

## HYGIENE ASSESSMENT OF ENVIRONMENT FOR LAYING HENS IN A SEMI NATURAL BUILDING IN THE SUMMER

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### Abstract

A hygienic assessment of the environment for laying hens from a local population, living in a semi-captive environment-friendly building, has been performed. The egg productivity of the birds has been traced against changes in temperature and salt balance of the ration. Applying the Summers and Leesson index that measures danger from heat stress, showed that laying hens during the summer are under such stress. Reduced egg productivity during the warm period of the year is provoked by the low saline balance of the ration which is 13,8g MЭK/100 instead of 20-25g MЭK/100. To save all year egg laying the hens requires additional heating in winter and cooling in summer.

**Key words:** laying hens, heat stress, salt balance rations

### INTRODUCTION

The temperature and humidity of the environment according to most of the specialists are responsible for the health and productivity of the birds. They are also the reason for the occurrence of heat stress [7], characterized by decreased activity, rapid breathing and heart activity. The nutrition and metabolism are drastically reduced. According to [5], the reduction in food and energy exchange at 21 to 27°C is 1,25% per 1°C in 28 to 32°C – 1,5%, and at temperatures above 33°C reduction can go up to 2,5%. To maintain the level of energy, due to reduced feed intake [3], they offer that at temperatures above 29°C the energy must grow to 20-22 kcal/kg per 2,5°C. In parallel, the protein, amino acids vitamins and minerals should be adjusted in proportion to the decreased feed intake. By adding KCl in quantity from 1,8 to 2,7 kg/t feed, according to the same authors, increases water consumption, which makes acid-base balance (impaired as a result of the stress) normal.

The only way to release heat from the body of the bird is by breathing faster. However high humidity makes its release difficult, regardless of the number of respiratory movements. To be effective the process, the humidity should not exceed 50-70%.

The weight of the heat stress depends on the temperature fluctuations and its duration,

relative humidity and the composition and energy security of the ration [3], [6].

In this study, we set ourselves the task to do evaluation of hygienic environment for laying hens from a local population, living in a semi-captive environment-friendly building and connecting the hygienic evaluation with the grow up in egg productivity.

### MATERIAL AND METHOD

The experiment held a flock of 300 hens from a local population grown environmentally friendly - in a semi-free linkage building (eight birds per 1m<sup>2</sup>) on top of loose litter and yard for exercise (48m<sup>2</sup>) in the period from December to September. The building was not heated during the cold days and not cooled (ventilation) during the hot summer days. Water drinkers were fed continuously by hydrophore system. The birds received combined feed freely with the same component and energy composition throughout the control period. Compound contained:

Moisture – 11,6%  
Metabolizable energy - 11,6 MJ/kg  
Crude protein – 15,3%  
Crude fiber – 5,8%  
Crude fat – 5,3%  
Calcium – 2,88%  
Phosphorus – 0,61%  
Potassium – 0,51%  
Sodium – 0,16%  
Chlorine – 0,22%

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Compound feed was prepared in the farm and didn't contained banned organic components. The consumption of feed was measured by the difference between the projected feed and residual feed at the end of the day.

Acid-base balance of the body was judged by the salt balance of the ration (SBR) according to [6] SBR is the difference between the amount of milligram-equivalents of potassium and sodium and milligram-equivalent chlorine ( $SBR=K+Na-Cl$ ). In the hot periods, according to the author, this balance should be between 20 and 25 MƏK/100g. The procedure for calculating milligram equivalents K, Na and Cl according to the author is:

$$0,16\% Na \times 10\,000 / 23 = 69,57 \text{ MƏK}$$

$$0,51\% K \times 10\,000 / 39,1 = 130,43 \text{ MƏK}$$

$$0,22\% Cl \times 10\,000 / 35,5 = 61,97 \text{ MƏK}$$

$$69,57 + 130,43 - 61,97 = 138,03 \text{ MƏK/kg} = 13,8 \text{ MƏK/g}$$

Temperature, relative humidity and velocity of air in the building were established using known hygiene methods - Aastmans psihrometar and katatermometar. In parallel, we measured changes in the temperature of the outdoor air. For this purpose, we processed the daily weather information from Weather Station - Plovdiv, located within the training and experimental field of the Agricultural University - Plovdiv

and we determined the basic meteorological parameters during the study. The actual assessment of the environment, represented by the temperature and humidity conditions, was conducted by the [9] index warning of the danger of heat stress:

$$ID = (1,8 \cdot t + 32) + R, \text{ where}$$

ID - index is danger of heat stress

t - Ambient temperature in  $^{\circ}C$

R - Relative humidity in%

The results were statistically processed.

## RESULTS AND DISCUSSIONS

The analysis of building heating system as a whole during the warm and cold periods of the year is presented in our other work [8].

We found that the dynamics of the ambient temperature in the winter is minimal diurnal  $1-4^{\circ}C$  and up to  $14-15^{\circ}C$  while in warm days they are within  $16^{\circ}C$ . The internal temperature within the cold period takes the form of a sine wave, with a minimum amplitude of  $0$  to  $6^{\circ}C$  and maximum of  $12^{\circ}C$ . In the summer the temperature does not exceed  $14^{\circ}C$ . All this proves the impact of the structural elements of the building which reduce the daily temperature amplitudes by around  $4-5^{\circ}C$  or by 27%. The registered phase deviation of maximum and minimum temperature curve fluctuated within 30min (in winter) and 90min (in summer), which actually characterizes the thermal inertia of the interior of the building (Figures 1 and 2).

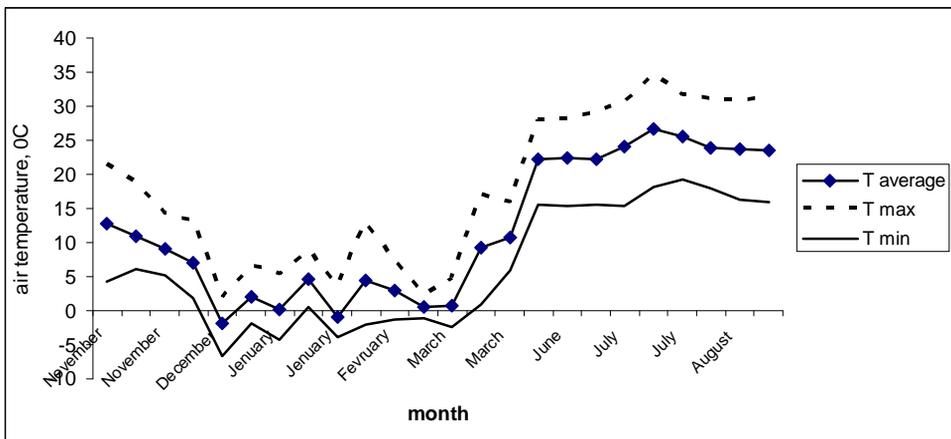


Fig. 1 Dynamics of the external medium, minimum and maximum temperatures

The building or shed used for breeding laying hens must meet the standards, guaranteeing optimum temperatures for birds within 15 to 25°C in order not to cause distress-arising from extreme temperatures (below 8-10°C or above 25°C [1].

The registered outside temperature dynamics, seen through building quality, directly affects the temperature regime of the production area, i.e. the area where the hens are located.

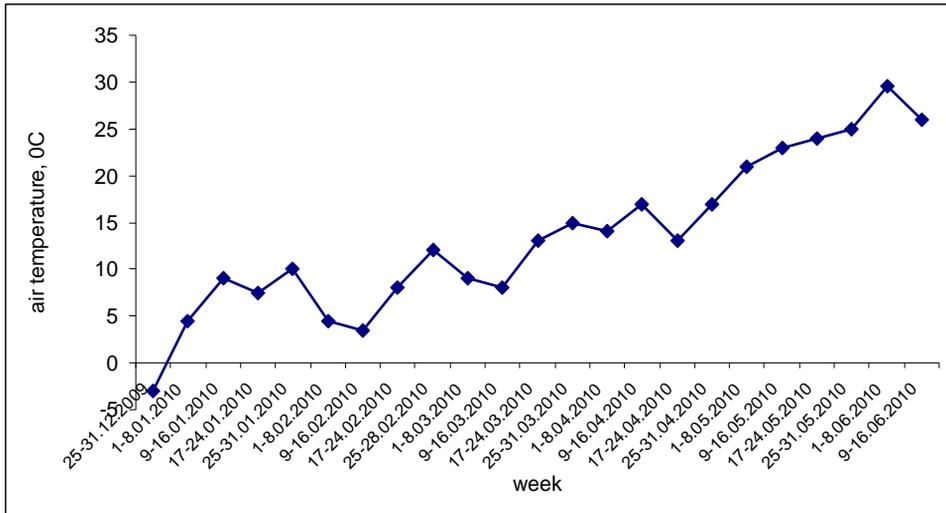


Fig. 2 Dynamics of average internal temperatures

The accumulation capacity of the building ( $S=0,4-13,9^{\circ}$  C) showed that its structures can ensure this temperature difference in temperatures from  $-12^{\circ}$  to  $36^{\circ}$  C, if they provide additional heating during the winter. In the summer due to the lack of ventilation system and air conditioning, the achieved temperature difference is minimal and insufficient to protect the birds from heat stress.

By applying ID proposed by the [9] and [2] found that ID under 150 makes birds feel comfortable. By increasing ID from 150 to 160 productivity starts to decrease. Raising ID up to 160-165 leads to reduced intake of feed while water consumption is increased. Raising ID up to 170 - birds growth stops completely and we also observe mass lesions of the respiratory and circulatory systems. When the ratio exceeds 170 we observe massive bird deaths.

By transforming our temperature and humidity conditions in the building using the index, we found that its values are between 150 and 170, i.e. there is heat stress accompanied by a significant reduction in egg production of birds (Figure 3) and feed consumption.

The beginning of laying eggs started at the age of 19 weeks, in the middle of October, coinciding with the autumn-winter period and the lower average daily temperatures (Fig. 1, 2). This slowed the increase in their egg production compared with birds reared under controlled microclimate. The controlled birds reached 10% production at the age of 24 weeks, i.e. second half of November. By the end of their 35 week the birds were able to increase their egg production by 20%. This slow and sustained increase we succumbed to low average daily temperatures.

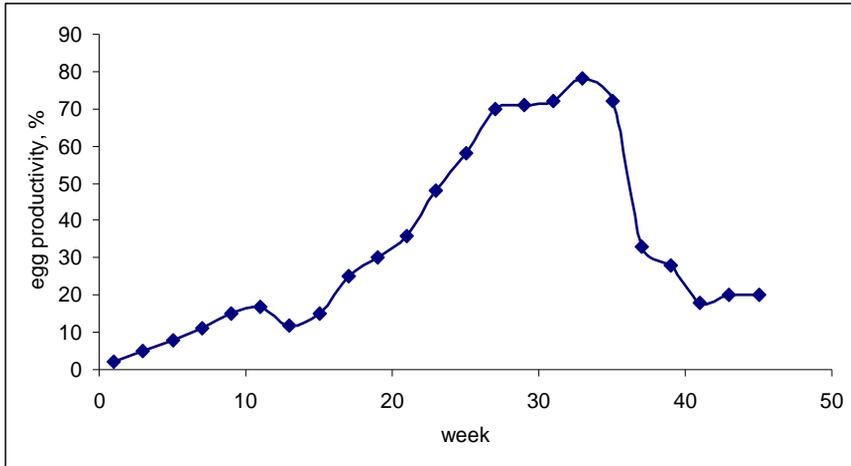


Fig. 3 Egg productivity of the herd during the study period

Since mid-February, with the increase of the daylight, and the increase in average daily temperatures the egg production began to increase. The highest value (70%) was reached between 44 - and 52-week-old or between the 25th and 33rd oviparous week -in the beginning of April to June. As temperatures raised above 25°C the egg production of the birds was dramatically reduced (mid June to August).

With a particularly adverse impact were temperatures in the afternoon when they reached 35-40°C and more. Similar results were reported by [4].

In such situations [6] recommends control of water and salt balance in the body. According to him, due to the rapid breathing a large amounts of CO<sub>2</sub> are released from the body, which changes the acid-base balance of the blood. According to the author the equilibrium (SBR=K+Na-Cl) should be between 20 and 25g MƏK/100 feed. On our analysis of these elements in feeding forage we found that SBR is MƏK/100 13,8g, i.e. well below the norm for birds. To overcome heat stress [6] and [3] recommend adjusting the mineral content of the ration or the addition of minerals in the drinking water, continuous replacement of drinking water with cool, increasing air movement up to 10m/s, giving vitamin "C" and others.

## CONCLUSIONS

1. Laying hens growing in a semi-building summer are under the influence of heat stress (ID = 150 to 170).

2. Salt balance of the feed ration (SBR) is about two times lower in potassium, sodium and chlorine than the limits.

3. Normal egg laying in birds throughout the year is possible only by using heating in winter and cooling in summer.

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