PERFORMANCES OF LAYING HENS IN CONDITIONS OF EXPLOATATION IN AVIARIES

C. Spridon[1], Paula Druc[1], Carmen Gavrilescu[1], M.G. Usturoi[1*]

[1]*University of Agricultural Sciences and Veterinary Medicine-Iasi, Romania*

Abstract

The predictions regarding exploitation of laying hens in cages show a possible renounce of this working principle, so the specialists are improving the nowadays alternative rearing systems; those technical solutions must allow greater densities on square unit and to assure a suitable free movement for birds. In the current paper are presented the performances realised by laying hens in conditions of exploitation in aviaries, during 20-60 weeks age period. Investigations were carried out on 36343 ISA Brown hens accommodated into a shelter of 2642 m^2 equipped with a Natura Nova Twin aviaries, and for comparison were utilised 10346 ISA Brown hens exploited in Big Dutchman cages, Eurovent type. The assured microclimate factors presented lower or higher variations, function of several factors, but especially due to the utilised rearing system, but without leaving the zone of physiological comfort. Body weight of the studied hens was higher than the standard of utilised hybrid, consequence of a photo-stimulation process applied in the host unit, sustained their very good egg production. During studied period, hens reared in aviaries obtained a production of 254.49 eggs/head, and the ones from cages obtained 258.08 eggs/head (face to a theoretical value of 246 eggs), at a mean laying intensity of 88.66%-aviaries and respectively 89.88%-cages (88.51% being the theoretical intensity). Maximum intensity of laying was reached at age of 31 weeks and was of 93.3% for the hens in aviaries and 93.85% at the ones from cages (theoretical performance being 96%). During whole studied period, mean daily consumption of mixed fodders was 120.17 g m.f./head/day respectively, of 115.29 g m.f./head/day, while feed conversion index was situated at levels of 135.34 g m.f./egg in the case of hens reared in aviaries and of only 127.66 g m.f./egg at the ones from cages. In conclusion, we could say that rearing system in aviaries assure optimal conditions for productive potential of laying hybrids, at comparable levels with the ones realised at rearing in cages.

Key words: rearing, aviaries, hens, production, eggs

INTRODUCTION

Even if are incriminated for apparition of cardiovascular diseases and increasing of cholesterol level, eggs remain important alimentary products for human consumer, due to their high nutritive value as well as due to the quality of contained proteins and high digestibility level of the compounds [8, 12].

For decades, the most profitable variant for rearing of laying hens was the one in classic cages, placed in shelters with controlled environment [7, 9]; this working technique allowing realisation of some very high productions on square unit, in conditions of a maximum economical efficiency, but weren't suitable with the desideratum of animal's welfare [2, 13].

From those reasons appeared different technical solutions, known as alternative systems (improved cages; on permanent layer; in opened shelters at paddock; in aviaries) [8] which were imposed in European aviculture after 1st of January 2012, when classical cages were banned for exploitation of laying hens [3, 11].

Rearing systems for laying hens accepted by European Union generated also a criteria for eggs' classification, which place them into a certain quality area [9].

In the last period increased the demand for eggs from free rearing systems or free-range (code 1) [6], but especially for the ones from organic production (code 0) [5]; eggs obtained from hens reared in improved cages receiving code 3, respectively the last quality level [1, 9].

*Corresponding author: umg@uaiasi.ro
The manuscript was received: 26.09.2017
Accepted for publication: 13.10.2017

Research in domain show that aren't quality differences between those contested system (cages) and other alternative systems; even more, eggs from cages have a much lower contamination level [4, 8, 10].

One of the technical solution for which opt more and more European farmers is the one in aviaries, because allow high densities on square unit, good production of eggs and more over respect totally the welfare condition; in addition eggs from such system are coded with 2 [9, 12].

Also in Romania, was introduced the rearing system of hens in aviaries, but only in few units; so, the handling experience of those working principle is quite reduced and the scientific information related to possible performances are completely lacking [9].

MATERIAL AND METHOD

To achieve the proposed goal were compared two exploitation systems for laying hens, accepted at European level.

The rearing system subjected to our study was the one in Natura Nova Twin aviaries type, placed into a shelter of 2642 m^2; the itself research were carried out on 36343 laying hens belonging to ISA Brown commercial hybrid.

For comparison was used a classical shelter of 930 m^2, equipped with an improved Big Dutchman cage, Eurovent type; the initial flock was of 10346 ISA Brown laying hens.

The tracked indicators were observed during birds' age period 20-60 weeks and were recorded and calculated in according with the methodology accepted by aviculture, as follows:

- ambient temperature – was taken over from the shelter PC's, as a mean value from a certain day; based on daily temperatures were calculated the weekly mean temperatures;
- air relative moisture – daily means were utilised for calculation of weekly mean moistures;
- body weight – were made weekly individual weightings on 80 individuals from each shelter;
- numerical production of eggs – based on rate between weekly mean flock and number of laying eggs from that week was calculated the daily number of eggs/hen, weekly number of eggs/hen;
- individual egg production – resulted from summing of weekly productions for each hen, during the studied period (20-60 weeks);
- laying intensity – was calculated as a rate between weekly eggs' production and weekly mean flock, during reference period (7 days);
- consumption of fodders – was calculated daily mean consumption and respectively feed conversion index for age periods 20-45 weeks and 46-60 weeks, as well as for the whole studied period.

The obtained data were statiscally processed, being calculated: arithmetic mean ($\bar{x}$), standard error of mean (±sx) and variation coefficient (V%).

RESULTS AND DISCUSSIONS

Dynamics of microclimate factors. Regarding ambient temperature (tab. 1), the recorded data show quite high differences between those two utilised shelters, generated by the number of accommodated hens, by the adopted constructive solution, and also by the season.

So in the case of shelter equipped with aviaries, the higher number of hens leaded to a supplement of biological heat which determine quite high thermal levels in the first weeks of the study (which coincide with August month), with a maximum of 24.63±0.20°C in 22nd life week of hens.

In the next weeks, mean temperatures in the above mentioned shelter being to decrease progressively, at the same time with passing to the cold season; the lowest value of 17.97±0.28°C, being recorded in the 41st life week of hens (beginning of January), after that ambient temperatures beginning to increase up to a level of 22.99±0.47°C reached in the last week of investigation, week 60.

This fluctuant evolution of ambient temperature from the shelter with aviaries was due to the very high number of accommodated hens which needed a more aggressive ventilation rate than at other constructive solutions; in addition, the very big area of shelter (2642 m^2) reduced the efficiency of PAD chilling system during periods with very high external temperatures.

Table 1 Ambient temperature (ºC) in studied shelters

Age of birds (weeks)	Rearing in aviaries (n=7)				Rearing in cages (n=7)			
	$\bar{X} \pm s_{\bar{x}}$ (ºC)	V%	Min.	Max.	$\bar{X} \pm s_{\bar{x}}$ (ºC)	V%	Min.	Max.
20	24.15±0.22	2.66	23.4	25.3	20.53±0.08	1.04	20.2	20.8
21	24.43±0.25	2.75	23.5	25.5	20.63±0.13	1.65	20.1	21.0
22	24.63±0.20	2.14	23.8	25.1	20.59±0.04	0.52	20.5	20.7
23	24.53±0.29	3.18	23.6	25.9	20.46±0.04	0.48	20.3	20.6
24	24.34±0.34	3.73	23.1	25.2	20.46±0.08	1.01	20.1	20.8
25	21.49±0.69	8.45	18.9	24.0	20.73±0.11	1.41	20.4	21.2
26	23.80±0.17	1.93	23.1	24.2	20.61±0.06	0.76	20.4	20.8
27	22.79±0.38	4.42	21.3	24.1	20.57±0.05	0.67	20.4	20.8
28	21.47±0.39	4.80	20.1	22.8	20.53±0.08	1.04	20.1	20.7
29	22.06±0.44	5.29	20.5	23.1	20.50±0.05	0.63	20.3	20.7
30	21.91±0.32	4.01	19.8	22.3	20.80±0.23	2.90	20.3	22.2
31	22.04±0.52	6.19	19.2	23.2	21.29±0.26	3.28	20.5	22.0
32	20.20±0.43	5.67	19.1	22.2	21.21±0.21	2.67	20.6	22.7
33	19.01±0.22	3.07	18.3	20.1	21.86±0.14	1.73	21.5	22.5
34	21.44±0.22	2.70	20.8	22.2	21.29±0.24	2.99	20.5	22.4
35	19.36±0.59	8.10	18.1	22.2	21.22±0.25	3.00	20.4	22.1
36	20.21±0.19	2.45	19.7	21.2	21.10±0.22	2.75	20.5	22.0
37	19.07±0.19	2.69	18.5	20.1	21.07±0.28	3.47	20.5	22.5
38	18.90±0.17	2.35	18.1	19.3	21.12±0.23	2.88	20.2	22.0
39	18.82±0.27	3.84	17.8	19.8	21.21±0.21	2.67	20.5	22.7
40	18.39±0.17	2.48	17.9	19.1	21.14±0.27	3.37	20.3	22.2
41	17.97±0.28	4.09	17.2	19.0	21.54±0.27	3.30	20.3	22.6
42	18.94±0.18	2.45	18.2	19.6	21.27±0.34	4.29	20.0	22.6
43	18.77±0.16	2.25	18.1	19.4	20.91±0.25	3.18	20.1	21.8
44	18.50±0.15	2.14	18.1	19.1	20.86±0.29	3.65	20.0	21.9
45	18.16±0.06	0.89	17.9	18.4	20.63±0.24	3.08	20.0	21.7
46	19.09±0.12	1.70	18.6	19.6	20.70±0.21	2.66	20.1	21.8
47	19.07±0.21	2.98	18.4	20.1	20.89±0.15	1.88	20.2	21.4
48	19.11±0.20	2.78	18.3	20.1	21.56±0.18	2.12	21.0	22.2
49	18.27±0.19	2.77	17.5	19.1	21.57±0.24	2.93	20.3	22.2
50	18.91±0.27	3.83	18.1	19.8	21.73±0.14	1.70	21.3	22.3
51	18.79±0.30	4.18	17.8	20.1	20.86±0.19	2.46	20.4	21.6
52	21.10±0.33	4.11	19.8	22.0	21.66±0.17	2.11	21.0	22.3
53	19.73±0.20	2.74	18.9	20.4	21.59±0.15	1.84	21.1	22.2
54	20.29±0.66	8.58	18.1	22.0	21.31±0.32	4.03	20.1	22.6
55	19.05±0.28	3.84	18.1	20.1	21.21±0.21	2.67	20.5	22.0
56	23.31±0.86	9.71	20.1	26.1	20.86±0.21	2.60	20.5	22.0
57	24.23±0.41	4.44	23.0	26.1	20.70±0.09	1.18	20.4	21.1
58	22.37±0.19	2.26	21.9	23.1	21.81±0.17	2.10	20.2	21.3
59	22.93±0.27	3.13	22.1	24.2	21.33±0.31	3.81	20.5	22.6
60	22.99±0.47	5.44	21.6	24.5	21.54±0.28	2.17	20.8	22.4

In the case of shelter equipped with cages, the lower surface and the reduced number of hens than at the above mentioned constructive allowed to the shelters' equipments to keep the ambient temperature in much more closer limits. So in the first 10 weeks of study, this physical microclimate factor varied between 20.50±0.05ºC (week 29) and 20.80±0.23ºC (week 30), and after that maintaining for 12 weeks at a little bit high levels of +21ºC (21.07-21.86ºC), and to the end of rearing cycle to vary between 20.63±0.24ºC (week 45) and 21.81±0.17ºC (week 58).

Air relative moisture (tab. 2) recorded quite a similar evolution with temperature, in the way that was more variable in the shelter equipped with aviaries and more uniform in the one with cages.

So, air moisture from shelter with rearing in aviaries varied between 54.86±2.53% (week 56 of hens life) and 74.57±0.78% (week 33), while in the shelter with rearing in cages the variation limits were between 55.43±0.57% (week 47) and 58.50±0.82% (week 20).

Table 2 Air relative moisture (%)in studied shelters

Age of birds (weeks)	Rearing in aviaries (n=7)				Rearing in cages (n=7)			
	$\bar{X} \pm s_{\bar{x}}$ (%)	V%	Min.	Max.	$\bar{X} \pm s_{\bar{x}}$ (%)	V%	Min.	Max.
20	64.55±2.99	6.78	58	75	58.50±0.82	3.69	55	62
21	64.29±2.96	12.17	52	75	58.02±0.69	3.15	55	60
22	69.29±2.24	8.57	60	78	56.71±0.64	3.01	55	59
23	63.86±1.68	6.97	56	71	56.43±0.57	2.68	55	59
24	63.57±1.11	4.62	59	67	58.03±0.44	1.99	57	60
25	55.86±2.33	11.06	50	68	57.14±0.63	2.93	55	59
26	55.00±1.11	5.35	51	58	57.29±0.71	3.30	55	60
27	57.14±1.49	6.88	52	62	57.02±0.58	2.68	55	59
28	61.57±1.89	8.11	56	68	58.04±0.53	2.44	56	60
29	60.57±1.27	5.55	56	65	58.14±0.55	2.52	56	60
30	62.86±1.10	4.63	58	67	55.86±0.26	1.24	55	57
31	61.71±0.64	2.76	59	64	56.57±0.57	2.67	55	59
32	64.71±3.13	12.8	56	76	58.08±0.44	1.99	57	60
33	74.57±0.78	2.78	72	78	58.43±0.43	1.94	57	60
34	63.43±0.78	3.26	61	66	57.71±0.61	2.78	56	60
35	67.43±1.86	7.31	60	72	56.43±0.53	2.48	55	59
36	63.71±0.81	3.36	61	67	57.14±0.74	3.42	55	60
37	62.29±0.42	1.79	61	64	57.03±0.62	2.86	55	59
38	62.28±1.30	5.54	58	67	57.14±0.61	2.35	55	59
39	67.14±1.47	5.80	63	75	56.71±0.57	2.64	55	59
40	67.57±2.22	8.71	61	75	57.01±0.58	2.68	55	59
41	70.57±1.57	5.89	64	76	56.57±0.75	3.51	54	59
42	62.57±0.84	3.56	59	66	56.57±0.57	2.67	54	59
43	61.02±0.72	3.14	59	64	55.57±0.56	2.72	54	58
44	58.14±1.56	7.12	54	66	55.86±0.86	4.06	52	59
45	55.14±0.94	4.49	52	59	56.14±0.63	2.99	54	59
46	65.71±1.15	4.63	61	69	56.00±0.58	2.73	54	58
47	65.43±1.84	7.43	60	73	55.43±0.57	2.73	53	57
48	66.14±0.96	3.85	61	68	57.14±0.59	2.75	55	59
49	60.43±1.21	5.31	55	66	56.57±0.48	2.25	55	58
50	63.03±2.39	10.04	56	70	57.14±0.46	2.13	55	58
51	66.43±1.46	5.82	59	70	58.05±0.49	2.23	56	60
52	65.03±1.88	7.64	59	71	56.57±0.37	1.73	55	58
53	62.29±0.75	3.17	60	66	56.43±0.57	2.68	55	58
54	61.29±2.35	10.13	55	68	56.71±0.57	2.64	55	59
55	63.29±1.41	5.89	58	69	56.61±0.42	1.96	55	58
56	54.86±2.53	12.2	50	66	57.14±0.51	2.35	55	59
57	65.57±1.23	4.97	61	69	57.43±0.75	3.46	55	60
58	62.29±1.80	7.63	55	68	56.57±0.69	3.2	54	59
59	58.57±0.65	2.93	56	61	56.86±0.61	2.86	54	59
60	59.43±0.78	3.48	57	63	58.29±0.71	3.24	56	61

Dynamics of body weight (tab. 3). Previous of starting the experiment, hens were subjected to a photo-stimulation programme which leaded to achieving of higher weights than the theoretically ones.

So, if in week 20 of hens' life, their weight was 1783.25±0.014 g (the ones from aviaries) and 1741.20±0.012 g (the ones from cages), in the last control week (week 60), the recorded weights were of 2245.25±0.018 g (hens from aviaries) and of 2231.57±0.012 g (hens from cages); theoretically weights for those two mentioned ages are 1640 g respectively 1979 g.

This over-pass of recommended weights was benefice because it compensated the energetic consumptions generated by a greater freedom of movement, especially in the case of hens reared in aviaries.

Numerical production of eggs (tab. 4). In the first week of investigations (week 20 of hens life), those 36312.5 hens from the shelter equipped with aviaries have deposited 150314 eggs (4.14 eggs/head/week), and those 10344 hens from the shelter with cages totalised a number of 46670 eggs (4.51 eggs/head/week).

The highest number of eggs (233484 pcs. in aviaries rearing system and 67552 eggs in the one with rearing in cages) was obtained in the 31st week of hens life, resulting an individual production of 6.53 eggs/head/week - for aviaries respectively 6.77 eggs/head/week - for cages.

In the next laying weeks, numerical eggs production of studied hens progressively decreased, reaching a minimum level in the last week of our investigations (week 60 of hens life) being of 5.48 eggs/head/week for hens reared in aviaries (185246 eggs/week at a mean flock of 33811.5 heads) and of 5.72 eggs/head/week at the ones accommodated in the shelter with cages (56813 eggs at a mean flock of 9931 heads).

Per total studied period (20-60 weeks), eggs production of hens accommodated in shelter equipped with aviaries was of 254.49 eggs/head, and for the ones exploited in cages was of 258.08 eggs/head.

Laying intensity (tab. 5). In the first week of research (week 20 of hens life), laying intensity of studied hens was higher than the theoretic potential of the utilised hybrid (38%), as well as for the ones exploited in aviaries (59.13%), but especially for the ones reared in cages (64.45%).

Table 3 Body weight of studied hens

Age of birds (weeks)	Theoretic weight (g)	Rearing in aviaries (n=80)				Rearing in cages (n=80)			
		$\bar{X} \pm s_{\bar{X}}$ (g)	V%	Min.	Max.	$\bar{X} \pm s_{\bar{X}}$ (g)	V%	Min.	Max.
20	1640	1783.25±0.014	8.23	1505	2010	1741.20±0.012	6.89	1400	1900
21	1705	1807.50±0.012	5.89	1510	2050	1804.40±0.011	5.47	1505	2005
22	1755	1837.50±0.014	6.67	1610	2105	1850.23±0.011	5.42	1510	2035
23	1790	1887.50±0.013	6.33	1630	2125	1891.21±0.012	6.83	1525	2115
24	1805	1918.75±0.016	7.47	1650	2205	1922.29±0.012	6.50	1600	2125
25	1818	1920.00±0.014	6.49	1680	2235	1953.54±0.013	7.14	1605	2255
26	1830	1956.25±0.016	7.53	1690	2350	1960.55±0.012	6.74	1615	2260
27	1840	1983.75±0.017	7.71	1695	2350	1965.29±0.013	7.49	1630	2315
28	1850	2018.75±0.015	6.64	1710	2390	1971.58±0.009	4.66	1655	2365
29	1860	2021.25±0.015	6.62	1725	2405	1975.45±0.010	5.52	1700	2405
30	1870	2025.00±0.017	7.34	1730	2420	1975.96±0.009	4.60	1715	2425
31	1878	2025.63±0.016	6.96	1740	2440	1982.74±0.012	6.63	1805	2430
32	1883	2030.05±0.013	5.63	1815	2445	2035.35±0.012	6.33	1825	2445
33	1888	2037.50±0.014	6.31	1830	2450	2055.25±0.013	6.97	1835	2445
34	1893	2063.75±0.013	5.51	1840	2460	2073.33±0.012	6.28	1835	2465
35	1898	2065.00±0.013	5.50	1845	2470	2075.12±0.011	5.51	1840	2470
36	1903	2085.00±0.011	4.65	1865	2485	2075.98±0.011	5.44	1845	2505
37	1908	2102.50±0.016	6.68	1870	2490	2130.56±0.012	5.49	1850	2520
38	1913	2108.75±0.016	6.67	1885	2500	2135.54±0.012	5.61	1865	2530
39	1918	2121.25±0.015	6.39	1890	2540	2151.11±0.013	6.39	1870	2530
40	1925	2122.50±0.015	6.22	1895	2545	2155.45±0.012	5.62	1875	2540
41	1930	2131.25±0.013	5.56	1915	2545	2158.89±0.013	6.81	1895	2540
42	1935	2140.00±0.013	5.49	1930	2505	2160.62±0.013	6.89	1900	2555
43	1935	2147.50±0.013	5.49	1940	2515	2165.96±0.013	6.76	1910	2565
44	1940	2166.25±0.013	5.44	1965	2530	2168.88±0.014	7.03	1915	2570
45	1945	2167.50±0.019	7.72	1705	2540	2171.41±0.015	8.24	1915	2580
46	1945	2168.75±0.015	6.32	1810	2540	2175.25±0.011	5.89	1920	2585
47	1950	2186.25±0.013	5.67	1930	2545	2178.56±0.012	6.67	1920	2585
48	1950	2190.25±0.016	6.81	1945	2545	2180.20±0.012	6.33	1925	2585
49	1950	2195.75±0.016	6.89	1890	2560	2185.25±0.013	7.47	1930	2560
50	1955	2198.75±0.016	6.76	1940	2565	2190.90±0.012	6.49	1945	2565
51	1955	2200.25±0.017	7.03	1945	2570	2195.49±0.013	7.53	1945	2570
52	1960	2207.50±0.016	6.99	1960	2585	2198.26±0.014	7.73	1965	2585
53	1960	2210.13±0.013	5.49	1965	2590	2200.85±0.012	6.65	1965	2590
54	1960	2217.50±0.013	5.49	1970	2590	2205.13±0.012	6.62	1970	2595
55	1965	2225.00±0.016	6.87	1980	2595	2208.26±0.013	7.34	1975	2595
56	1965	2226.00±0.015	6.49	1985	2595	2214.39±0.013	6.92	1980	2595
57	1965	2228.75±0.016	7.11	1980	2595	2220.56±0.012	6.68	1985	2595
58	1965	2230.04±0.015	6.71	1990	2600	2224.65±0.012	6.67	1990	2600
59	1970	2235.20±0.017	7.46	1995	2600	2228.60±0.013	6.34	1995	2600
60	1970	2245.25±0.018	4.65	1995	2605	2231.57±0.012	6.21	1995	2600

Table 4 Numerical production of eggs for the studied hens

Age of birds (weeks)	Rearing in aviaries					Rearing in cages				
	Mean flock (heads)	Total egg production (pcs/week/ shelter)	Individual egg production			Mean flock (heads)	Total egg production (pcs/week/ shelter)	Individual egg production		
			eggs/ week/ head	eggs/ day/ head	summed (eggs/ week/ head)			eggs/ day/ head	eggs/ day/ head	summed (eggs/ week/ head)
20	36312.5	150314	4.14	0.59	4.14	10344.0	46670	4.51	0.64	4.51
21	36243.5	154918	4.27	0.61	8.41	10338.5	59267	5.73	0.81	10.24
22	36178.5	205389	5.68	0.81	14.09	10333.0	61905	5.99	0.85	16.23
23	36122.0	220427	6.10	0.87	20.19	10327.0	63422	6.14	0.87	22.37
24	36069.5	228173	6.32	0.90	26.51	10319.5	65300	6.33	0.90	28.70
25	36024.0	230677	6.40	0.91	32.91	10314.5	66067	6.41	0.91	35.11
26	35977.5	229541	6.42	0.91	39.33	10309.5	66305	6.43	0.91	41.54
27	35927.0	231799	6.45	0.92	45.78	10304.0	66700	6.47	0.92	48.01
28	35874.0	231469	6.45	0.92	52.23	10300.0	66960	6.50	0.92	54.51
29	35825.5	232174	6.48	0.93	58.71	10295.0	67005	6.51	0.92	61.02
30	35787.5	233230	6.52	0.93	65.23	10289.0	67137	6.53	0.93	67.55
31	35749.5	233484	6.53	0.93	71.76	10282.5	67552	6.77	0.93	74.32
32	35709.0	233074	6.53	0.93	78.29	10274.5	67390	6.56	0.93	80.88
33	35672.5	232909	6.53	0.93	84.82	10262.5	67124	6.54	0.93	87.42
34	35636.0	232554	6.53	0.93	91.35	10251.0	66990	6.53	0.93	93.95
35	35599.5	232748	6.53	0.93	97.88	10242.0	66905	6.53	0.93	100.48
36	35756.0	232241	6.51	0.93	104.39	10234.0	66701	6.52	0.93	107.00
37	35504.5	231019	6.50	0.92	110.89	10227.0	66552	6.51	0.92	113.51
38	35456.0	230671	6.50	0.92	117.39	10219.0	66475	6.50	0.92	120.01
39	35403.0	231398	6.50	0.92	123.89	10210.0	66305	6.49	0.92	126.50
40	35351.5	229930	6.50	0.92	130.39	10198.5	66230	6.49	0.92	132.99
41	35299.0	229055	6.49	0.92	136.88	10186.0	66100	6.48	0.92	139.47
42	35249.0	228625	6.48	0.92	143.36	10176.5	66027	6.48	0.92	145.95
43	35197.5	228364	6.48	0.92	149.84	10167.5	65965	6.48	0.92	152.43
44	35141.0	227642	6.47	0.92	156.31	10156.5	65890	6.48	0.92	158.91
45	35084.0	226974	6.47	0.92	162.78	10145.5	65805	6.48	0.92	165.39
46	35025.0	224929	6.42	0.91	169.20	10136.5	65447	6.46	0.92	171.85
47	34962.5	223632	6.40	0.91	175.60	10129.5	65105	6.43	0.91	178.28
48	34904.5	223237	6.39	0.91	181.99	10121.0	64749	6.40	0.91	184.68
49	34844.5	221442	6.36	0.91	188.35	10110.0	64455	6.37	0.91	191.05
50	34781.5	219245	6.30	0.90	194.65	10097.0	63915	6.33	0.90	197.38
51	34722.5	218027	6.28	0.89	200.93	10083.5	63560	6.30	0.90	203.68
52	34664.5	216298	6.24	0.89	207.17	10070.0	62995	6.26	0.89	209.94
53	34605.0	214299	6.19	0.88	213.36	10056.5	62400	6.20	0.88	216.14
54	34540.5	212298	6.15	0.87	219.51	10043.0	62045	6.18	0.88	222.32
55	34479.5	210519	6.11	0.87	225.62	10025.5	61630	6.15	0.87	228.47
56	34254.0	204421	5.97	0.85	231.59	10006.5	61001	6.10	0.87	234.57
57	34017.5	203053	5.97	0.85	237.56	9989.5	60210	6.03	0.86	240.60
58	33950.5	200954	5.92	0.84	243.48	9971.5	59102	5.93	0.84	246.53
59	33884.0	187485	5.53	0.79	249.01	9952.0	58006	5.83	0.83	252.36
60	33811.5	185246	5.48	0.78	**254.49**	9931.0	56813	5.72	0.81	**258.08**

The laying peak was reached in week 31, being of 93,30% at the ones in aviaries and 93.85% at the ones from cages; ISA Brown have a maximum laying intensity of 96%, realised in weeks 26-29.

Laying intensity had very high levels till week 50 at the hens in aviaries (90.05%) and week 51 at the ones in cages (90.05%), after that decreased progressively till an intensity of 78.27% at the ones from aviaries and of 81.72% at the ones from cages.

Consumption of mixed fodders (tab. 6). Hens which were subjected to the current study benefit of two mixed fodder types, differentiating by the contented raw material, by quality conditions and by the moment of administration: recipe 21-5 A till week 45 of hens life and recipe 21-5 B administrated from week 46.

In the first age period (20-45 weeks), those 35701 hens from shelter with aviaries consumed 775160 kg of fodders, resulting a mean consumption of 119.3 g/head/day and a conversion index of 128.47 g m.f./egg (at a production of 6033728 eggs). In the case of hens exploited in cages, total fodder consumption of those 10243 individuals was 212970 kg, resulting a mean consumption of 114.24 g/head/day and a conversion index of 125.66 g m.f./egg (production=1694749 eggs).

Per whole period (20-60 weeks), the most convenient fodder consumption was at the hens from the shelter with cages, with a mean consumption of 115.29 g/head/day (flock=10133 heads; consumed fodders =335270 kg) and a conversion index of 127.66 g m.f./egg (egg production=2626182 pcs.). Hens reared in aviaries had a mean consumption of 120.17 g/head/day (flock=35215 heads; consumed fodders =1214482 kg) and a feed conversion index of 135.34 g m.f./egg (egg production=8973884 pcs.).

Table 5 Laying intensity (%) of the studied hens

Age of birds (weeks)	Theoretic laying intensity (%)	Rearing in aviaries			Rearing in cages		
		Mean flock (heads)	Total egg production (pcs/week/ shelter)	Laying intensity (%)	Mean flock (heads)	Total egg production (pcs/week/ shelter)	Laying intensit y (%)
20	38	36312.5	150314	59.13	10344.0	46670	64.45
21	65	36243.5	154918	61.06	10338.5	59267	81.89
22	87	36178.5	205389	81.10	10333.0	61905	85.58
23	92	36122.0	220427	87.18	10327.0	63422	87.73
24	94	36069.5	228173	90.37	10319.5	65300	90.40
25	95	36024.0	230677	91.48	10314.5	66067	91.50
26	96	35977.5	229541	91.54	10309.5	66305	91.88
27	96	35927.0	231799	92.17	10304.0	66700	92.47
28	96	35874.0	231469	92.18	10300.0	66960	92.87
29	96	35825.5	232174	92.58	10295.0	67005	92.98
30	95	35787.5	233230	93.10	10289.0	67137	93.22
31	95	35749.5	233484	93.30	10282.5	67552	93.85
32	95	35709.0	233074	93.24	10274.5	67390	93.70
33	94	35672.5	232909	93.23	10262.5	67124	93.44
34	94	35636.0	232554	93.22	10251.0	66990	93.36
35	94	35599.5	232748	93.22	10242.0	66905	93.32
36	94	35756.0	232241	92.95	10234.0	66701	93.11
37	93	35504.5	231019	92.79	10227.0	66552	92.96
38	93	35456.0	230671	92.78	10219.0	66475	92.93
39	93	35403.0	231398	92.75	10210.0	66305	92.77
40	92	35351.5	229930	92.71	10198.5	66230	92.77
41	92	35299.0	229055	92.70	10186.0	66100	92.75
42	92	35249.0	228625	92.66	10176.5	66027	92.69
43	92	35197.5	228364	92.66	10167.5	65965	92.68
44	91	35141.0	227642	92.54	10156.5	65890	92.68
45	91	35084.0	226974	92.42	10145.5	65805	92.66
46	91	35025.0	224929	91.74	10136.5	65447	92.24
47	91	34962.5	223632	91.38	10129.5	65105	91.82
48	90	34904.5	223237	91.37	10121.0	64749	91.39
49	90	34844.5	221442	90.79	10110.0	64455	91.08
50	89	34781.5	219245	90.05	10097.0	63915	90.43
51	89	34722.5	218027	89.70	10083.5	63560	90.05
52	88	34664.5	216298	89.14	10070.0	62995	89.37
53	88	34605.0	214299	88.47	10056.5	62400	88.64
54	87	34540.5	212298	87.80	10043.0	62045	88.26
55	87	34479.5	210519	87.22	10025.5	61630	87.82
56	86	34254.0	204421	85.25	10006.5	61001	87.09
57	86	34017.5	203053	85.25	9989.5	60210	86.40
58	85	33950.5	200954	84.56	9971.5	59102	84.67
59	85	33884.0	187485	79.04	9952.0	58006	83.26
60	84	33811.5	185246	78.27	9931.0	56813	81.72
MEAN	**89.29**			**88.66**			**89.88**

Table 6 Consumption of mixed fodders for the studied hens

Age period (weeks)	Specification	Exploitation system	
		in aviaries	in cages
20-45 (182 days)	Mean flock (heads)	35701	10243
	Consumed fodders (kg/period)	775160	212970
	Daily mean consumption (g/head/day)	119.30	114.24
	Egg production (pcs./period)	6,033,728	1,694,749
	Feed conversion index (g m.f./egg)	128.47	125.66
46-60 (105 days)	Mean flock (heads)	34573	10030
	Consumed fodders (kg/period)	439322	122300
	Daily mean consumption (g/head/day)	121.02	116.13
	Egg production (pcs./period)	2,940,156	931,433
	Feed conversion index (g m.f./egg)	149.42	131.30
20-60 (287 days)	Mean flock (heads)	35215	10133
	Consumed fodders (kg/period)	1214482	335270
	Daily mean consumption (g/head/day)	120.17	115.29
	Egg production (pcs./period)	8,973,884	2,626,182
	Feed conversion index (g m.f./egg)	135.34	127.66

Per whole period (20-60 weeks), the most convenient fodder consumption was at the hens from the shelter with cages, with a mean consumption of 115.29 g/head/day (flock=10133 heads; consumed fodders =335270 kg) and a conversion index of 127.66 g m.f./egg (egg production=2626182 pcs.). Hens reared in aviaries had a mean consumption of 120.17 g/head/day (flock=35215 heads; consumed fodders =1214482 kg) and a feed conversion index of 135.34 g m.f./egg (egg production=8973884 pcs.).

CONCLUSIONS

The date obtained by us regarding the productive performances of laying hens exploited in shelters equipped with aviaries revealed some interesting aspects, which will be presented below.

Ambient temperature in the shelter with cages was much more uniform (20.46-21.86°C), in comparison with the one in shelter with aviaries (17.97-24.63°C), situation similar also for air relative moisture (56.43-58.14% in shelter with cages and 55.0-74.57% in the one with aviaries); this state of fact was due to the technical solutions applied in shelters.

In those 41 laying weeks, the studied hens realised an individual mean production of 254.49 eggs/head (rearing in aviaries) respectively 258.08 eggs/head (rearing in cages), namely with 8.49-12.08 more eggs than the productive potential of ISA Brown hybrid (246 eggs).

Even if maximum laying intensity was lower (93.3% in aviaries and 93.85% in cages) than the theoretic performance of hybrid (96%), the plateau of laying curve was higher at the studied hens, so on the whole period, mean laying intensity was of 88.66% at the hens reared in aviaries and of 89.88% at the ones from cages, face to 89.29% as is the theoretic intensity of ISA Brown hybrid.

Daily mean consumption of mixed fodders for the whole studied period was higher than the theoretical one with 5.18% in the case of hens from aviaries respectively with only 0.91% for the ones reared in cages.

Feed conversion index calculated for the whole studied period was of 135.34 g m.f./egg at the hens reared in shelter equipped with aviaries and of only 127.66 g m.f./egg at the ones from shelter with cages.

The final conclusion of the study was that rearing system in aviaries assures optimal conditions for externalization of productive potential of laying hybrids, at comparable levels with the ones realised at rearing in cages, system considered to be the most rentable one from this point of view.

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