

Effect of environmental variables on buffaloes physiology

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ABSTRACT: The objective of this work was to evaluate the effect of environmental variables on dairy buffaloes physiology in two different places after milking, shaded plus artificial ventilation and another one non-shaded, in Ribeira Valley, São Paulo State, Brazil. Data on the respiratory rate (RR) and the surface temperature (ST) at udder, neckmiddle, forehead, back middle and rump were collected in 12 dairy buffaloes at autumn. In the same way, it were recorded the black globe temperature in the sun (GTS) and in the shade (GTNS), air temperature and wind speed at padronized height of 1.60 meters. All data were collected at 10:30am and 1:30pm. The results showed statistical difference among black globe temperature, wind speed, RR and ST ($P<0.01$) in two treatments. The results showed the necessity of protection against the solar radiation in the buffaloes, even in periods of warm climates.

Key words: Respiratory rate, Thermal comfort, Buffaloes production.

INTRODUCTION - The buffalo is an homeothermic animal and the body temperature maintenance depends on a constant exchange of thermal energy and the environment. All metabolic heat produced and acquired for the environment must be equal to the rate of lost heat for the termoregulation, to keep the body temperature constant. The ways of body heat losses used by the ruminants are the evaporative mechanisms (sweating and panting), convection, conduction, radiation and behavioral changes (reduction of the food ingestion, stay on shade and water for ingestion and immersion) (McGovern & Bruce, 2000; Arcaro, 2005). In order to protect the buffaloes of the heat stress, the housing (constructions and grass) must offer protection against the direct solar radiation. It is important that the buffaloes grope in pastures with shade and stall in a place with good ventilation, the animal are handled in the coolest hours of the day and lesser incidence of solar radiation. This work had the objective to evaluate the effects of two places after milking, one shaded plus artificial ventilation and another non-shaded, in the physiological and productive parameters of dairy buffaloes in Vale do Ribeira Region, State of São Paulo, Brazil.

MATERIAL AND METHODS - The experiment was carried out on autumn, in the Pólo Regional do Vale do Ribeira (APTA), in Registro, São Paulo State, Brazil, located at the coordinates of 24° 26' 15" S e 47° 48' 45" W.

12 dairy buffaloes in lactation were separated in two treatments after milking. The first treatment was composed for a stall covered with ceramic tiles and artificial ventilation ($300 \text{ m}^3 \cdot \text{s}^{-1}$) in the feeder line. The second treatment was composed for an area non-shaded.

Surface temperature (ST) and respiratory rate (RR) were monitored in two periods, at 10:30 am and 01:30 pm. After this period, all the animals were conducted to the pasture. The ST at different sites (udder, neck middle, forehead, back middle and rump) were recorded using a non-contact temperature measurement thermometer by infra-red (Das *et al.*, 1999). The RR of animals was recorded by counting the flank movement by 20 seconds.

Black globe temperature was collected by a black sphere with a temperature sensor inside its geometric centre. This temperature shows the animal thermal sensation in that moment (Sevegnani, 2000). The black globe temperature was measured in the shade (GTS) and non-shaded (GTNS).

Air temperature was collected by a dry bulb thermometer, in the shade and air velocity was measured at padronized height of 1,60 meters by an anemometer. The weather conditions were collected twice a day, 10:30 am and 01:30 pm,.

The statistical analysis of the data was performed using analysis of variance.

RESULTS AND CONCLUSIONS - The means squares of the weather conditions are shown in Table 1. There were no significant differences between the treatments for air temperature ($P > 0.05$). Although, the means showed significant differences between periods. Black globe temperature was significantly different ($P < 0.01$) for the means in the shade ($24.07^\circ\text{C} \pm 0.99$) and in the sun ($28.54^\circ\text{C} \pm 1.08$).

There were significant differences in the air velocity in two treatments. There were no significant interactions between treatments and periods for the three variables.

Respiratory rate was significantly ($P < 0.01$) affected by treatment (Table 2). Sevegnani *et al.* (2006) observed RR values of 6 and 7 movements/20 seconds in the morning and 10 and 13 movements/20 seconds in the afternoon.

Table. 1. Means of the weather conditions.

Parameters	Black globe temperature ($^\circ\text{C}$)	Air temperature ($^\circ\text{C}$)	Air velocity (m/s)
Treatments	192.25**	0.027	2.4538**
Periods	26.86	40.283*	0.0866
Treatments* Periods	1.41	0.306	0.0916
Residual	20.86	6.850	0.2424

** $P < 0.01$; * $P < 0.05$.

The non-shaded treatment resulted in higher values of temperature for the physiological variables ($P < 0.01$) when compared with the shaded treatment (Table 2).

The differences found for GTS, GTNS, RR in two treatments showed that the animal feels the difference of the incident radiation and increases the RR like a method of heat loss, even on autumn that at warm temperatures.

Table 2. Means of Respiration Rate and Surface Temperature.

Treatment	Respiration Rate (mov/20s)	Forehead Temperature (°C)	Neckmiddle Temperature (°C)	Udder Temperature (°C)	Back middle Temperature (°C)	Rump Temperature (°C)
Shaded	6.12 b	28.855 b	30.348 b	32.399 b	30.005 b	29.559 b
Non-shaded	8.1 a	30.855 a	32.565 a	33.698 a	33.401 a	33.623 a

Columns with differing letters are significantly different.

An additional advantage of panting relates to cooling of the blood passing the nasal area, which allows the brain temperature to be kept lower than the core body temperature (Silanikove, 2000). Shade has a large impact at higher temperature on physiological responses, mainly respiratory rate and body temperature (Brown-Brandl *et al.*, 2005;). The respiration rate is the most appropriate indicator of thermal stress to monitor because it was consistently affected in all animal categories, it is easy to monitor without the need for costly equipment and there is little or no lag associated with it (Brown-Brandl *et al.*, 2005).

The surface temperature at all sites significantly increased in relation to the treatment non-shaded (Table 2). Das *et al.* (1999) found significant positive correlation between air temperature and surface temperatures.

CONCLUSIONS - The results of this paper show that the use of shadow is necessary even in warm climate conditions.

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