay particular attention to the proportion of nest eggs. Theoretically, laying an egg in the nest box should not only facilitate mostly mechanical egg collection but also assure a good quality of the egg understood in general through the prism of the state of the eggshell. Most of the floor eggs are characterized by the cracked and dirty eggshell what causes their exclusion from class A consumption products. However, the acceptance of nests by laying hens varies. First of all, it results from the technical solution of the nest box and also from its accessibility and location in the henhouse in relation to the other technological equipment.
The location of technical equipment in the henhouse influences the process of laying floor eggs. In the alternative breeding a proper arrangement of technological facilities, suitable management, lighting regime and ventilation may reduce the number of floor eggs up to 1% (Van Emous, 2005). Whereas Colson et al. (2005) indicates that in case of non-cage system for laying hens the quantity of floor eggs may average from 2% to 5% depending on the former rearing system applied for pullets.

Hens are genetically predisposed to laying eggs in nests. In the commercial cage the implementation of the nest box, as one of the elements assuring welfare, should create the possibility for meeting this natural need for nesting. Laying hens willingly use this piece of equipment and over 62% of eggs are laid in the nest boxes of furnished cages (Cronin et al., 2005). This indicator may be increased to 80 and even 95% (Sherwin and Nicol, 1992; Tauson et al., 2002; Tauson, 2003). In the furnished cages not only the location of nest boxes but also the remaining technical equipment placed inside the cage influence the process of laying nest eggs (Barnett et al., 2005; Cronin et al., 2005). The recent studies showed that the presence of a perch is also the important element having an effect on the share of nest eggs because in the cage additionally equipped with it the proportion of eggs laid in the nest box was higher. Access to perches from early weeks of age decreases the prevalence of floor eggs during the laying period also in commercial flocks of loose housed laying hens (Gunnarsson, 1999).

**Materials and methods**

The experiment was conducted during the years 2003-2005 in the experimental house at IBMER within two cycles of laying eggs. In the research there were involved the following laying hen production lines: Astra S, Astra W, Rhode Island Red and New Hampshire. Birds from the same rearing flocks were housed in the stands of furnished cage, litter system and alternative breeding system (IBMER patent) in which the hens were kept on the wire floor with the access to: the dust bath area filled with grit, T-shape perches and two-level nest boxes. Moreover, in IBMER alternative system all the flock service was mechanical including egg collection from nests without litter. The total number of birds in the experiment was 465. The flock size was:

- 2 x 20 birds in furnished cage system (FC), density: 11.2 hens/m²,
- 2 x 50 birds in litter system (LS), density: 6.2 hens/m²,
- 150 and 175 birds in IBMER alternative system (AS), density: 8.3 and 9.7 hens/m² adequately.

Data were obtained from 14-week-periods from start-of-lay, i.e. from 18 until 32 weeks of birds’ age. In the conducted experiment, in both series and all housing systems, hens had at their disposal nests without litter constructed in the way assuring that eggs rollout into the collection tray or on the collection belts immediately after being laid. In AS it was a nest pad of Euronest type (Fig. 1a), in FC an artificial grass mat (Fig. 1b) and in LS the nest floor was made of fibreboard. In second series of research in LS the floor in nest boxes was exchanged for the Euronest type pad. In all three housing systems there were the same lighting regime and microclimatic conditions. Hens were supplied with the same feed and water. Eggs were collected ones a day with the registration of total egg production and floor eggs. Egg collection was manual in LS and FC, in AS eggs were collected mechanically.

Statistical analysis enhanced indicators of overall egg production and nest eggs. There were calculated in each series and housing system the basic statistical measures of location and variability: arithmetic mean, standard deviation, coefficient of variance, quartiles, minimum, maximum and median. Next, a two-way ANOVA with interaction was done in order to assess the significance of differences among the housing systems and series of research for particular mean values of the analysed characteristics (for the nest eggs first three weeks were excluded from analyses due to not representative values).
Significant (P<0.05) differences between means of nest eggs were determined using the Tukey method.

Analyses were performed using Statistica 6.1 (StatSoft. Inc., 2300 East 14th Street, Tulsa, OK 74104, USA).

Results and discussion

Total egg production did not differ significantly (P=0.069) in particular examined housing systems for laying hens. And also the series had no effect (P=0.688) on production results (Tab. 1).

<table>
<thead>
<tr>
<th>Housing system</th>
<th>Total egg production (%)</th>
<th>Egg production in series 1 (%)</th>
<th>Egg production in series 2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AS</td>
<td>FC</td>
<td>LS</td>
</tr>
<tr>
<td>Total egg production (%)</td>
<td>64.8±22.9</td>
<td>72.0±26.7</td>
<td>56.7±26.0</td>
</tr>
<tr>
<td>Egg production in series 1 (%)</td>
<td>68.7±25.2</td>
<td>74.2±27.9</td>
<td>48.6±22.1</td>
</tr>
</tbody>
</table>

In whole experiment the majority (P<0.001) of nest eggs (93.7%, SD±5.7%) were laid in alternative system (AS). The most equal nest egg production was also in AS, particularly in series 1 (coefficient of variance = 2.1%), in which the mean of eggs laid in the nest was 94.1% (SD±2.0%). The lowest share of nest eggs (91.0%) in AS series 1 was in the first week of experiment and the highest one (97.3%) was in the last week of experiment (14th) of this series. Within the series 2 in AS the initial share of nest eggs was 76.0% and was increased up to 100% in 13th and 99.9% in 14th week of the research.

Fig. 2 presents the course of variance in laying nest eggs in particular housing systems and both series.

In furnished cage (FC) in series 1 in the first week of research only 26.1% of eggs was laid in the nest box. After the following two weeks of this series the majority of eggs were laid in the nest and the highest share of nest eggs (65.0%) was achieved in the 11th week of the experiment. The same level of nest eggs has been reported in some studies (Sherwin and Nicol, 1993; Guesdon and Fauré, 2004) giving the reason of competition for the nest place as a motive for laying floor eggs. However, Fiks-van Niekerk et al. (2002) obtained 98.2% of nest eggs in this type of furnished cage. The second series of research in FC recorded both the decreasing and increasing tendencies in the number of nest eggs. First week of series 2 with the maximum share of nest eggs was simultaneously the week of the low total egg production – below 30%. The average share of nest eggs for FC in series 2 was significantly (P<0.001) lower (68.5%±11.7%) than the share of nest eggs in this series in AS. For the whole FC the mean was 61.3% (SD±13.1%). Presumably, the nest floor of artificial grass type caused the medium acceptance of nest in furnished cage. Wall et al. (2002) indicated that the decrease in dimension of Astroturf lining in furnished cage for six hens by 50 or 30% led to the significant decrease in the number of eggs laid there. In the conducted experiment in FC the floor pad was continually slipping from the nest box stopping the later on laid eggs inside the nest.
Besides, the artificial grass was also a source of soiling and contamination of eggs laid in the nest and the activities connected with the repeated cleaning and placing of this mat inside the nest box were disturbing the birds.

Figure 2. Share of nest eggs in examined housing systems in particular weeks in two series of the experiment.

Litter system with nests without litter and floor made of fibreboard obtained the lowest (P<0.001) results regarding nest eggs. In series 1 of system in question, except for the first week of research, the share of nest eggs did not exceed 20% and was on average merely 12.8% (SD±5.3%). Hens did not accept this kind of nest having straw litter for their disposal in the stand. Therefore, in the series 2 the nest floor in LS was replaced with the pad of Euronest type. Similarly as in the first week of series 2 in FC the mean of nest eggs was the highest (75.0%) but simultaneously with very low initial egg laying – below 5%. The average share of nest eggs was a little bit higher (21.0%±16.7%) in comparison to the first series but the difference was not significant (P=0.069). The overall mean for the whole LS with no litter nests was 16.9% (SD±12.9%).

In the conducted experiment not only the construction of nest floor but also the applied housing system for laying hens has influenced the process of laying eggs in nests. In furnished cage the majority of hens accepted the nest box and taking into account the continuous slipping of the artificial grass pad, the conditions of some kind of isolation seem to be the factor influencing the usage of this place. The solution of nest pad of Euronest type gave very good results in IBMER alternative housing system where hens were kept on the wire floor with the access to the dust bath area filled in with the grit. Whereas the same pad applied as a nest floor in the litter system had no significant effect (P=0.069) on laying eggs in the nest boxes. Hens still preferred litter of the stand.

References


