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SEASONAL VARIATIONS IN CHARACTERISTICS OF ESTROUS CYCLES IN BRAHMAN HEIFERS

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SUMMARY

A group of estrous cycling Brahman heifers (n=16) was monitored from October of one year through March of the next year to investigate seasonal changes in estrous cyclicity. The heifers were kept on pasture with sterile heat check bulls. Supplemental feed was provided to meet NRC requirements. Estrus occurrence was checked daily and a blood sample was collected from each heifer between 7 and 14 days after estrus. A high proportion of the heifers had abnormalities of the estrous cycle during the winter such as estrus without formation of a functional corpus luteum (ENC) or anestrus. Heifers that had ENC or anestrus had low serum progesterone concentrations. The highest incidence of anestrus occurred during the months with the shortest daylengths (December and January). Transitional periods were found before (November) and after (February) the months with the greatest amounts of anestrus. During the transitional periods, the frequency of ENC increased. Serum progesterone concentrations were lower during estrous cycles occurring in the winter months. Brahman heifers exhibited irregularities of the estrous cycle beginning in November and lasting through February which would decrease fertility during these winter months.

INTRODUCTION

Although the bovine has not been considered to be a seasonal breeder, numerous reports have described seasonal variations in reproductive traits of cattle. It has been reported that conception rates in Zebu cattle in a tropical climate differed between dry and rainy seasons and were also affected by increasing daylength. Others have found significant differences in the number of anovulatory estrous cycles (higher incidence in summer than in winter months) and in silent ovulations (occurred less frequently during the summer than during winter) due to season.

Ovarian function has also been shown to be modified by season. A lower percentage of Brahman heifers developed a corpus luteum during late fall to early winter than during late summer. Corpus luteum weight and luteal concentration of progesterone were higher during summer than during winter months in Brahman and Hereford x Holstein heifers.

An experiment was designed with the following objectives: 1) to study the seasonal variations of estrous activity and estrous cycle characteristics in estrous cycling Brahman heifers; and 2) to analyze the effect of season on serum progesterone concentrations during the luteal phase in estrous cycling Brahman heifers.

PROCEDURES

A group of 16 estrous cycling Brahman heifers was selected for study from October 1, 1987 through March 31, 1988 at the Texas Agricultural Experiment Station at Overton. Mean age of the heifers was 16.7 ± 0.5 months at the initiation of the experiment. During the experimental period, the heifers grazed on pasture and received a fixed amount of supplemental ration as well as Coastal bermudagrass hay and mineral supplement which were provided free choice. The heifers were kept on pasture with sterile heat check bulls and were checked once daily for estrus. The following meteorological data were recorded: daylength and daily maximum and minimum temperatures.

Blood samples were taken once from each heifer between day 7 and 14 after each estrus. Between January 11 and February 5, blood samples were obtained biweekly from a group of 7 heifers that had not shown signs of estrus for at least 30 days before January 10.

RESULTS

A high proportion of the Brahman heifers (88%) exhibited abnormalities such as estrus without formation of a functional corpus luteum, anestrus or both during the experimental period. Thereafter, different percentages of estrous cycle abnormalities were detected between months. The occurrences of estrus without formation of a functional corpus luteum (CL) and anestrus by month were: November, 38% and 25%; December, 0% and 50%; January, 0% and 50%; February, 18% and 31%; March, 0% and 7%, respectively (Figure 1). These results confirm previous studies showing seasonal variations in estrous activity and in the occurrence of abnormal estrous cycles in Brahman cattle. Brahman heifers began exhibiting anestrus in November. The number of anestrous animals reached a peak during December and January, declined in February and became minimal in March. A transitional period seemed to occur during November and February, before and after the months with the highest expression of anestrus. In those transitional months, a higher frequency of estrus without formation of a functional

corpus luteum was detected. Curiously, this abnormality of estrous cycles preceded and followed the months with the highest percentages of anestrus. It is possible that this reflects some transitional state, where the inhibitory mechanisms on the estrous cycle are still not completely active or have not been overcome so that estrus without formation of functional corpus luteum represents an incomplete inhibition.

Serum progesterone concentrations also were affected by month ($P < 0.001$; Figure 2). Serum progesterone concentrations were lowest in November and with October and March having the highest. During months with decreased incidence of abnormal estrous cycles, the heifers showed increased mean serum progesterone concentrations. It could be possible that those environmental factors that were inducing the abnormal characteristics of the estrous cycle, also were exerting some detrimental effects on those heifers which were able to maintain normal estrous cyclicity. Therefore, the estrous cycling heifers may have been less susceptible to inhibition by the environment.

Six out of seven heifers had uniformly low serum progesterone concentrations during the twice weekly blood sampling period (Table 1). This would mean that they did not have any ovarian activity and were therefore truly anestrus heifers. The remaining heifer exhibited a silent estrus which produced a short luteal period, followed by a normal estrus with formation of a corpus luteum. Evidently, silent estrus occurred in our study; however, we are not able to speculate about how prevalent it was.

The heifers that had shown anestrus at some point during the experimental period had lower mean serum progesterone concentrations after estrus than did those that had regular estrous cycles. Apparently, the anestrous heifers were sensitive to the environment during most of our experimental period. It is also possible that these animals normally had a lower progesterone profile, characterizing a group that would be more susceptible to environmental factors, such as low temperature and short daylength.

The average monthly daylengths were: 11.37, 10.48, 10.07, 10.30, 11.07 and 11.98 hours for October, November, December, January, February and March, respectively (Figure 3). The average monthly maximum and minimum temperatures were: October, 26.0 and 7.8°C; November, 20.7 and 5.4°C; December, 16.4 and 1.6°C; January, 14.3 and 0.4°C; February, 16.1 and 2.1°C; March, 20.8 and 6.5°C (Figure 3). December and January, the months with the shortest daylengths and the lowest temperatures, had the highest incidence of anestrus (50%). The occurrence of

anestrus was negatively influenced by the average monthly maximum and minimum temperatures as well as daylength.

The increased occurrence of anestrus and estrus without formation of a functional corpus luteum could be related to the reduction of daylength (photoperiod). Photoperiod has been shown to affect reproduction in several species. Our study would suggest that, in the case of Brahman cattle, shorter photoperiods produce an inhibitory effect on estrous cyclicity. Cold temperatures during the winter months also could negatively affect estrous activity. Our study showed that when maximum and minimum temperatures were lowest, the number of heifers in anestrus was highest.

From the information presented above, we conclude that most Brahman heifers respond negatively to the shorter photoperiod and cold temperatures found during the winter months with respect to reproductive parameters. This response is reflected in an increased occurrence of anestrus and estrus without formation of a functional corpus luteum, as well as variations in serum progesterone concentrations. These abnormalities in estrous cycles indicate that fertility of Brahman heifers is lower during the winter months.

TABLE 1: SERUM PROGESTERONE CONCENTRATIONS OF ANESTROUS HEIFERS BLED TWICE WEEKLY DURING THE PERIOD 1/11/89 TO 02/05/89.

	Serum progesterone concentrations (ng/ml) by month and day of sampling							
Heifer ID	1-11	1-15	1-18	1-22	1-25	1-29	2-1	2-5
6004	0.49	0.38	0.01	0.14	0.14	0.07	0.14	0.89
6018	0.19	0.01	0.12	0.01	0.10	0.06	0.10	0.26
6021	0.08	0.02	0.07	0.12	0.07	0.09	0.09	0.42
6051	0.09	0.21	0.07	0.11	0.06	0.05	0.09	0.00
6072	0.22	0.26	0.01	0.01	0.26	0.12	0.22	0.19
6088	0.04	0.05	0.07	0.08	0.07	0.04	0.05	0.19
6091	0.12	0.46	0.30	0.19	2.00	0.17*	0.59	2.52

* Detected in estrus on 1/31.

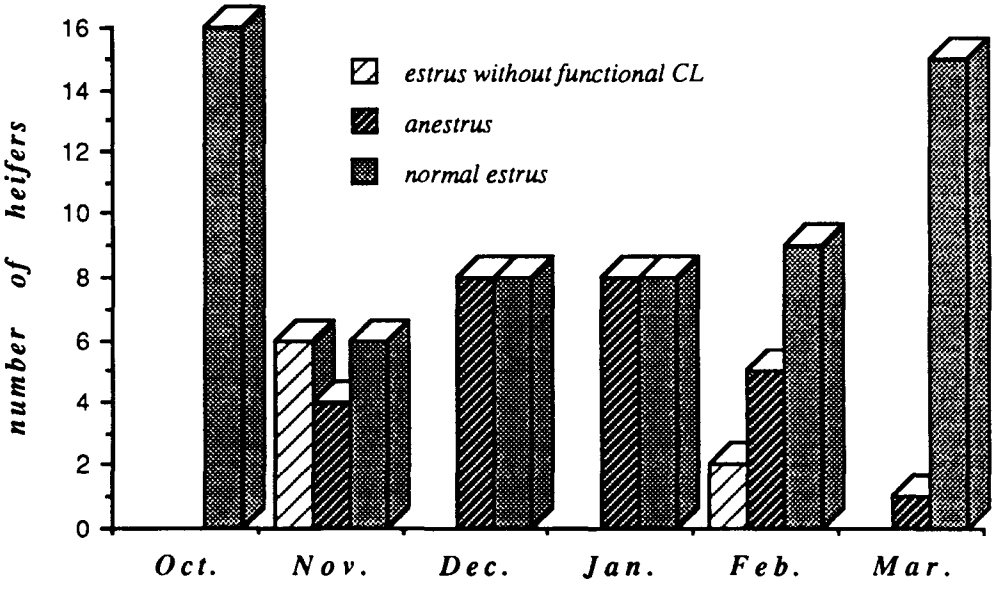

Figure 1: Distribution of the occurrence of normal estrus, estrus without formation of functional CL and anestrus by month.

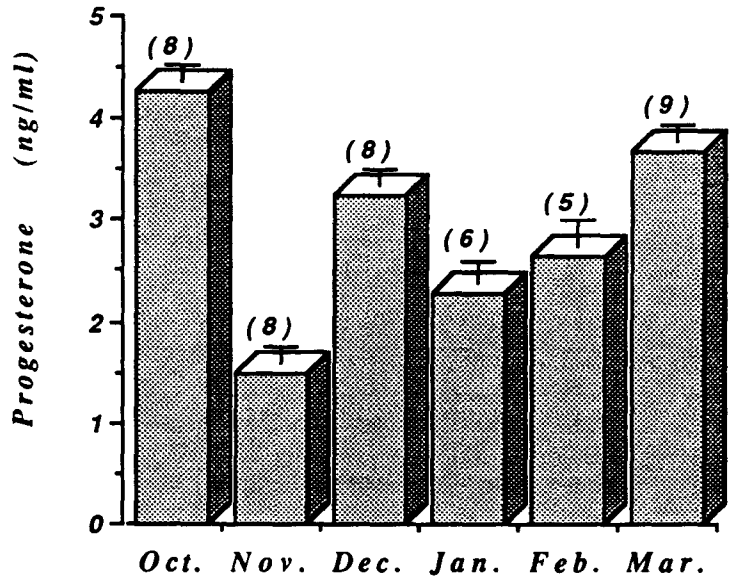

Figure 2: Mean serum progesterone concentrations by month (bars represent mean ± SE for number of heifers in parenthesis; differ $p<0.001$).

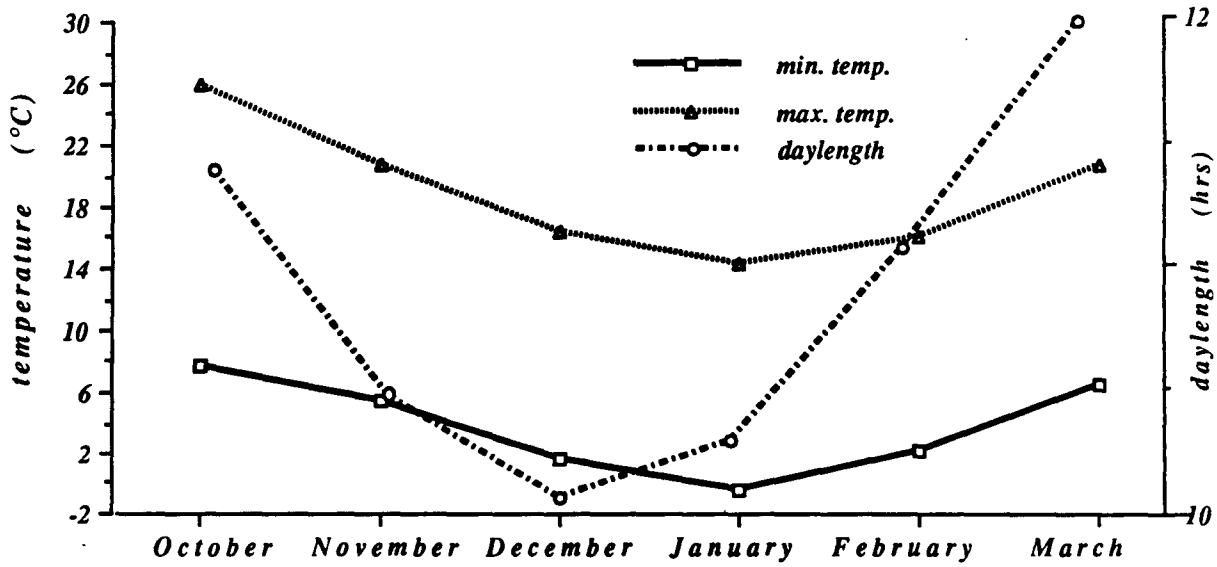

Figure 3: Mean monthly maximum and minimum temperatures and mean monthly daylength for the experimental period.