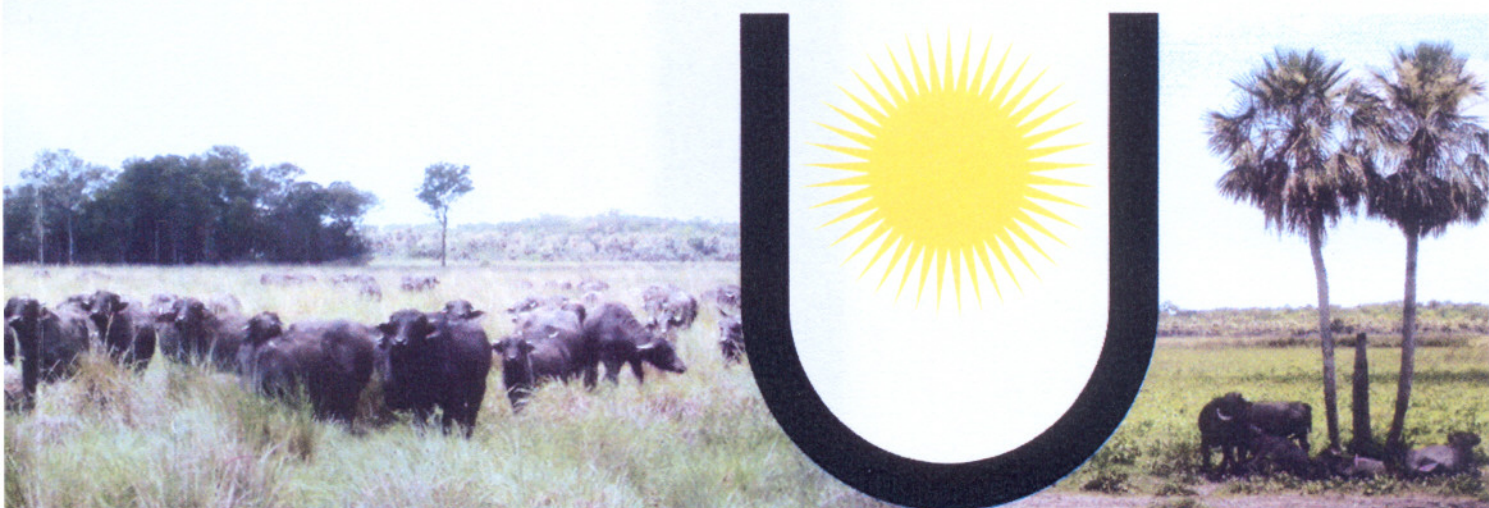


FACULTAD DE CIENCIAS VETERINARIAS
UNIVERSIDAD NACIONAL DEL NORDESTE
CORRIENTES, ARGENTINA

REVISTA VETERINARIA



Volumen 21 - 2010 - Suplemento 1

PROCEEDINGS

9TH
WORLD
BUFFALO CONGRESS
ARGENTINA 2010

Buenos Aires, 25-28 April 2010

Guest Editors:

Gustavo A. Crudeli (Coordinator)
Exequiel M. Patiño, José L. Konrad

Revista Veterinaria

Rev. vet. 21: 1, 2010 - ISSN 1668-4834 (on line: ISSN 1669-6840)

Registro de la Propiedad Intelectual N° 549193 (on-line: N° 430406). Indizada en LATINDEX (México, DF), INFOCYT-OEA (Chile), CAB International (Oxford, UK), Scopus (ELSEVIER, Holanda), Gale Cengage Learning (México), DOAJ ORG. (Lund, Suecia) y EBSCO Publishing (USA). Se edita un volumen con dos números por año. La revista se financia con aportes de la Universidad Nacional del Nordeste, la Facultad de Ciencias Veterinarias, aranceles percibidos de los autores y publicidad.



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Sargento Cabral 2139, Corrientes (3400), Argentina. Tel/fax: 54 03783 425753.

E-mail: revista@vet.unne.edu.ar

Publicación on line: <http://www.vet.unne.edu.ar>

Effect of the climatic conditions of the brazilian eastern amazon in the tolerance to the heat in buffaloes (*bubalus bubalis*) created on the shading and sun

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ABSTRACT

The effect of the climatic conditions of the Brazilian Eastern Amazon on the rectal temperature (RT), respiratory frequency (RF) and index of tolerance to the heat (ITH) - Benezra was evaluated, 20 female buffaloes of the Murrah race, entirely randomized distributed, in two experimental groups (Group Without Shading - WS and Group With Shading - S), in silvopastoral system, with *Brachiaria humidicola*, in rotationed grazing. The buffaloes of Group S (n=10) had remained in pasture shadings for the leguminous *Acacia mangium*, while of Group WS (n=10) was kept in pasture without access to the shade. All the animals had access to the water to drink and mineral salt "add libitum". The period of adaptation of the animals to the systems was of 14 days. The physiological variable was taking in two turns in the morning (7 AM) and in the afternoon (13 PM). The statistical analysis presented differences significant ($P<0.05$) between the turns, for the two treatments, the RT of the turn in the afternoon, 38.6 and 38.8°C, respectively of Groups WS and S, was superior to temperatures takes in the morning, 38.4 and 38.4°C. The RF, in Group WS, in the turn of the afternoon, was different ($P<0.05$) between the months, with bigger values in May (38 movement/minute) and lesser in June (31 movement/minute). The average values of the ITH only showed differences between the turns of the morning (2.24) and the afternoon (2.46).

Keywords: Bioclimatology, physiological variable, rectal temperature, respiratory frequency, silvopastoral system, *Brachiaria humidicola*.

INTRODUCTION

The climate of the Eastern Amazon Region is characterized for presenting high temperatures and relative humidity of the air. These climatic conditions are a challenge for the homoeothermic animals that has difficulties in wasting heat to restore its thermal balance corporal. The buffaloes, pertaining to this group, have specific structural characteristics, with raised concentration of melanin in the skin, reduced amount of sweat glands and density of hair, what it becomes very sensible to the direct solar radiation. Being thus, this research aims to evaluate the effect of the availability of shade of trees (leguminous *Acacia mangium*), in two periods of the day (7 A.M. and 1 P.M.) in the rectal temperature, respiratory frequency and index of tolerance to the heat of buffaloes of the Murrah race, 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 of the pasture "quicuio-da-Amazônia" (humidicola *Brachiaria*), with access the water to drink and mineral salt ad libitum. The studied physiological variable, rectal temperature (RT) and respiratory frequency (RF) was surveyed two times per week, to 7:00 A.M. and 13:00 P.M., with the aid of clinical thermometer veterinarian, with scale until 44°C, and for the inspection and counting of the thorax-abdominal movements, during one minute (movement/minute). The Index of tolerance to the heat of Benezra 3 was used, values next the two (2.0) indicate that the animals are adapted to the environment. The calculation was effected using the formula: $ITH = RT/38.33 + RF/23$, where RT: rectal temperature and RF: respiratory frequency. The climatic variable referring to the temperature of air (AT) and relative humidity of air (RHA) were gotten in the Meteorological Station of the INMET - 2° DISME, located the 500 meters of the experimental area, and from them, was calculated the Index of Temperature and Humidity (ITH) 8: $ITH: [0.8 \times T + (RH/100) \times (T-14.4) + 4.4]$, where: T = temperature (°C) and RH = relative humidity of air (%). Descriptive analyses and of variance were made, 0.05% of significance, in the SYSTAT, version 12.

RESULTS AND DISCUSSION

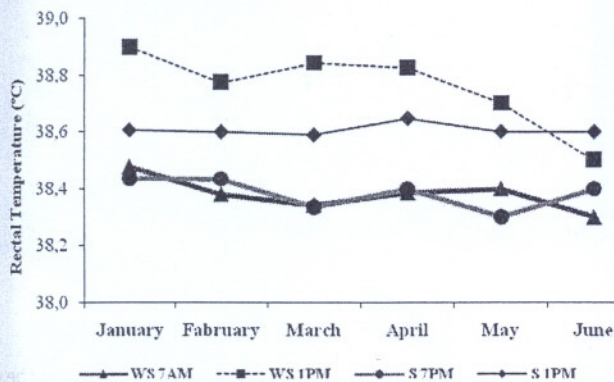


Figure 1: Variation of rectal temperature of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.

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.

Period	HRA (%)	AT (°C)	ITH
Morning	91.0	26.4	78.4
Afternoon	82.0	28.9	81.0
Average	86.5	27.7	79.7

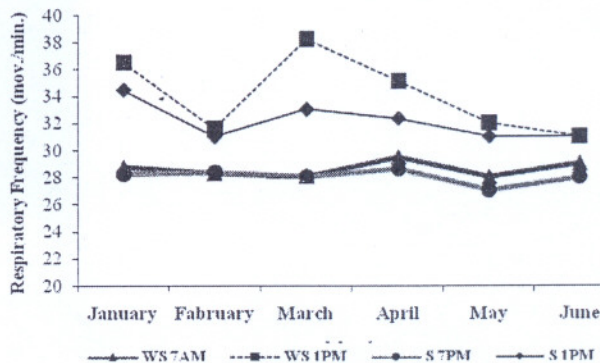
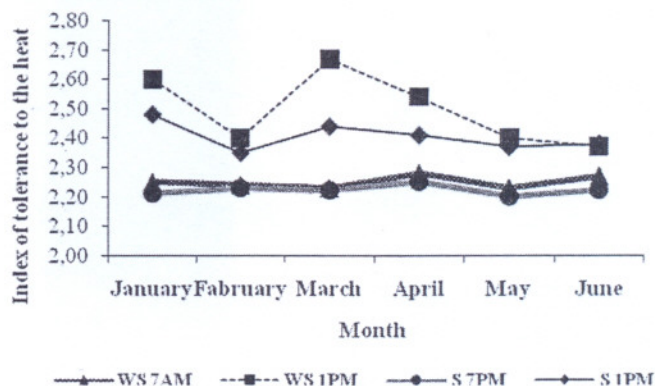


Figure 2: Variation of respiratory frequency of buffaloes created without shade (WS) and shade (S), of morning (7:00 A.M.) and to the afternoon (1:00 P.M.), in Eastern Amazon.

In Figure 1 is illustrated the variation of the RT in the experimental period. Significant differences ($P<0.05$) between averages of the turns and treatments had been observed, with 38.6 and 38.8°C, in Groups WS and S, per the afternoon, superiors to the the morning, 38.4 and 38.4°C.

In the experimental period had significant differences ($P<0.05$) in all months, between Groups WS and S and turns. In Group WS, in both the turns, had significant difference ($P<0.05$) between the months, with lesser values in June (38.55°C), that it can have occurred due to adaptation acquired for the animals, in elapsing of the period of collection of data, when they presented differentiated behavior, in mud puddles formed by the water of rain. In them, the animals lay down, in order to keep the body temperature in normal levels, considering it that in this group it did not have shade availability. This behavior was waited, therefore as research executed in São Paulo State, Brazil 1, buffaloes has preference for water for bath, when they desire to thermoregular. In both the studied groups, the RT was significantly superior in the turn of the afternoon, when the ambient temperature if found higher. Research in Rondônia State, Brazil, with buffaloes created in silvopastoral system 6, had presented resulted similar, where the RT passed of 38.7°C for 39.2°C , per the morning and late, respectively, what demonstrates that the rise of the ambient temperature influences in this physiological variable. The variation of the RF of the animals studied, during the experimental period, is presented in Figure 2. In March and April had significant differences ($P<0.05$) between Groups WS and S and turns. In January, February, May and June the differences ($P<0.05$) had been only between the turns. In Group WS, to the afternoon, the difference ($P<0.05$) occurred between the months, with bigger values in March (38 mov./min.) and minors in June (31 mov./min.). These results are in accordance with literature 9. 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 it harms its productive performance 7. The daily average value of the index of tolerance to the heat of Benezra was 2.32, in Group S, and 2.38, in Group WS. Per the morning and to the afternoon, the average results were, respectively, 2.22 and 2.41 (Group S) and 2.25 and 2.50 (Group WS). The variance analysis disclosed differences significant ($P<0.05$) of the index, in Group WS, to the afternoon, probably due to rise of the ambient temperature and the direct solar radiation on the skin of the animals, since they did not have availability of shaded areas to be protected.

Figure 3: Index of tolerance to the heat of Benezra, in the experimental period.



In January, March and April had differences ($P<0.05$) between Group S and WS and turns. In February, May and June the difference ($P<0.05$) was only between turns. The averages of the index of tolerance to the heat of Benezra, in the experimental period, are in Figure 3. Similar results had been gotten in Eastern Amazon 4, where it was observed that the ITH of the animals kept in the system with shade is next the 2,0, in 70% of the carried through comments, what it proves the importance of the shade in the animal ambience, tropical climates, as of the Brazilian Amazon. In Table 2 are the average results of the rectal temperature, respiratory frequency and index of tolerance to the heat of Benezra, in buffaloes created to the shade and the sun, per the morning and to the afternoon.

Table 2: Averages of the rectal temperature, respiratory frequency and index of tolerance to the heat of Benezra (ITH), buffaloes created to the shade and the sun, per the morning and to the afternoon, in Belem, Para State, Brazil.

Variável	Group S		Group WS		Average	
	7:00 A.M.	1:00 P.M.	7:00 A.M.	1:00 P.M.	7:00 A.M.	1:00 P.M.
Rectal temperature ($^{\circ}\text{C}$)	38,4	38,6	38,4	38,8	38,4	38,7
Respiratory frequency (mov.min.)	28	32	29	34	28,5	33
ITH	2,22	2,41	2,25	2,50	2,24	2,46

The systems that allow access to the shade, as the silvopastoral, promote better tolerance of the buffaloes to the tropical heat, in comparison to the kept in area without shade. The simple shade in the pastures can have positive consequences in the productivity of the buffalo, although the temperature, relative humidity of air and index of temperature and humidity to affect the physiological variable and the index of tolerance to the heat, mainly, in the period of the afternoon.

Acknowledgements.

To the Supervision of Development of Amazon - SUDAM, for the financial resources. To the Embrapa Eastern Amazon, for the availability of the area and experimental animals. To the National Institute of Meteorology - INMET/2º District of Meteorology, for the supply of the climatic data.

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