ENVIRONMENTAL VARIABLES AFFECTING EGG PRODUCTION

VARIABLES AMBIENTALES QUE AFECTAN LA PRODUCCION DE HUEVOS

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ABSTRACT

Caged layers housed at open buildings have a defficient ability for protecting themselves from intense temperature variation that may occour during the production period. It is important to maintain the thermal amplitude within certain limits in order to provide an ideal thermoneutral environment inside the houses. However, this is a difficult task in open buildings without isolation, and the optimum management relies mostly on the management of fans and curtains. Collection of data took place in the Southeastern state of Parana, at the Tropic of Capricorn, in commercial and caged layers' houses, during the Spring of 94. Environmental data were recorded and the results were analyzed based on the incidence of critical days. The reduction in egg production and quality was recorded. The objective of this experiment was to quantify the main direct and indirect environmental variables that may influence production in commercial layer houses.

Keywords: Layers, environment, heat load.

RESUMEN

Jaulas para gallinas ponedoras y construcciones abiertas tienen una mala eficiencia para controlar ellos mismos las variaciones de temperatura interna que pueden ocurrir durante el período de producción. Es importante mantener la amplitud térmica dentro de ciertos límites en orden a proveer un ambiente termoneutro dentro de las cajas. Sin embargo, esto es difícil lograr en construcciones abiertas sin aislación y el óptimo manejo requiere de ventiladores y cortinas. La recolección de los datos se realizó en el sur este del estado de Paraná en el trópico de Capricornio, en unidades comerciales de ponedoras en jaulas durante la primavera de 1994. Los datos del ambiente fueron recolectados y los resultados fueron analizados basado en la incidencia de los días críticos. La reducción de la producción de huevos y la calidad fue registrada. El objetivo de este experimento fue cuantificar las principales variables ambientales, directas e indirectas que pueden influir en la producción comercial de gallineros.

INTRODUCTION

Several environmental variables determine the thermal confort within layers housing and, consequently their final egg production. The cages concentration within the layers housing commonly used in Brazil, as well as the density of 3 birds per cage, leads to an excess of heat lost, either sensible or latent nearby the layers. This heat concentration, when not dissipated by the use of cooling equipment such as fans and evaporative coolers, affects considerably egg quality and production.

In tropical countries the high values of solar radiation associated to high environmental temperatures leads to thermal stress. One important thermal exchange parameter is the evaluation of the drinking water temperature and its effect on egg production. It can be found

Recepción: 16 - 09 - 96
Aprobación: 18 - 03 - 97

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in current literature that when drinking water is above 24°C the bird do not benefit from the cooling effect of drinking (Macari, 1995).

According to Silva y col. (1994), the poultry thermoneutral zone limits are related to the ideal environment, generally where the thermal amplitude is small, and where the layers reach the best characteristics production. Baêta (1995) concludes that frequent high thermal amplitudes are related to the time of the year as well as geographic situation. Macari and Gonzales (1990) found that the increase in metabolic deseases such as ascitis and sudden death in poultry are more directly related to temperature fluctuation than to the lack in ventilation. When comparing the birds performance at temperature range of 21 to 22°C, and 17 to 35°C, it was found that the productivity indexes were better for the case with more constant temperature, being observed less sanitary problems. It is then concluded that the Fall and Spring are somehow the worst climatic situation as affecting production for caged layers.

The objective of this experiment was to quantify the main direct and indirect environmental variables that may influence production in commercial layer houses.

METHODOLOGY

The experiment was conducted during the months of October and November of 1994. The local climatic characteristics is summarized on Table 1. There were collected data on egg production, maximum and minimum housing environmental temperatures, and drinking water temperature. The egg shell hardness was measured by using the compression test at the Instrom equipment.

The seven commercial houses were located on the state of Parana, Southern of Brazil, by the Tropic of Capricorn, and the houses dimension were 3.30m of width and 100,00m of length, with 1,600 cages. The drinker was the type of an open metallic channel, with continuos water flow. The Hy-Line White layers birds were in number of 4,800 per house, after molting. All temperature measurement were taken in three equally distributed in the central alley at 9.00h, 11.00h, 14.00h and 17.00h.

Table1. Climatic characteristics of experiment's micro region.

Max. Temp. °C	Min. Temp. °C	Wind Speed m/s	Solar Radiation, MJ/ h.m^2
27 +/- 2	15 +/- 1	1.2 +/- 0.1	2.2

RESULTS AND DISCUSSION

There were selected the most critical days based upon the critical enthalpy values for the high combination of high environmental temperature and relative humidity values. Enthalpy is an environmental variable representing the amount of energy involved in the change of mass of dry air, in kJ/kg of dry air. It is a physical index that may correlate temperature and relative humidity for a presented environment. By being aware of the environmental temperatures and relative humidity limit values for a certain animal production situation, it is possible to predict the limits for critical enthalpy. The association of both critical limits or environmental temperature and relative humidity leads to find out the actual limits where the thermal stress occurs. The critical values for enthalpy are given in CIGR, (1989), as found between 76 and 96 kJ/kg of dry air, for most homeotherms.

The plotted data in Figure 1 represents the eight more critical days within the experiment period. The Y axis represents the next day egg production in box of 30 dozen eggs, and, in the same scale thermal amplitude in degrees Celsius. It can be seen that the higher the thermal amplitude, the smaller is the egg production. This variation is probably due to the fact that for smaller animals their thermoregulatory system is defficient resulting difficult the

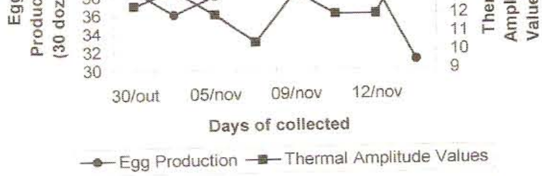

Figure 1. Egg production at different thermal amplitude values.

adaptation over the temperature ranges along the day. The Y axis represents the next day egg production in box of 30 dozen eggs, and, in the same scale, temperature in degrees Celsius. The environmental temperatures were generally higher than the recommended thermoneutral production zone limits (Macari, 1995; Silva y col., 1994; and Silva y col., 1991).

It can be seen in Figure 2 that the environmental temperatures are far above the thermoneutral temperatures for caged layers production, with values of 30 to 36°C. Its response in production are coincident, such as increasing the environmental temperature, there is a decrease in egg production in the following day.

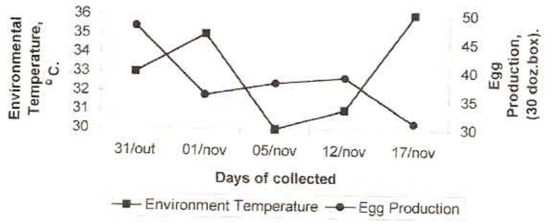

Figure 2. Egg production variation at different environment temperatures.

Analyzing the environmental data, the drinking water temperature, as well as the egg production in the same graph, it is possible to verify that, as the drinking water temperature increases, the egg production decreases, as confirmed in Macari (1995). However this effect is simply a response to high environmental temperatures, that warms up the drinking water by heat conduction. The recommended maximum drinking water temperature is 24°C. At critical environmental temperatures, specially above 28°C, the general egg production maintains constant, however the egg quality such as hardness of shell, and cleanness of egg is affected. The drinking water temperature is then a limiting egg production factor for climates with high environmental temperatures. It is cited in Macari (1995), that when the drinking water temperature is around 13 to 15°C, the layer is able to decrease it's body temperature in 1°C, and, at critical environmental temperatures this is not only related to production, but also to the bird's survival.

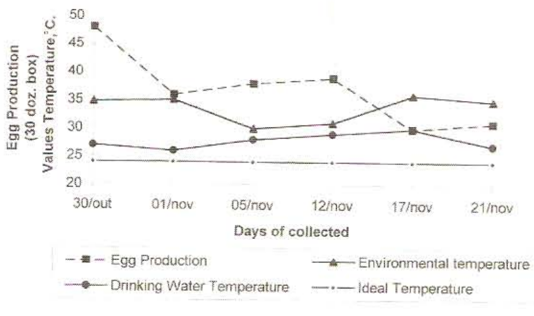

Figure 3. Egg production at different environmental temperatures and drinking water.

The drinking water has an important role on the thermal exchanges in order to eliminate the excess of body heat, during high environmental temperatures. Several researchs show that the amount of drinking water for layers is directly related to the increase in environmental temperature. It can be seen in Table 2 that the commercial layers exposed to heat stress at environmental temperatures of 36°C, and drinking water at 1.4 to 4 °C below these temperature, consumed 5 grams more feed ration per day, and consequently the egg production increased as well as the egg weight, (Tardin, 1989).

Table 2. Effect of the drinking water temperature on egg production parameters.

Factors	Drinking water temperature (at local situation)	
	Environment	Fresh
Feed consumption, g	92.0	97.0
Egg production, %	64.3	67.3
Egg weight, g	54.6	55.0

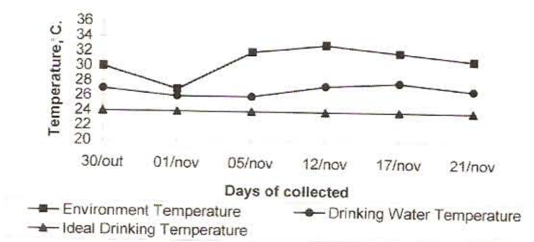

Figure 4. Relation between the occurrence of the all temperatures, and the ideal drinking water temperature.

When the environmental temperature reaches 32°C, the next day egg production tends to decrease, as the drinking water temperature increases. The higher the thermal amplitude is the largest are the losses due to thermal stress in the egg production of the following day.

CONCLUSIONS

In terms of egg production, for tropical housing and climatic conditions, the thermal amplitude plays an important role in the egg production response. The drinking water temperature is also a limiting egg production factor for climates with high environmental temperatures.

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