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# Thermoregulatory answers in buffaloes (*bubalus bubalis*) created on the shading and sun, in the climatic conditions of the brazilian eastern amazon

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## ABSTRACT

To evaluate the thermoregulatory answers of 20 females buffaloes, Murrah race, created on the sun and on the shading in the Embrapa Eastern Amazon, Belem, Para state, Brazil. Were used in completely randomized design, two experimental groups (group on shading - S and group without shading - WS). The buffalos of Group S (n=10) had remained in rotation grazing, in silvopastoral system, shadings for the leguminous *Acacia mangium*, while of Group WS (n=10) was managed in poles without access to the shade, in rotation grazing. In both groups the animals use *Brachiaria humidicola* with access to water for drink and mineral salt "add libitum". The physiological variable studied were: rectal temperature (RT), respiratory frequency (RF), cardiac frequency (CF) and temperature of the corporal surface (TCS) and were surveyed in the turns in the morning (7:00 a.m.) and in the afternoon (13:00 p.m.). The results of the variance analysis had disclosed differences significant ( $P<0.05$ ) between the turns, for the two treatments, sun and shading, being the RT, of the turn in the afternoon, 38.6 and 38.8°C, respectively of Groups S and WS, superior to the morning, 38.4 and 38.4°C. The RF, in Group WS, the turn of the afternoon, was different ( $P<0.05$ ) between the months, with bigger values in May (38 movement/minute) and less in June (31 movement/minute). The CF, also, had significant difference ( $P<0.05$ ) between the turns, for the two treatments, being the CF, of the turn of afternoon, 65 and 71 beat/minute, significantly superior to the morning, 59 and 65 beat/minute, respectively of Groups S and WS. The variance analyses showed differences ( $P<0.05$ ) of the TCS between treatments and turns in the months of January, April, May and June. The months of February and March had differences between turns to TSC. Enters the months of the experimental period, had differences of the TSC, with bigger values in January, the turn of the afternoon, of 34 and 36°C, and less in May, the turn of the morning, of 27 and 28°C, respectively for group S and WS.

**Keywords:** Silvopastoral system, ambience, physiological variables, *Brachiaria humidicola*, intensive rotation grazing.

## INTRODUCTION

The homoeothermic animals, as the buffaloes (*Bubalus bubalis*), get to keep constant its body temperature, inside of narrow limits, although the variations in the ambient temperature. Under thermoneutral ambient conditions, has ability to keep the balance between production and loss of heat. On the other hand, in conditions of raised ambient temperatures, show intensification of manning and physiological answers. Although the adaptability to the most varied ambient conditions, the buffalos possess specific structural and functional particularities, as high concentration of melanin in the skin and the hair, low amount of sweat glands, low density of hair and the dark skin, being, therefore, very sensible when displayed to the direct solar radiation. However, in shade conditions, the buffalo acts as a typical "black body" heat radiator, therefore it recoups its thermal balance quickly 8. Thus, the objective of this work was to evaluate the thermoregulatory answers of buffaloes submitted to the sun and the shade of trees of the leguminous *Acacia mangium*, in two periods of the day (7:00 A.M and 13:00 P.M.), in the climatic conditions of the Eastern Amazon Region.



## MATERIALS AND METHODS

This Work was lead in the Unit of Research "Senator Alvaro Adolpho" (01°.26'.03" S and 48°.26'.03" W), Belem, Para State, Brazil, pertaining to the Embrapa Eastern Amazon, of January to June 2009. The local climatic type is the Afi, according to Köppen. The pluvial precipitation annual average is 3,001 mm, annual average relative humidity of air 85%, annual average temperature 27°C and 2,400 hours of annual insolation 2. Were used 20 Murrah buffaloes, between four and five years old, average weight 359kg, cyclical, non-lactating. The animals were distributed, randomized, in two experimental groups (Group S - with shade and Group WS - without shade). The period of adaptation was of 14 days. Group S (n=10) remained in rotation pasture, in poles with shade of trees of the leguminous *Acacia mangium*, in silvopastoral system, while Group WS (n=10) was kept without access to the shade, also, in rotation pasture.

The feeding was exclusively the grass of the grassy "quicuí-da-Amazônia" (humidicola *Brachiaria*), with access the water to drink and mineral salt ad libitum. Were determined rectal temperature (RT), respiratory frequency (RF), cardiac frequency (CF) and temperature of corporal surface (TCS), surveyed two times per week, to 7:00 A.M. and 13:00 P.M. For attainment of the RT veterinarian clinical thermometer was used, with scale until 44°C. The RF was gotten by inspection and counting of the thorax-abdominal movements, during one minute. The CF was measured for auscultation of the beatings, with a veterinarian stethoscope, per one minute. The TCS was gotten with a laser thermometer, defendant in maximum distance of 1 meter of the points of measure in the animal: front, right side of the thorax and left side, in the direction of rumen, getting averages of these values.

The referring climatic variable to the temperature of air (AT) and relative humidity of air (RHA) was gotten in the Meteorological Station of the INMET- 2° DISME, located the 500 meters of the experimental area. From them the Index of Temperature and Humidity - ITH 10 was calculated:  $[0.8 \times T + (RHA/100) \times (T-14.4) + 46.4]$ , where: T = temperature (°C) and RHA = relative humidity of air (%). Was made descriptive and variance analyses, 0.05% of significance, in the SYSTAT, version 12.

## RESULTS AND DISCUSSION

The averages of climatic variable and the index of temperature and humidity, in the experimental period, per the morning and to the afternoon, are in Table 1.

**Table 1:** Average values of the relative humidity of air (HRA), temperature of air (AT) and index of temperature and humidity (ITH), of January to June of 2009, in Belem/Para State, Brazil.

Treatment	Average daily intake (kg)	Daily weight gain (kg)
Treatment A - Control	4.208 <sup>a</sup>	0.935
Treatment B	3.242 <sup>b</sup>	0.991
Treatment C	3.853 <sup>ab</sup>	1.096

The averages of the RT, in the experimental period, are illustrated in Figure 1. It had significant differences ( $P<0.05$ ), between turns and treatments, per the afternoon (38.6 and 38.8°C), significantly superior to the observed per the morning (38.4 and 38.4°C), for groups S and WS, respectively. Similar results were observed in Rondônia State, Brazil, in buffaloes created in silvopastoral system, where the RT was of 38.7°C and 39.2°C, per the morning and afternoon, respectively 6, what it demonstrates the influence of the ambient temperature, on this physiological variable.

Had significant differences ( $P<0.05$ ) between Groups WS and S and turns, in every month of the experimental period. In Group WS, in both the turns, had significant difference ( $P<0.05$ ) between the months, with lesser values in June (38.55°C). This fact can have occurred due to adaptation acquired for the animals, in elapsing of the collection of data, when they presented differentiated behavior, when using mud puddles formed by the water of rain. In them, the animals lay down, in order to keep the body temperature in normal levels, therefore in this group it did not have shade availability, similar behavior to the observed one in other localities, where the buffalos look water for bath, aiming at its thermoregulation 1.



In Figure 2 was observed variation of the RF, during the experimental period. In the months of March and April, had significant differences ( $P<0.05$ ) between Groups WS and S and turns. In the others months the differences ( $P<0.05$ ) was only between the turns. In Group WS, to the afternoon, the difference ( $P<0.05$ ) occurred between the months, with bigger value in March (38 mov./min.) and minors in June (31 mov./min.). In pasture, without shade, the buffaloes present significant rise in the RT, of 38.3 for 39.1°C, and in the RF, of 22.6 for 48.4 mov./min., as form to waste the excess of corporal heat, in result of thermal stress, that harms productive performance 9.

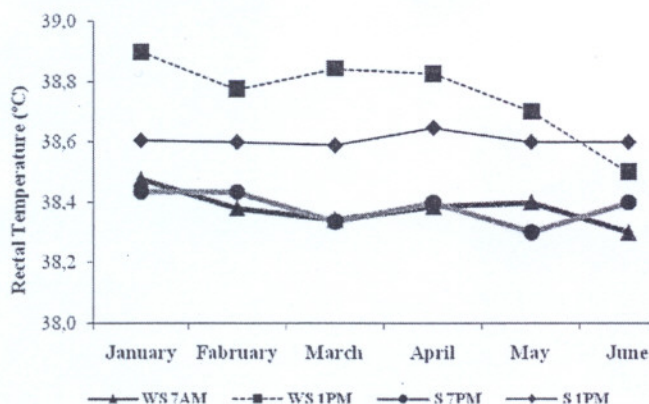
Are illustrated in the Figure 3 the averages of the CF, in the experimental period. It had significant differences ( $P<0.05$ ) between Groups WS and S and turns, in all months of the experimental period. The averages observed in Groups WS and S were, respectively, 65 and 71 beat/min., per the afternoon, superiors to averages in the morning, 59 and 65 beat/min. When are considered the systems of creation, independent of period, the cardiac frequency are significantly lower in the animals created in Silvopastoral System. The availability of shade in this system protects the animals of the direct incidence of the solar radiation, what confers thermal sensation of lesser temperature and, consequently, propitiates greater thermal comfort 7. Under temperatures of air lesser, the cardiac frequency of the buffaloes is less intense, between 60 and 61 beatings/minute. However, from the moment where the average temperature of air exceeds 26.5°C, this physiological variable, also, increases and reaches 66 beatings/minute, when the temperature of air reaches 29°C 5. In Group WS, in both the turns, had significant difference ( $P<0.05$ ) between the months, with lesser values in June (56 beat/min.).

The averages of the TCS, in the experimental period, are illustrated in Figure 4. Differences ( $P<0.05$ ) between treatments and turns had been observed, in January, April, May and June. In February and March only had differences between turns. In all the experimental period, superiority ( $P<0.05$ ) in the averages of the turn of the afternoon is observed (33.1 and 34.1), respectively, in Groups WS and S. In the same way, in the wasteland of Pernambuco State, Brazil 3, the temperature of the corporal surface of heifers buffaloes and buffaloes in gestation were bigger ( $P<0.05$ ) to the afternoon, in comparison with the morning. This effect can have the peripheral vasodilatation, as reply to the rise of the ambient temperature and consequent increase of the sanguine flow for the surface of skin 4.

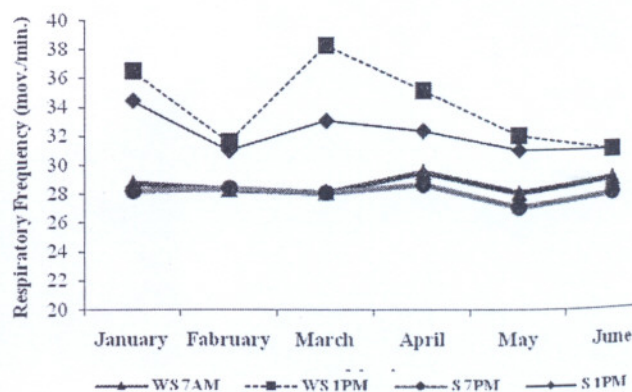
When the buffalos are created in systems without access to the shade or water, its thermoregulatory system immediately are activated, in order to keep the thermal balance, deviating energies that could be being used to get bigger productivity. Thus, the systems that allow access to the shade, as the Silvopastoral System, better promotes tolerance of the buffalos to the tropical heat.

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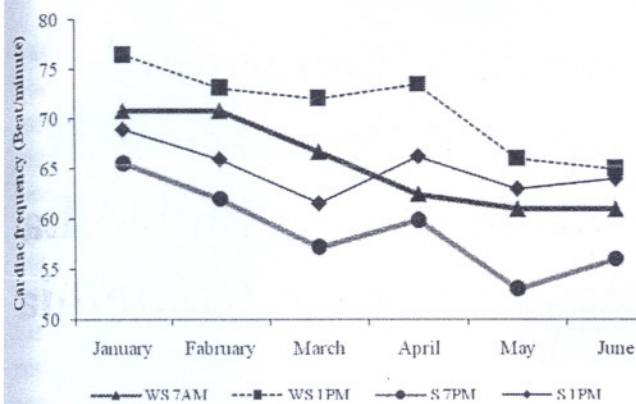


**Figure 1.** Variation of rectal temperature of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.

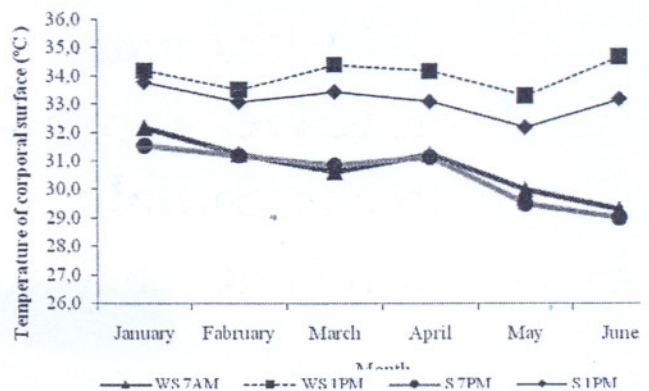


**Figure 2.** Variation of respiratory frequency of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.





**Figure 3.** Variation of cardiac frequency of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.



**Figure 4.** Variation of temperature of corporal surface of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.

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