ESTRUS BEHAVIOR IN GUZERA (*Bos taurus indicus*) BREED COWS

Comportamento estral de vacas da raça Guzerá (*Bos taurus indicus*)

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ABSTRACT

The estrus behavior was evaluated during an induced and natural subsequent estrus in twelve Guzera breed cows, in the winter and summer seasons in two consecutive years. The proportion of cows that responded to estrus synchronization was 84.8%. The effect of the interaction season x year of experiment on estrous cycle length was observed. Pro-estrus was longer in the summer (57.69±4.72h) and in the natural estrus (74.23±4.41h) than in the winter (38.95±4.02h) and in the induced estrus (22.40±4.36h). Estrus length was similar in the winter (11.48±0.70h) and in the summer seasons (13.40±0.82h) as well as among cows with induced (12.47±0.75h) and natural estrus (12.41±0.76h). The number of mounts accepted during estrus and the number of mounts accepted/ hour in estrus were similar in winter (29.17±2.86 and 2.59±0.22, respectively) and summer (31.45±3.36 and 2.42±0.26, respectively) as well as between induced (30.23±3.10 and 2.54±0.24, respectively) and natural estrus (30.40±3.14 and 2.47±0.24, respectively). The length and intensity of estrus were not influenced by synchronization or season of the year. Longer period of pro-estrus in summer may favor the identification of sexually active animals in this season.

Index terms: Estrus synchronization, season of the year, zebu.

RESUMO

A manifestação do comportamento estral foi avaliada durante um estro induzido e o estro subseqüente, em 12 vacas da raça Guzerá, no inverno e no verão em dois anos consecutivos. A proporção de vacas que respondeu à sincronização de estros foi de 84,8%. Observou-se efeito de interação entre estação e ano sobre a duração do ciclo estral. O proestro foi maior no verão (57,69±4,72h) e no estro natural (74,23±4,41h), que no inverno (38,95±4,02h) e no estro induzido (22,40±4,36h). A duração do estro foi similar no inverno (11,48±0,70h) e no verão (13,40±0,82h), assim como entre as vacas com estro induzido (12,47±0,75h) e natural (12,41±0,76h). O número de montas recebidas durante o estro e o número de montas recebidas/hora em estro foram similares no inverno (29,17±2,86 e 2,59±0,22, respectivamente) e no verão (31,45±3,36 e 2,42±0,26, respectivamente), assim como entre o estro induzido (30,23±3,10 e 2,54±0,24, respectivamente) e o natural (30,40±3,14 e 2,47±0,24, respectivamente). A duração e a intensidade do estro não foram influenciadas pela sincronização ou pela estação do ano. O maior período de proestro no verão pode favorecer a identificação dos animais sexualmente ativos.

Termos para indexação: Sincronização de estros, estação do ano, zebu.

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INTRODUCTION

A high percentage of reproductive programs in tropical countries depends on natural mount. However, a growing interest in the use of artificial insemination (AI) has been observed in the last decades. The success of this technology depends on several factors, with estrus detection being one of the most important. However, correct estrus detection is still one the obstacles to obtain high pregnancy rates and is, many times, cited as the most common and expensive flaw in AI programs. Factors such as frequency, length, observation time (ORIHUELA et al., 1983) and number of cows simultaneously in estrus (LAMOTHE et al., 1995) may influence the efficiency of estrus detection programs.

Sexual behavior peculiarities of Zebu breed animals, such as short length of pro-estrus (MATTONI et al., 1988) and reduced mounting activity (GALINA et al., 1982) can lead to errors in estrus detection. Differences in estrus intensity between *Bos taurus taurus* and *Bos taurus indicus*

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were reported by Galina et al. (1982), with the higher number of mounts/h during estrus being observed in the Charolais animals, as compared to the Brahman breed (2.8 *vs* 1.6 mounts, respectively). Estrus length was 6.7 h in Brahman cows (PLASSE et al., 1970), 14.0 h in Zebu type cows (SOLANO et al., 1982) and 14.4 h in Gir cows (VIANA et al., 1999).

Estrus manifestation may be influenced by season. Zakari et al. (1981) observed that estrous behavior increased during the hottest months of the year and Galina et al. (1995) suggested that winter could limit the expression of estrus in Zebu type animals. The length of the estrous cycle also seems to be influenced by season. Plasse et al. (1970) observed a high occurrence of long estrous cycles and silent ovulations during the winter and Zakari et al. (1981) verified the occurrence of longer estrous cycles in the pre-raining season than in the raining season, in Zebu type cows.

Studies on estrus behavior in Zebu type animals can be made easier by estrus synchronization, since this management allows the observation of a large number of cows in estrus, within a short period. However, evidence suggests that the pharmacological agents utilized in synchronization can alter some animal behavior characteristics, such as estrus length (PINHEIRO et al., 1998) and intensity (ORIHUELA et al., 1983).

The objectives of this study were to evaluate the effects of winter and summer seasons on the characteristics of the estrous cycle, pro-estrus and estrus of Guzera breed cows with natural or induced estrus.

MATERIALAND METHODS

The experiment was carried out at the Santa Mônica Experimental Station, owned by EMBRAPA-Dairy Cattle, Valença, Rio de Janeiro, Brazil, during the winter and summer of two consecutive years. Weather variables observed during the experimental periods are shown in Table 1.

Twelve Guzera breed cows with average age of 8.3 years and average weight of 483.2 kg, non-lactating, were individually identified with fitted labels to their backs, kept in 0.5 hectare feeding lot and fed twice a day, with water and mineral salt supplied *ad libitum*. The animals were transferred to the site of the experiment 30 days before the beginning of the experimental period to allow socialization and adaptation. The same animals were evaluated in induced and subsequent natural estrus during a single experimental period; however, the animals were not the same in all periods.

Estrus synchronization consisted of two intra-muscular applications of 500 µg of synthetic prostaglandin[7] at 11-day interval. Approximately 24h (summer-year 2) or 48h (winter and summer-year 1, winter-year 2) after the second application, the animals were continually observed for 24h during three (winter-year 2), four (winter and summer-year 1) or five (summer–year 2) consecutive days. A work team was formed taking turns every three hours during the observation periods.

[7] Ciosin® - Coopers

Table 1 – Meteorological data mean of the experimental periods.

Month	Year	Average temperature (ºC)	Average maximum temperature (ºC)	Average minimum temperature (ºC)	Rainfall (mm)	Relative air humidity (%)
June	Year 1	16.6	23.9	9.0	6.4	78.0
July	Year 1	17.5	25.8	10.3	0	77.0
August	Year 1	22.9	29.2	14.0	18.0	74.0
November	Year 1	21.8	28.2	15.0	138.7	78.5
December	Year 1	24.4	30.4	18.5	239.2	77.0
January	Year 1	25.2	31.2	19.1	314.4	78.0
June	Year 2	18.5	24.8	12.1	23.6	79.7
July	Year 2	18.5	25.1	11.5	11.9	75.0
August	Year 2	18.7	27.0	11.3	2.4	70.0
January	Year 2	24.5	30.5	17.4	184.1	75.0
February	Year 2	24.1	30.4	16.1	111.1	76.0
March	Year 2	25.5	29.7	17.1	144.1	78.0

Source: Agroclimatological Station - Santa Mônica Experimental Station, 6th District of Meteorology of Rio de Janeiro, National Meteorology Institute.

Representative estrus behaviors (mounting, attempting to mount, butting, chin resting on the rump, sniffing and, or licking the vulva, licking the flank or the face and displaying Flehmen reflex) were registered along with the identification of the instigating (performer of the action) and target (receiver of the action) cows, and the time the action occurred. The animals were considered to be in pro-estrus when they started to show interest in mounting, butting and following other animals. The start and end of estrus were established based on the acceptance of the first and last mount, respectively (VALLE et al., 1994). Mounts were considered to be real and hence, indicative of estrus behavior, when the animal stood immobile when mounted. Due to the risk of subjective interpretations of behavior, the first mount was considered to be one out of a sequence of mounts (provided the interval between the first mount and the subsequent mount was less than 90 min). Estrus intensity was determined according to Voh et al. (1987).

The criteria adopted for the determination of natural estrus were the same used for synchronized estrus. The observations related to natural estrus behavior were conducted during six days (winter-year 1), seven days (winter-year 2) or eight days (summer-years 1 and 2), starting from the 19th day (summer-year 2), 20th day (summer-year 1 and winter-year 2) or 21st day (winter-year 1), after the second application of prostaglandin.

Data on lenght of estrous cycle (n=24), pro-estrus (n=55) and estrus (n=55), number of mounts per estrus (n=55) and number of mounts per hour in estrus (n=55) were analyzed by GLM of SAS Institute (1999) procedure. Before the variance analyses were performed, data were evaluated to check normality, by using the SAS univariate procedure (SAS INSTITUTE, 1999). The linear model utilized included season, luteolysis type, year of experiment and all the interactions of the factors. For multiple comparisons among the averages of the variation sources the t test was used at 5% probability, based on the SAS-PDIFF (SAS INSTITUTE, 1999).

RESULTS AND DISCUSSION

After the second application of prostaglandin, 84.8% of the cows were found in estrus, with this percentage being similar during the winter and the summer (88.2% and 81.2%, respectively). In non-synchronized animals, estrus manifestation was 88.2% and 75.0% in winter and summer, respectively. Synchronized estrus response was similar to that reported by Hardin et al. (1980), 83% and lower than that observed by Kabuga et al. (1992), 93%, in Zebu type cows. The absence of estrus manifestation in some cows can be attributed to the ideal timing for application of the luteolytic agent. Prostaglandin is not effective during the first five days of the estrous cycle and can cause partial luteolysis with subsequent recovery of the corpus luteum function when administered before the 10th day (WRIGHT & MALMO, 1992). In the estrus synchronization scheme with two prostaglandin applications at 11-day interval, the animals that responded to the first application were found to be between day 6 and day 9 of the cycle on the day of the second application (ODDE, 1990), a stage in which a luteal regression failure may occur.

The estrous cycle length after synchronization was similar ($P>0.05$) in both seasons (21.06±0.28 and 21.48±0.34h in the winter and summer, respectively) and experimental years (21.24±0.36 and 21.30±0.26h in the first and second years, respectively); however, interaction of the factors was observed ($P<0.05$). The estrous cycle length in the winter of the first year (20.45±0.42h) was smaller ($P<0.05$) than the that observed in the winter of the second year (21.67±0.38h) and in the summer of the first year (22.03±0.59h). The estrous cycle length observed in this study was similar to that related for the Zebu type cattle (REKWOT et al., 2000) and European breeds (HURNIK & KING, 1987). In relation to the seasonal effect, some studies reported longer cycles in winter (PLASSE et al., 1970) and in the dry season (ZAKARI et al., 1981), while others observed longer cycles in the raining season (LAMOTHE-ZAVALETA et al., 1991).

In this study, 100% of the cows presented defined periods of pro-estrus, suggesting that pro-estrus behavior, contrary to that reported by Allrich (1993), can be observed in Zebu cattle. The pro-estrus period was influenced by season and luteolysis type ($P<0.05$); however, no interaction ($P>0.05$) was observed. The pro-estrus period in summer and in non-synchronized animals was higher ($P<0.05$) than that observed in winter and in cows submitted to synchronization (Table 2).

Longer pro-estrus periods in the raining season, as compared to the dry one, were also observed by Lamothe et al. (1995) and Lamothe-Zavaleta et al. (1991), however, the reasons for this are not clear. The shorter pro-estrus period in synchronized animals was possibly due to a higher number of cows exhibiting sexual behavior simultaneously, which stimulated estrus behavior, making pro-estrus shorter. According to Kilgour et al. (1977), quoted by Orihuela (2000), the

participation of a higher number of cows in the sexually active group, after synchronization, favored social interaction and the manifestation of estrus behavior, making pro-estrus shorter. Conversely, the difficulty to encounter other animal ready to interact in mounting activities during natural estrus contributed to a longer pro-estrus period in non-synchronized animals. It is possible that cows in pro-estrus manifest estrus behavior in the presence of a sexually active group (ORIHUELA et al., 1983), which are smaller and less frequent in natural estrus (LANDAETA-HERNÁNDEZ et al., 2002).

In this study, no difference was observed between induced and natural estrus length (P>0.05, Table 3). Similar observation was related by Valle et al. (1994) in Nelore cows. However, Landaeta-Hernandez et al. (2002) verified that the length of estrus induced by prostaglandin and the subsequent natural estrus in Brahman cows was 17h and 6h, respectively. The length of synchronized estrus in Guzera cows (12.47±0.75 h) was similar to that observed in cows of *Bos taurus indicus* genotype, synchronized by prostaglandin**,** and continuously observed for estrus detection without teaser bull (GALINA et al., 1982) or with teaser bull (PINHEIRO et al., 1998). Spontaneous estrus length (12.41±0.76 h) differed from that observed in Brahman cows (6.7 h), in which estrus detection was conducted twice a day with vasectomized bulls (PLASSE et al., 1970) and was similar to that observed in Nelore cows (10.7 h), submitted to continuous visual observation of estrus associated to the use of penis-deviated bulls (VALLE et al., 1994).

No difference in the estrus length between seasons (P>0.05, Table 3) suggests that the weather conditions during the experimental periods (Table 1) did not cause heat stress in the animals, or that was not sufficient to interfere in the estrus behavior. Lamothe-Zavaleta et al. (1991) and Landaeta-Hernandez et al. (2002) observed a negative effect of high ambient temperature on the estrus length of Zebu type cows. However, the literature results are controversial, since some authors verified longer estrus in the dry season (MATTONI et al., 1988), others in the raining season (VOH et al., 1987; ZAKARI et al., 1981) or did not verify difference between seasons (LAMOTHE et al., 1995).

Although it was suggested that the estrus length is shorter in *Bos taurus indicus* than in *Bos taurus taurus* (RANDEL, 1994), the average estrus length in Guzera cows, in this study, was similar to that observed in Holstein cows by Solano et al. (1982), 14.2 h, Walker et al. (1996), 9.6 h, and Vliet & Eerdenburg (1996), 13.7 h.

During estrus, it was observed that the cows accepted a minimum of three and a maximum of 64 mounts. Wide variation in the number of mounts received during estrus was also reported by Mattoni et al. (1988) and Voh et al. (1987) in Zebu type cows. The total number of mounts accepted during estrus and the number of mounts accepted per hour in estrus did not differ between seasons (P>0.05) and among cows with induced or natural estrus (P>0.05), with no interaction being observed (Table 4 and 5).

Table 2 – Pro-estrus mean (hours) of Guzera cows with natural or induced estrus, during winter and summer.

Season of the year	Pro-estrus length (h)		
	Induced estrus	Natural estrus	Average
Winter	13.14 ± 5.69^{bB}	64.75 ± 5.69^{aB}	38.95 ± 4.02^{B}
Summer	31.67 ± 6.61^{bA}	83.20 ± 6.73^{aA}	57.69 ± 4.72^{A}
Average	22.40 ± 4.36^{b}	74.23 ± 4.41^{a}	

^{A,B,a,b} Values followed by different small letters in the same row or capital letters in the same column differs (P<0.05).

Table 3 – Induced and natural estrus length mean (hours) of Guzera cows in the winter and in the summer

Season of the year	Estrus length (h)		
	Induced	Natural	Average
Winter	11.32±0.98	11.64±0.98	11.48±0.70
Summer	13.62±1.14	13.18±1.17	13.40±0.82
Average	12.47±0.75	12.41±0.76	

Table 4 – Total mounts number mean received during induced or natural estrus of Guzera cows in the winter and in the summer

Season of the year	Total mounts number		
	Induced estrus	Natural estrus	Average
Winter	27.61±4.05	30.74±4.05	29.17±2.86
Summer	30.85±4.70	30.06±4.79	31.45±3.36
Average	30.23±3.10	30.40±3.14	

Table 5 – Total number mounts mean received per hour during induced or natural estrus of Guzera cows in the winter and in the summer

Season of the year	Total number mounts/hour		
	Induced estrus	Natural estrus	Average
Winter	2.53±0.31	2.65±0.31	2.59±0.22
Summer	2.55±0.37	2.28±0.37	2.42±0.26
Average	2.54±0.24	2.47±0.24	

In natural estrus, the number of mounts received (30.40±3.14) was higher than that verified by Mattoni et al. (1988) in Zebu type cows that stayed with vasectomised bulls (9.2 mounts), and similar to that reported by Lamothe-Zavaleta et al. (1991) in the presence of penis-deviated bulls (28.8 mounts). In induced estrus, the number of mounts (30.23±3.10) was smaller than that reported by Orihuela et al. (1988) in Indubrazil breed cows kept with the bull (51.2 mounts) and similar to that observed in the group in which the bull was absent (34.3 mounts). Smaller number of mounts were observed by Galina et al. (1982) in Brahman x Charolais cross cows (18.9 mounts) in the absence of bulls or teaser bulls. The lack of difference in the number of mounts between induced and natural estrus is not in agreement with previous studies that reported higher mounting activity in induced estrus (LANDAETA-HERNANDEZ et al., 2002; ORIHUELA et al., 1983), possibly due to the formation of sexually active groups, favoring interaction between cows (GALINA et al., 1996).

In relation to the seasonal effect on estrus intensity, the results of this experiment are similar to those of Lamothe et al. (1995) that not report difference in the number of mounts received during estrus in dry and raining seasons in Zebu type cows. However, Voh et al. (1987) observed effect of the season on the mounting activity in *Bos taurus indicus* animals and Landaeta-Hernández et al. (2002) verified that there was a reduction in the number of mounts of Brahman cows with increased temperature-humidity index.

The number of mounts/h during estrus, in this study, was similar to that verified by Galina et al. (1982) in Charolais cows (2.8 mounts/h) in the absence of bulls or teaser bulls. The average number of mounts/h during estrus, in this experiment, was always superior to 2.2 mounts, thus it is unlikely that behavioral mounting is a limiting factor to estrus identification in Guzera breed cows.

CONCLUSIONS

Estrus length and intensity were not influenced by synchronization or season of the year.

The longer pro-estrus period in summer could favor the identification of sexually active animals in this season.

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