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RESULTS OF EGG PRODUCTION IN DIFFERENT HOUSING SYSTEMS **

L. Perić*[1], N. Milošević[1], N. Tolimir[2], D. Žikić[1]

[1]Faculty of Agriculture, Novi Sad, Serbia
[2] Institute for Science Application in Agriculture, Belgrade, Serbia
* Lidija Perić; e-mail: lidija@polj.ns.ac.yu
**Original scientific paper

Abstract: The aim of this work was to present the production results of laying hens kept in different housing systems – conventional cages with different stocking densities, enriched cages or in houses with a range. The used hybrid was Shaver 579 (564 birds). The main production parameters were monitored: No. of laid eggs, laying percentage, mortality rate, feed intake, egg weight and number of culled eggs. Data were analyzed by ANOVA followed by t-test. Main production parameters in production of table eggs were significantly different depending on the housing system. The best results were realized in cage system with lower housing density, and the worst results in hens housed in floor system on free range.

Key words: hen, layers, housing systems, performances

Introduction

Over several decades, production of eggs has become increasingly intensive because of mass use of line hybrids, increase of their productivity, enlargement of the farms and increased use of machinery and automatization of work processes in egg production. Introduction of battery housing system in sixties and its great expansion lead to negative critics from the public focused mainly on the welfare of layer hens. This stimulated development of new housing systems such as enriched/improved cages, floor system, aviary system, free range, organic production, etc. Which eventually induced banning of conventional cages from use in countries of the European Union before year 2012 *(Council of the European Union,* 1999a,b*)*. However, use of alternative systems demonstrated some disadvantages. Compared to cage system, it was established that in aviary housing system increased emission of ammonia occurs *(Groot Koerkamp,* 1998*)*, cost of electricity is higher *(van Horne, 1996)* and conditions for workers are poor *(van den Top et al.,* 1995*)*. Also in case of other systems, adverse effect on economical

efficiency of production was registered *(van Horne,* 1996*)*. Therefore, the issue of housing of layer hens must be treated in a way that all production, economical, ecological and social aspects are taken into consideration *(de Boer and Cornelissen,* 2002*)*.

Objective of this paper is to present production results of layers of table eggs in different housing systems – conventional cage with different housing density, improved cage and free range.

Material and Methods

Trial was carried out on experimental farm of the Department of Animal Science of the Faculty of Agriculture in Novi Sad, from September 2005 to September 2006. Investigated hybrid was Shaver 579. Layers were reared in floor system, and at the age of 18 weeks layers were housed in four different systems, on the experimental farm:

1) cage system with 5 layers in cage, 650 cm^2 per layer - Big Dutchman (BD)

2) modified cage of 45.255 cm^2 surface with 60 layers per tier, perches, nests and send (Eurovent EU Big Dutchman)

3) standard cage system with 5 layers in cage of 500 cm^2 per hen (K)

4) floor system with range providing 1666 cm^2 of floor surface per hen in chicken coop and 3333 cm^2 per hen of free range (P)

Total of 564 layers were housed – 120 in group 1 (BD), 180 in group 2 (EU), 240 in group 3 (K) and 48 in group 4 (P).

Number of eggs, number of eggs of II class (dirty, cracked, eggs with soft egg shell, of irregular shape, eggs with two yolks), as well as mortality were registered each day. Use of feed was calculated based on total feed consumption in production cycle and number of feeding days. Also, once a month daily feed consumption was monitored in the following way: during three consecutive days, in the morning feeders were emptied, and precisely measured amount of feed given to birds, and after 24 hours the remaining feed was measured and difference divided by number of hens. Egg mass was controlled weekly, eggs were collected during 24 hours, measured and average values were calculated. Based on obtained data statistical analysis was done using method of variance analysis and t-test.

Results and Discussion

Based on obtained data registered during production year main

production parameters were calculated (tab. 1).

Table 1. Number of eggs, laying percentage and mortality rate

Group	No. of eggs		Laying percentage, %		II grade eggs, %	Mortality rate,%
	per hen housed	per average hen	per hen housed	per average hen		
1 (BD)	303.2[a]	310.5[a]	81.72[a]	83.67[a]	1.17[a]	3.33
2 (EU)	269.4[b]	290.4[b]	71.88[b]	78.27[b]	1.40[a]	14.44
3 (K)	275.4[b]	289.4[b]	74.03[b]	78.00[b]	0.70[b]	10.41
4 (P)	/	258.2[c]	/	69.73[c]	26.9[c]	/

[a-c] Values without same letter in superscript are significantly different (P<0.01)

Number of eggs per hen housed and average hen differed significantly depending on the housing system. The highest laying percentage per hen housed and average hen was realized in group 1 (BD), and the worst results in layers on free range (group 4).Low temperatures during winter period had significant adverse effect on the results established in group 4 when considerable drop in laying percentage occurred. Also, mortality increased in winter period, but considering small number of layers in the group, this parameter wasn't presented since it didn't reflect the real situation. Also, due to the same reason, number of eggs per hen housed wasn't presented.

In other systems also differences were observed. Differences were highly significant statistically between group 1 (BD) and groups 2 (EU) and 3 (K). In groups 2 and 3 slightly higher mortality was observed as a result of increased number of deaths during summer period. Assumption is that heat stress had negative effect on layers in conventional cages (K) with higher housing density, as well as layers on tiers (EU), especially those on top tiers. Based on these results it can be concluded that conventional cage system with lower housing density was the best solution for realization of maximum laying percentage. Number of eggs of II class was considerably lower in group 3 (K) compared to other systems, and considerably higher in case of layers in free range system. High percentage of eggs of II class is consequence of laying of eggs outside the nest, so high percentage of eggs was dirty.

Average daily feed consumption was the highest in layers on free range and the lowest in layers in conventional cages. However, feed conversion was the best in group 1 (BD) since this group, in spite of relative high feed consumption, had the best laying percentage. There were no significant differences in egg mass.

In results published by *Heil et al.* (2003) average number of eggs laid by

hens in cages was 317 compared to floor system where average number of eggs was 283. Conversion was better by 0.28 points in layers housed in cages, whereas no difference in egg mass was established. *Hähne et al.*

Table 2. Feed consumption and feed conversion ratio

Group	Average daily feed consumption	Average egg weight	Feed conversion ratio
1 (BD)	127[a]	64.29	2.36
2 (EU)	125[ab]	64.33	2.70
3 (K)	121[b]	65.25	2.51
4 (P)	134[c]	65.28	2.94

[a-c] Values without same letter in superscript are significantly different (P<0.01)

(2001) published their experiences in Switzerland and concluded that production in aviary system was at the level of production in battery system, but significantly lower results in floor system. *North* (1984), *Horne-Van and Van-Horne* (1994) and *Moorthy et al.* (2000) established better performances in layers housed in cages compared to layers housed on floor. In results presented by *Adams and Craig* (1985) and *Carey et al*. (1995) number of eggs of II class was considerably higher in layers reared in floor system compared to cages. Same authors also concluded that increased housing density has adverse effect on performances, especially because it is in positive correlations to poor hygiene conditions.

Conclusion

Main production parameters in production of table eggs were significantly different depending on the housing system. The best results were realized in cage system with lower housing density, and the worst results in hens housed in floor system on free range.

REZULTATI PROIZVODNJE KONZUMNIH JAJA U RAZLIČITIM SISTEMIMA DRŽANJA

L. Perić, N. Milošević, N. Tolimir, D. Žikić

Rezime

Cilj ovog rada je da prikaže proizvodne rezultate kokoši nosilja konzumnih jaja u različitim sistemima držanja – konvencionalni kavezi sa različitom gustinom naseljenosti, obogaćeni kavez i držanje na ispustu. Ispitivani hibrid bio je Shaver 579. Useljeno je ukupno 564 nosilje. Broj snesenih jaja, broj jaja II klase, mortaliet, utrošak hrane i konverzija su osnovni proizvodni parametri koji su korišćeni za procenu uspeha proizvodnje. Na osnovu dobijenih podataka urađena je statistička obrada metodom analize varijanse i t-testa. Osnovni proizvodni parametri proizvodnje konzumnih jaja značajno su se razlikovali u zavisnosti od sistema držanja. Najbolji rezultati ostvareni su u baterijskim kavezima sa manjom gustinom naseljenosti, dok su najlošiji rezultati ostvareni kod kokoši koje su držane u podnom sistemu sa ispustom.

Ključne reči: kokoši, nosilje, sistemi držanja, performanse

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