PREDICTING BROILER BREEDER'S BEHAVIOR USING ELECTRONIC IDENTIFICATION

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ABSTRACT

Monitoring and evaluating the breeder's behavior can be an useful tool in order to evaluated the inside environment. The EID (Electronic Identification) is based upon the use of electronic devices to detect and record a code or a number ID. In order to make the communication feasible between the parts involved in the ID response an specific microchip named transponder needed to be attached to the ID target. This research had the objective of predicting the breeder's behavior and relates it's behavior to the environmental dry bulb temperature and relative humidity using EID. Eight female breeders were housed in a small scale housing model and they all had a transponder implanted subcutaneous. Three readers were used to record their movement within the housing and they were placed under the nest, passage and drinker. Dry and wet bulb temperatures were recorded using a datalogger. Data were analyzed statistically and the breeder's behavioral pattern according to the environmental characteristics as well as the predicting equations were determined. The EID was an useful tool for determining the females breeder's movement as function of the dry bulb temperature and the relative humidity.

Keywords. Electronic Identification, Broiler breeders, Behavior

1. Background

The use of electronic ID in different animal species has been applied following some producer's standards. Studies show that the use of miniaturized ID electronic integrated circuits, known as transponders or microchips, is feasible, as cited in WADE & MAYALL (1994). This technique has been adopted for controlling herds in intensive animal production and in controlling and monitoring wildlife.

The use of the electronic ID technology in Brazil is in initial stage and only few companies are using it commercially around the world (CURTO et al, 1997). It has been partially used for animals' identification in zoos since the early 90's. Commercial production farms also use this system associated to computer expert system, for managing the herd and decision making.

The thermoneutral dry bulb temperature for breeders during the production stage lies between 22°C and 25°C. When the upper critical temperature is reached, the latent heat lost by evaporation is highly affected by relative humidity. The upper critical temperature is mainly influenced by the environmental variables such as dry bulb temperature, relative humidity and diffuse solar radiation. TINOCO (2001) points the limits of relative humidity within 70-80% when referring to the use of evaporative cooling for broiler breeders. According to NÄÄS (1995) and FOREHLICH et al (1975), the bird's thermal regulation processes in response to heat stress conditions uses extra energy leading to losses in productivity. Broilers in the first three weeks are more sensitive to sudden weather changes requiring a more isolated building while older birds suffer more heat stress. BOTTJE et. al. (1983) found that male breeder under heat stress have their ability for dissipating heat quite reduced. This situation leads to a certain degree of prostration as a physiological response to the dec rease in their metabolic rate. Optimal poultry or breeder production requires a housing environment that offers a well distributed ventilation in order to reach the ideal environment and consequently high performance standards.

Breeder housing is also influenced by its solar orientation. The seasons characterization is related to solar declination, and the solar orientation of a building is then affected by the solar radiation flux density that reaches all the housing sides throughout the day (OLGAY, 1992) and transformed in heat. The design of adequate animal houses, as well as cooling strategies, requires the knowledge of their behavioral responses to stressing environment. However when data is taken under circumstances of human intervention, the behavioral pattern may not be true.

This paper presents the female breeder's pattern behavior in small scale housing model, as function of dry bulb temperature and relative humidity, by using the Electronic Identification technology.

The concept of biosensors technology applied to animal production, mainly based on the miniaturized electronic mechanics (MEM) has being used to individual identification and monitoring, which is a important step towards tracking of actions and application of traceability of events and processes in the animal protein production chain. NÄÄS (2002) presented the importance and the great potential for applications in the livestock industry,

particularly where rapid grow, low cost, high sensitivity and specific measurement in field situations is required and the use of automation/mechatronic in animal production will help farmers decrease losses during the animal production cycle, by the use of precision principles and more accuracy, improving animal management.

A radiotelemetry system for the remote monitoring and recording of ECG, heart rate and deep body temperature in poultry was described by KETTLEWELL *et al.* (1997) under laboratory conditions and by the evaluation of the system, it was demonstrated accurate and reliable it was transmission and recording of the physiological signals, during control periods and exposure to thermal stress.

Retention rate and digestive and performance effects of ceramic boluses were presented by CAJA *et al.* (1999) in three experiments where reading distances of transponders inside and outside the boluses did not vary. The use of the ceramic bolus was recommended as a safe and tamper-proof method for electronic identification of ruminants once the animals have reached a weight where successful administration was possible. When SMITHS *et al.* (2001) presented the suitability of electronic identification of ruminants, as a part of a sound and uniform system of identification and registration, that was being investigated in the EU project IDEA (IDentification Electronique des Animaux). The electronic identification devices (EID) were tested in a total of almost 1 million ruminants (cattle, sheep and goat) in six EU countries. The factors that play a part in the varying results in the execution phase were analyzed, e.g. loss of transponders and reading of boluses in the rumen.

In another experiment the YANAGI *et al.* (2002) developed a control and measurement system for studying physiological responses of poultry to thermal challenges and means of heat stress relief. The system features automatic control of air temperature and relative humidity (RH); manual setting of air velocity and continuous recording of surface and core body temperatures of the animal. The study with laying hens, concerning thermoregulatory responses to heat challenge and its relief, was conducted to demonstrate application of the system.

The global positioning system (GPS) technology offers a means for studying how spatial and temporal variability of animal, forage, soil and landscape features affect grazing behavior and forage utilization. The results of the experiment conducted by TURNER *et al.* (2001) could provided information to assist managers and their advisors in pasture management, in improving efficiency of utilization, and in optimizing profits. The results should be useful in planning new research using this technology.

To study the effect of injection body site on migration and readability of transponders in sheep, 153 glass encapsulated passive transponders (Tiris, 32.533.8 mm) were showed by CAJA *et al.* (1998) where the transponders were subcutaneously injected in 26 ewes and the results suggested firstly armpit, and secondly ear base, as suitable subcutaneous injection sites for electronic identification of sheep.

In experiment with dairy cows, ZAPPAVIGNA et al. (1998) analyzed automatic feeding of dairy cows and examined a solution based on the controlled access of individual animals to the manger. Concerning the system's capacity to ensure a pre-arranged mode of feeding

behavior, it was observed that the correspondence between the programmed lengths of stay in the different pre-set sectors and the actual ones turned out to be very good, not only over the long term but also on a daily basis. On the contrary, the rationing method was found to have no significant effect on milk production.

2. Methodology

The experiment was carried out in Campinas, state of São Paulo, Brazil, at a latitude of 22° 54 ' S, longitude of 47° 05 ' W and altitude of 674 m. The research was set at the experimental area of the College of Agricultural Engineering, FEAGRI, at the State University of Campinas, UNICAMP, Brazil. A small and distorted scale model was built representing the usual breeder's housing. The scales were 1:10 in the horizontal dimension and 1:2 in the vertical dimension. Reduced scale models have been used in experiments related to animal environment research by HAHN et al (1961) and FOREHLICH et al (1975). The distorted models, where there is more than one scale to describe one dimension was made according to MURPHY (1950) showing the ideal situation for reproducing thermodynamic processes, when relating length and width associated to temperature and its response in the real scale. The model in the trial was oriented East-West, as shown in Figure 1.

Figure 1. View of the experimental model with the birds

Eight females breeder Hybro-G genetic had a transponder (the electronic identification) implanted subcutaneous in the leg and foot (Figure 2), as a previous study showed that there was not statistical difference the place of implant for EID response (PEREIRA et al, 2001). The readers (commercial Trovan® antennas) were placed in three locations: the nest, the passage and the drinker to register the breeder's movement. Thermocouples J type were used to collect temperatures, the dry bulb temperature had a plain thermocouple (1) while the wet bulb temperature recording had thermocouple placed inside a small white box filled with water (2). A datalogger recorded the dry and wet bulb temperature within the model. Relative humidity was calculated using psychrometrics equations as cited in ALBRIGHT (1990) and

ASHARE (1985). The antenna reading was set for every 2s (not less than 60s after the first reading), when the birds moved around the passage, drank water or got inside the nest. A software was developed for registering the female breeder movement within the housing.

Figure 2. Transponder implant subcutaneous

The birds moved freely in the housing and data were recorded continuously. A system of query was used for selecting the bird's placement at a certain range of dry bulb temperature (Class range of DBT=14.8-37.2°C) and relative humidity (Class range of RH=40-100%). The experiment took place from October to December 2001.

3. Results and Discussion

Over 500.000 readings where recorded and a large spectrum of behavioral possibilities were found. It was selected to evaluate the bird's path as function of both the dry bulb temperature (DBT) and the relative humidity (RH), distributed in 8 classes range. Table 1 show the class range for relative humidity and dry bulb temperature.

Table 1. Class range for the DBT and RH used for organizing the environmental data

Class	1	2	3	4	5	6	7	8
RH (%)	40,0 - 47,5	47,5 - 55,0	55,0 - 62,5	62,5 - 70,0	70,0 - 77,5	77,5 - 85,0	85,0 - 92,5	92,5 - 100,0
DBT (ºC)	14,8 - 17,6	17,6 - 20,4	20,4 - 23,2	23,3 - 26,0	26,0 - 28,8	28,8 - 31,6	31,6 - 34,4	34,4 - 37,2

Figure 3 show the frequency of the location's use by the birds as function of the DBT. It can be seen that as the DBT increases, the use of the drinker also increases inversely proportional to the movement in the passage, indicating that the bird tends to increase the consumption of water or lay near the drinker, benefiting from the evaporative cooling of the surrounding air. Same results were found by BOTTJE et. al. (1983) showing the effective increase in prostration of male broiler breeders under heat stress, and the reduction of heat dissipation.

The use of the nest did not have a specific pattern nor had statistically significant results, although the graph in Figure 1 indicates an increase in the use of the nest when environmental temperature was low (14.8°C), as well as a small decrease when temperatures reached 28.8°C.

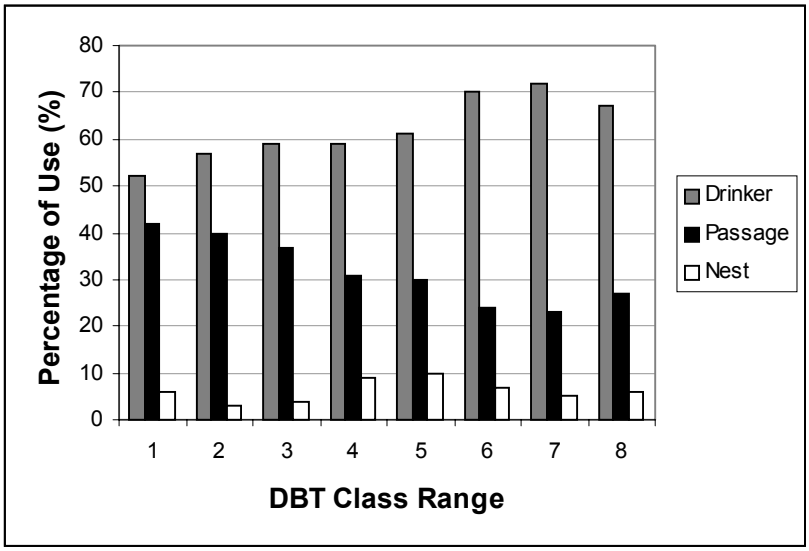

Figure 3. Frequency of the use of nest, passage and drinker by the breeders during the daily hours, according to DBT range.

It was possible to find the following equation that described the best fit function (PFP) for the breeder's use of the passage regarding the values of DBT:

$$PFP = 1.10 - 0.244 \ln(DBT) \text{ , for } \alpha = 1\% \text{ and } R^2 = 80.4$$

The following function was found to describe the frequency of use of drinker, again the best fit function (PFD) related to DBT change:

$$PFD = 0.398 + 0.00866 (DBT), \text{ for } \alpha = 1\% \text{ and } R^2 = 66.0$$

The same procedure was done for analyzing the effect of the relative humidity in the breeder's behavior. Figure 4 shows the frequency of the bird's use of the drinker, passage and nest as the relative humidity changed.

It is clear that the lower the relative humidity the more the breeder drinks water or stays near the drinker. As the relative humidity reaches 70%, that is within the thermal comfort zone, the pattern of the drinker's use appears to be more balanced.

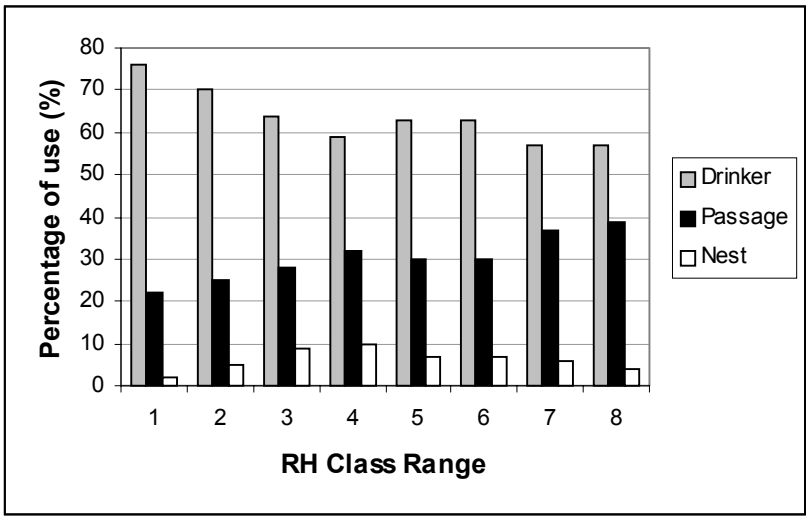

Figure 4. Frequency of the use of nest, passage and drinker by the breeders during the daily hours, according to RH range.

4. Conclusions

It was possible during the trial to register the female breeder's path within the models using electronic identification technology, as well as to predict a model relating the DBT and the breeder's movement inside the housing. The birds tend to stay in cooler places when dry bulb temperatures increased, as commented in the literature. The data recorded was exactly the female breeder's response to the inside environment, as the technology permits the remote recording without the negative intervention of people nearby the housing.

5. Acknowledgment

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