SUMMARY

Keywords: ***welfare, laying hens, improved cages battery, free range, quality, egg***

It is widely recognized that "we are what we eat" and that is why healthy eating policy has an important place in any state, food is a topic with multiple social, economic and cultural. For this reason, the livestock sector must offer high quality products to a population that is in a continuous increase.

Considered high nutritional value food with a very good digestibility of components, eggs are recommended for all consumers, which is why poultry sector is in constant development in most developed countries

Nutrition is the key to maintaining health and the eggs is a real gold mine in this regard; eggs helps in blood circulation, protect eyesight, strengthen the immune system, nervous and bone and assists in the development and proper functioning of the brain. Although it contains a significant amount of cholesterol, recent studies have shown that eggs intake does not have any effect on the level of cholesterol in the blood.

Regardless of the system of rearing used to produce eggs, they should be consumed because they are natural products with high nutritional properties, source of high quality protein and not least provide biological value superior to other food.

The existence of intensive exploitation systems that ensure efficiency in economics but are discredited through the lack of welfare granted hens have led to alternative systems that provide ethological needs, but with lower economic efficiency.

Therefore, this paper addresses a broad study of the actual performance of laying hens operated in two systems of rearing: battery cages respectively modified (conventional) and free range (alternative). From this point of view there were analyzed microclimate conditions ensured to studied birds to study their impact on the morphological and productive performance; also there were monitored egg production and laying intensity, water and feed intake, mortality, body weight, groups homogeneity etc.

Along with those parameters ensuring welfare and productive performance of laying hens, egg quality was assessed and obtained through the physical, chemical and microbiological traits.

To achieve the proposed theme, the research was organized in stages and specific objectives of each group were studied; investigations were carried out according to a general protocol for the organization of research.

In the stage entitled "*Microclimate factors provided to the studied hens*" it was intended to assess the environmental factors (temperature, relative humidity and pollutant concentration) assured to laying hens in two farming systems studied (conventional and free range). Records data were performed from the age of 20 weeks of birds and have continued throughout the productive period including the 70th week.

A second phase, "*Morpho productive traits achieved by studied hens*" focused on analysis of the influence of the rearing system on the traits of growth and production realized by the hybrid Lohmann Brown under the specific rearing conditions of cage battery and free-range systems.

The objectives of this stage envisaged to determine the morpho productive parameters namely: the dynamics of body weight; flock homogeneity; livability vs. casualties; eggs yield; laying intensity; feed consumption.

These investigations were carried out for the entire production period, from their age of 20 weeks until the 70th week, inclusively.

The third phase "*Quality of the eggs laid by studied hens*" was a complete analysis of eggs laid by birds in the two rearing systems. This was done on eggs collected five important moments of laying curve (laying onset= week 22nd; laying peak = week 34th; laying plateau = week 45th; decline period of laying = 55th week; ending of lay = 70th week) and consisted in conducting qualitative assessments of physical, chemical and microbiological traits. The objectives were the:

- assessment of physical parameters of quality (incidence of morphological abnormalities in eggs, egg weight, shape index, mineral shell breaking strength, shell thickness mineral structure of egg, albumen index, yolk index, yolk color and Haugh index);
- assessment of chemical parameters of quality by establishing water content and dry matter (proteins, lipids, minerals) yolk, egg white and mix respectively;
- assessment of microbiological quality parameters from the mineral shell (NTGMA, *Pseudomonas spp*., *Escherichia coli* and *Enterobacter spp*) and egg content (NTGMA and *Salmonella spp*.).

The biological material studied was the laying hybrid Lohmann Brown (created in Germany, from 4 pure lines of Rhode Island) and was reared for a period of 50 weeks (March 2013-February

2014) in a unit for the production of table eggs - SC. AVICOLA LUMINA SA, member of the Group of Agricola International Bacau.

Specific analyzes were performed in laboratories of the University of Agricultural Sciences and Veterinary Medicine in Iasi and Food Safety Laboratory in the DSVSA Iasi.

To achieve its purpose, were considered two lots of experience (Lc and Lexp) with the following features:

- Lot Lc = 32.000 Lohmann Brown hens reared in a controlled environment hall, Eurovent batteries in 1500, where they secured the cage 750 cm2 / bird;

- Lot Lexp = 7.000 Lohmann Brown hens reared free range system, in a hall provided with corresponding paddock; the density of the hall was 7 head / m^2 and the paddock 4 of head / m^2.

In the first stage of the research there were tracked the dynamics of microclimate factors in both halls, to highlight whether they influence or not productivity and health of fowl. Ambient temperature recorded in the halls studied revealed different values depending on the season, the operating system and the density of birds. From this point of view we can say that, although in some cases the assured temperature exceeded the thermal comfort zone (especially its upper limit), it did not affect the production and health of studied hens.

Relative humidity in the halls was dependent mainly on the variations in atmospheric humidity, which changed from one season to another. The values recorded for this parameter microclimate oscillations had relatively wide limits, but did not reach levels which were critical for the birds.

The concentration of pollutants recorded higher values with birds ageing, due to the accumulation of bird droppings and gradual environmental degradation in the two halls. The noise level recorded in hall equipped with batteries (Lc) was lower than the free range halls as a result of proper ventilation and an integrated and efficient system.

Opinion on the microclimate has revealed that in the controlled environment systems is much easier to achieve an optimum microclimate.

In the second phase, the investigations were watching for the morphoproductive parameters of hens.

Body weight of the birds performed according to standard curve, following an ascending line, so that at the end of the research they had a weight of 1938.000 ± 25.430g in group Lc and 2086.29 ± 29.663g in group Lexp (hybrid user guide Lohmann Brown indicates a weight of 2038g).

Must noted that while at the onset it was a lower weight, the free range poultry quickly equalized and then they exceeded those reared in battery due to additional sources of feed provided by access to outside.

Homogeneity of the two groups was very good, indicating that the rearing farm applied proper management of nutrition and environmental factors.

Total actual casualties stood at a very good level of 1.44% to birds raised in battery (group Lc) and 2.08% in the free range system (group Lexp).

Casualties dew to accidents and diseases, nutrition, without being recorded mortality from infectious diseases, which confirms the well-organized vaccination and prevention.

Eggs yield was 325.98 eggs / capita in hens kept in battery (group Lc) and 319.33 eggs / capita in free range (group Lexp), noting that in both cases exceeded theoretical performance Lohmann Brown in both breeding systems (with 6.22% and respectively 8.21%).

Food consumption was correlated with bird egg production (conversion ratio was 132.41g / egg group and 132.43g increased battery / free range egg to the exploited), but was also influenced by access or no additional feed sources resulted in a consumption 120.17g / head / day in group Lc, compared to only 118.45g / head / day in group Lexp.

The average daily water consumption for the entire period was of 215.84 ml / head / day from caged hens and 220.67 ml / head / day in the free range system.

Given the performance achieved in both operating systems by Lohmann Brown hybrid, we can say that is a genetically enhanced product, with good organic resistance, high and sustained production of eggs and feed conversion efficiency.

Physical quality traits of the eggs were significantly better in those obtained alternative system compared to the conventional system.

Thus, the incidence of eggs with morphologic abnormalities in group Lexp (free range farming) was lower by 0.22%, while egg weight was higher by 2.12%, plus 2.68% mineral shell thickness, strength shell increased with 2.87%, 5.45% better albumen index, while yolk index and Haugh index were improved by 1.041% and 2.22%.

The yolk color was more intense in group Lexp (31.11% - level 9 from La Roche, and 10% color on color step 10), compared with eggs lot Lc (only 20% on step 9 colored eggs La Roche).

As for the structure of farming, our research showed higher percentage of yolk (up by 3,112%) and the mineral shell (+ 1.817%) of eggs from the system free range (group Lexp), while the eggs laid by hens reared in battery (group Lc) found higher proportion of whites (+ 1.634%).

Chemical traits of eggs quality from the two operating systems compared were situated at normal levels, noting that the proportion of dry matter of the white and the yolk, including melange, was higher in eggs laid by hens bred in free range (group Lexp), hence higher values for the main constituents were also recorded (proteins, fats and minerals).

In white, the protein was, on average, of 10.672% of the eggs group Lexp and 9.892% in the case of the group Lc, the lipids reached 0.135%, respectively, 0.116%, and the mineral substances 0.885% and 0.785%.

For yolk, the proportion of protein on a dry weight basis was an average of 17.329% in group Lexp and 16.929% in group Lc, the lipids of 28.926%, respectively, of 28.377% and minerals of 1.720% and respectively 1.686%.

The assessments on melange revealed better levels of eggs collected from free range system for both protein (11.246% vs. 11.821%) and lipids (10.155% vs. 9.386%) and mineral substances (1.312% vs. 1.121%).

Indicators of microbiological quality showed higher level of microbial load (especially shell surface) in the eggs laid by the free range hens (group Lexp) correlated with high levels of environmental contamination that had been accommodated them.

The dosages performed on shells revealed values of 1.34 to 2.27 log / cfu / g in group Lc and 1.39 to 2.99 log / cfu / g in group Lexp for *Escherichia coli;* of 2.17-2.33 log / cfu / g (group Lc) and 2.13 to 2.77 log / cfu / g (group Lexp) for *Enterobacteriacae;* from 1.13 to 1.49 log / cfu / g (Lc) and from 1.12 to 1.57 log / cfu / g (Lexp) for *Pseudomonas spp.*, respectively of 3.60 to 5.99 log / cfu / g (Lc) and 4.80- 6.01 log / cfu / g (Lexp) for TNGMA.

The TNGMA content in eggs varied from 1.77 to 2.45 log / cfu / g in the cage reared group (Lc) and from 2.15 to 2.77 log / cfu / g in the free range (Lexp). However, it was not identified contamination with *Salmonella spp.* in any of the two groups.

Considering the conclusions of studies that focused on the morphoproductive traits of the Lohmann Brown laying hens accommodated in Eurovent 1500 batteries respectively in free range system, we make the following recommendations for poultry practice:

- continuation of table eggs production (irrespective of the husbandry system) to supply specialized market with a product that should not be absent from the diet of any person;
- rearing of laying hens in variants of intensive breeding system (improved batteries, opened batteries, deep litter etc.) as parameters suggest the possibility to achieve for higher yields, with positive economic effects;
- structuring of table eggs farms on specific production systems (battery, on permanent litter, halls opened to the outside and possibly organic production), in order to cover consumers' preferences for a certain type of eggs;
- introducing of mandatory decontaminant equipment for eggs in all sorting, packing plants, given the risks that could arise from unavoidable microbial load of mineral shell.