www.pan.olsztyn.pl/journal/
e-mail: joan@pan.olsztyn.pl

Pol. J. Food Nutr. Sci.
2007, Vol. 57, No. 4(A), pp. 77-79

EGG QUALITY IN MULTI–DECK CAGE TECHNOLOGY SYSTEM

Ludmila Chmelničná, Lenka Solčianska

Slovak Agricultural University, Nitra, Slovakia

Key words: quality of eggs, non–standard eggs, uneatable eggs

The quality of table eggs was monitored in hens housed in seven-floor cage technology system from the 25th to 54th week of hen's age. We classified the eggs on the non-standard ones, *i.e.* double-yolked, with weight under 45 g, with egg shell deformation, with egg shell cracks and on the uneatable, *i.e.* with broken egg shell and without egg shell. We found out different light intensity (from 20 to 180 luxes) on individual floors. The laying period was divided to three parts and we realized 5 classifications of whole day egg production in every part.

We found out the different share of eggs with egg shell cracks (0.31 – 0.47 – 0.68%) in relation to age of hens in the 1st – the 2nd – the 3rd part of laying cycle. The egg less than 45 g occurred only in the 1st period, but the occurrence of eggs with deformation of shell (0.31 – 0.47 – 0.68%) and the double-yolked eggs (0.67 – 0.52 – 0.54%) was relatively well-balanced. Total production of the non-standard eggs from the whole production was 1.33 – 1.44 – 1.46 in the parts of the cycle. The occurrence of non-standard eggs in relation to the number of the etage was followed as the most relevant in double-yolked eggs at 0.53 – 0.47 – 0.42 – 0.52 – 0.75 – 0.65 – 0.68% from the 1st to the 7th floor in direct relation to the light intensity. The other categories of non-standard eggs showed relatively equal values at every etage. We found out the share of the uneatable eggs in relatively low values at 0.85 – 0.70 – 1.24% from total production in the 1st, the 2nd and the 3rd part of the laying cycle. The results of these shares were found out at 90.8 – 91.8 – 76.8% of laying intensity of hens.

INTRODUCTION

The change of cage area from 450 cm^2 to 550 cm^2 per hen in table eggs production according to EU Directive 1999/74 EC will mean the decrease of the laying house capacity for farmers. By the year 2012, with using previous conventional cages, this decrease represents about 20%. The house capacity will decrease about other 30% with using only enriched cage systems with 750 cm^2 per hen. It can be supposed, that farmers will reflect upon possibility of using multi-deck cage technologies in hens breeding.

Cage system of layers breeding was attacked by animal protectors during the last ten years. But cage systems started to develop because of bad experiences with layers breeding in large groups on deep litter or slats before over 30 years. Laying hens housed in cage systems do not suffer the presence of endoparasites and most of ectoparasites, higher dustiness and ammonia level. This house environment provides them suitable living conditions, which shows reached egg production about 300 eggs with 0.5% mortality per month in intensive layers breeding [Košař, 2000]. Layers breeding system allowed solving the main problems of egg production economy: operation process automatization and breeding hygiene increase. Closed poultry houses with strict hygienic rules provide isolation of housed poultry from external environment. Thereby layers are protected from infectious diseases transmitted by insect, rodents and wild birds [Mihina *et al*., 2000]. The quality of table eggs laid by hens housed in cage systems depends on health and condition state of hens. This state is in straight connection with provision of suitable microclimatic and technologic breeding conditions. Crucial factors in multi-deck battery cage systems of layers breeding (floors right above) are especially cage area, ambient temperature, uniform house ventilation and light intensity in individual floors. In spite of that we reached the same useful parameters of laying hens with lower cage area than 550 cm^2 per hen in our experiments, with decrease of cage area below 400 cm^2 the risk of layers stress and house space overcrowding increased [Chmelničná, 2003]. Cage area increase from 573 cm^2 to 860 cm^2 per hen in conventional cages in our experiments had no effect on the most of qualitative parameters of eggs, but we found out the increase of egg weight by 0.48 g [Chmelničná, 2004]. Temperature interval from 18 to 20 °C is considered as the optimal temperature for laying hens [Holoubek & Samek, 1998], but the values to 23 and 24°C are recommended for better feed utilization [Technological process Isa-Brown, 2000]. Optimal light intensity during the laying cycle is 20 to 30 luxes, but for laying hens lower light intensity is sufficient. Košař & Chaloupková [2000] found out no differences in egg production after hens transfer to laying houses with light intensity 5.5 – 12 – 46 – 78 luxes.

MATERIALS AND METHODS

The aim of the research paper was to monitor and evaluate the external quality of table eggs laid by hens housed in

Author's address for correspondence: Doc. Ing. Ludmila Chmelničná, CSc.Slovak Agricultural University, Tr. A Hlinku 2, 94976 Nitra, Slovakia; e-mail: Ludmila.chmelnicna@uniag.sk

seven-floor cage technology "COMFORT". The experiment was realized in service conditions from 25 weeks till 54 weeks of age.

The experimental evaluation of external egg quality after the collection before the distribution was performed in breeding house with area 1056 m^2, where the laying hens were housed in seven – floor cage technology "COMFORT". Seven-floor cage batteries were organized in 10 lines with 48 m length. The initial status of laying hens at the age of 23 weeks at the beginning of laying period was 80 600 hens, which responds to the stocking density about 76 hens per m^2 of breeding area. The feed for hens was transported by the portal transporters to the feed trough in front of the cages, drinking was provided by nipple drinkers – 1 drinker for 6 hens. The lighting was provided by 11 ceiling and 9 suspended lamps in every corridor – energy saving fluorescent lamp in total number of 220 lamps in whole house. The highest light intensity was measured in the 4th and the 5th floor (120 to 180 luxes) and in the 7th floor below the ceiling lamps (80 to 120 luxes). The light intensity in the 1st to the 3rd floor was between 20 to 40 luxes. The observation of external quality of laid eggs was performed in two-week periods from 25 till 54 weeks of age, total of 15 evaluations. For our evaluation we divided the laying period to 3 parts (25 to 34, 35 to 44, 45 to 54 weeks of age). We performed 5 evaluations in every third of the laying cycle. Whole-day egg production was divided to standard, non-standard and uneatable eggs. The non-standard eggs were classified to these categories: double-yolked, with weight under 45 g, deformed and cracked eggs. Determined numbers were re-counted to the share of whole-day egg production. Experimental monitoring was performed in Isa-brown layers breeding. This hybrid produces eggs with brown shell.

TABLE 2. Share of individual categories of non-standard eggs from the total number of non-standard eggs (%).

Period of the laying cycle	Double-yolked	Weight under 45 g	Deformed	With corrupted shell
I.	50.6	4.1	22.5	22.9
II.	35.7	1.1	31.4	31.9
III.	35.7	0.6	18.3	45.6
Average	40.6	1.9	24.1	33.7

TABLE 3. Statistical characteristic of the share of double-yolked eggs from the total egg production.

Period of the laying cycle	$\bar{x}$	SD	v
I.	0.67	0.21	31.3
II.	0.52	0.34	65.4
III.	0.54	0.46	85.2

TABLE 4. The occurrence of double-yolked eggs in individual floors.

Floor of cage technology	Period of the laying cycle		
	I.	II.	III.
1	0.68	0.48	0.43
2	0.58	0.36	0.48
3	0.55	0.36	0.36
4	0.66	0.46	0.44
5	0.81	0.78	0.67
6	0.66	0.61	0.68
7	0.74	0.58	0.71

RESULTS AND DISCUSSION

The share of non-standard eggs during the observed laying cycle was relatively well-balanced with slow increase with age of hens (Table 1). By proportional representation expression of individual categories of non-standard eggs we found out the highest share of double-yolked eggs in the first and partially in the second part of the laying cycle. High proportional representation of this category at the beginning of the laying period (50.6% from the total non-standard eggs) is in accordance with the beginning of the physiological process of egg production (Table 2). Persisting relatively high share of double-yolked eggs, about 35% of total non-standard eggs what represented 0.52% and 0.54% from total egg production (Table 3), was probably the result of unbalanced light intensity in individual floors (Table 4).The highest values of double-yolked eggs were noticed in the 5th, 6th and 7th floor of the cage batteries during the whole laying cycle and there were also measured the highest light intensities. Our results confirmed the evidences about no effect of different light intensity on egg production noticed by Košař & Caloupková [2000], but the different light intensity markedly affects the share of double-yolked eggs. Persisting higher share of double-yolked eggs weakens the health condition and markedly aggravates the welfare of laying hens.

TABLE 1. Share of the main categories of eggs (%).

Period of the laying cycle	Eggs		
	Standard	Non-standard	Uneatable
I.	97.79	1.33	0.88
II.	97.86	1.44	0.70
III.	97.30	1.46	1.24
Average	97.65	1.41	0.94

Non-standard eggs with weight under 45 g were noticed only in very low share and occurred only at the beginning of the laying cycle (Table 2). The occurrence of this category of eggs was in accordance with the assumption, that hens were well raised and laid eggs in long series of the egg production. The share of deformed eggs or eggs with changed shape (Table 5) was found out only in relatively low share from the total egg production from 0.28% in the 3rd third and 0.30% in the 1st third to 0.47% in the 2nd third of the laying cycle (Table 2). The highest statistically significant share of deformed eggs was in the 2nd third of the laying cycle, in which participates the hens housed in higher floors of the cage batteries (Table 6). The total structure of the eggs from this category had relatively equal frequency. We noticed no outstanding changes, which could define the enormous health condition of laying hens.

TABLE 5. Statistical characteristic of the share of deformed eggs from the total egg production.

Period of the laying cycle	$\overline{x}$	SD	v
I.	0.30[a]	0.14	46.7
II.	0.47[b]	0.04	8.5
III.	0.28[c]	0.26	92.1

TABLE 6. The occurrence of deformed eggs in individual floors.

Floor of cage technology	Period of the laying cycle		
	I.	II.	III.
1	0.28	0.38	0.29
2	0.36	0.51	0.23
3	0.28	0.44	0.29
4	0.29	0.37	0.34
5	0.27	0.44	0.31
6	0.23	0.61	0.20
7	0.39	0.53	0.30

TABLE 7. Statistical characteristic of the share of eggs with corrupted shell from the total egg production.

Period of the laying cycle	$\overline{x}$	s	v
I.	0.31[a]	0.07	22.6
II.	0.47[b]	0.08	17.0
III.	0.68[c]	0.14	20.6

TABLE 8. The occurrence of eggs with corrupted shell in individual floors.

Floor of cage technology	Period of the laying cycle		
	I.	II.	III.
1	0.22	0.51	0.80
2	0.31	0.46	0.67
3	0.35	0.42	0.54
4	0.31	0.41	0.51
5	0.24	0.44	0.59
6	0.31	0.46	0.82
7	0.42	0.54	0.84

The share of eggs with little corrupted shell belongs to the most important losses caused by unbalanced mineral nutrition. This category of non-standard eggs presented the second proportional representation (33.7% from the total non-standard egg production). The share of these eggs statistically significant increased with the age of hens (Table 7) from 0.31% in the 1st third to 0.68% to the 3rd third of the laying cycle with relatively balanced variability between the individual observations. Increasing share of eggs with little corrupted shell was noticed in every floor (Table 8). Higher increase tendency was noticed in the 1st, 6th and 7th floor of the cage batteries.

The total occurrence of uneatable eggs had similar tendency in our observations as the occurrence of eggs with little corrupted shell (Table 1). The main share in this category of eggs presented the eggs with broken shell, so that egg content got in touch with the external environment.

CONCLUSION

In experimental monitoring of share of individual categories of non-standard eggs expressed by the share from the total egg production of the laying hens housed in the seven-floor cage system, we noticed the significant effect of the floor on the deformed eggs, eggs with corrupted shell and double-yolked eggs between the parts of the laying cycle. The different share of these categories of eggs was in direct connection with the noticed light intensity and air temperature in the evaluated floors of the cage technology. In accordance with the aim of the research paper, the experimental monitoring of the occurrence of non-standard eggs was realized in service conditions, where hens were housed in seven-floor cage technology. It is the only one model of this kind of cage technology installation in Slovak Republic, so the monitoring for experimental observation was specially valuable.

REFERENCES

1. Chmelničná L. Qualitative index of table eggs production on increasing of hen's cage area. Ochrana zvířat a welfare, 2003, VFU, Brno, pp. 82–84 (in Slovak; English abstract).
2. Chmelničná L. The effect of decreased cage area for hens on their performance indexes. Chov drůbeže, 2004, MZLU, Brno, pp. 107-112 (in Slovak; English abstract).
3. Holoubek J., Samek M. The effect of ambient temperature on utility of hens in three-deck cages. Aktuální problémy chovu, zdraví a produkce drůbeže, 1998, České Budějovice, SCP JČU, pp. 195–197 (in Czech).
4. Košař K. Can the subjective appraisal of hen's welfare by human be the crucial factor of their breeding? Slovenský chov, 2000, 12, 24-26 (in Slovak).
5. Košař K., Chaloupková H., Using of fluorescent lamps in poultry houses. Vnútorná klíma poľnohospodárskych objektov, 2000, SSTP Bratislava, pp. 70-73 (in Czech).
6. Mihina Š., Botto Ľ., Orság J., Animal requirements respect in breeding environment creation in Slovakia in the past and present. Tvorba prostredia chovu zvierat v zmysle európskej legislatívy transformovanej do slovenských podmienok, 2000, Nitra, RIAP, pp. 4-10 (in Slovak; English abstract).
7. Technological process ISA BROWN. Hatchery corporation (Liarenský podnik) Nitra, 1994 (in Slovak).