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Estrous Behavior and Time of Ovulation in Beef Cows During the Summer

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Story in Brief

Seventeen Angus x Hereford cows were used to evaluate the time of ovulation relative to the onset of behavioral estrus during August and September. Average daily maximum ambient temperature during the experiment was 88° F. HeatWatch[®] 6 (an electronic sensor which records each time a cow is mounted) was utilized to determine duration of estrus, number of mounts, and longest interval between two mounts. Commencing 16 h after onset of estrus, ovaries were evaluated by transrectal ultrasonography every 4 h to determine time of ovulation. All cows detected in estrus by HeatWatch[®] ovulated an average 32.0 ± 4.7 h (mean ± SD) after the onset of estrus. Time from end of estrus to ovulation was 20.6 ± 6.4 h and duration of estrus averaged 10.8 ± 5.6 h. Cows were mounted 22.9 ± 15.3 times during estrus and periods of inactivity were observed between mounts that ranged from 0.5 h to 8.2 h (average = 4.0 ± 2.4 h). Time of ovulation relative to the onset of estrus was not related to the duration of estrus. Visual observation conducted twice daily for 30 min at 0700 and 1900 identified 13 of 17 cows that were detected in estrus by HeatWatch[®]. The interval from the onset of estrus to ovulation in beef cows exposed to elevated ambient temperatures is variable and averaged 32 h.

(Key Words: Beef Cow, HeatWatch, Estrus, Ovulation.)

Introduction

Only about 6% of the beef cows in the U.S. are artificially inseminated. Limited use of genetically superior sires with A.I. occurs because cows often graze large pastures making it difficult to detect when cows are in estrus. Sperm are usually fertile for 24 to 30 h after insemination and ova have a fertile life of 8 to 10 h. Estrous behavior (cows standing to be mounted by other animals) is the only external sign as to when ovulation may occur and when cows should be artificially inseminated.

Studies with dairy cows indicate that parity and environmental temperature may influence the interval from the onset of estrus to ovulation. However, the effects of extreme ambient temperatures on the relationship between estrus and ovulation have not been evaluated in beef cows.

The HeatWatch[®] system can be used to continuously monitor estrous behavior. The system is composed of a pressure sensing transmitter that is secured in a cloth patch to the tail head of a cow, a signal receiver, a receiver that stores mounting activity and computer software that sorts data by cow, time of estrus, duration of estrus, and number of mounts. When dairy cows were observed twice daily for estrus by technicians, only 61% of the cows detected in estrus by HeatWatch[®] were identified and only 3% of the cows detected visually were not identified by HeatWatch[®] (Nebel et al., 1995).

The objective of this experiment was to evaluate estrous behavior in beef cows during the summer in Oklahoma and to determine the time of ovulation relative to the onset of estrus.

Materials and Methods

Seventeen nonlactating Angus x Hereford cows were maintained in a 30 acre pasture during August and September. Estrus was synchronized with prostaglandin F_{2a}⁷ so one to three cows would be estrus per day. Blood samples were collected twice weekly during the next two estrous cycles to assess luteal activity and to verify that cows were exhibiting normal estrous cycles.

Cows were fitted with HeatWatch[®] sensors and the duration of estrus, number of mounts during estrus and the longest interval between mounts were recorded. Cows were observed twice daily at 0700 and 1900 for 30 min to detect estrus.

Time of ovulation was determined after the second estrus following synchronization. Commencing 16 h after the onset of estrus, ovaries were evaluated by ultrasonography every 4 h until ovulation and time of ovulation was recorded. During the period that ovulation was determined in late August and September, average daily maximum ambient temperatures ranged from 57 to 97° F and averaged 88° F.

Results and Discussion

All seventeen cows exhibited estrus based on HeatWatch[®] and normal cycles were confirmed by concentrations of progesterone in plasma. However, only 13 of the 17 cows were in standing estrus when observed for 30 min each morning and evening. Two of the cows that were not observed standing were active (mounting and being mounted but not standing) and the other two cows did not display any estrous behavior. Thus 24% of the cows would not have been inseminated based on visual observation.

The onset of estrus occurred throughout the day and night with an obvious lack of onset between 0900 and 1500 (Figure 1). This interval is usually associated with the warmest temperatures of the day.

Estrous activity of a cow that was estrus for 19 h is illustrated in Figure 2. The cow was mounted a total of 40 times during estrus and had a 5-h interval when she was quiescent and not mounted.

The duration of estrus ranged from 2 to 19 h and averaged 10.8 h (Table 1). The number of mounts during estrus averaged 22.9, however, one cow was only mounted four times. With only a 2-h estrus and four mounts, some cows are not detected in estrus by visual observation. The longest interval between mounts averaged 4 h. However, one cow had a quiescent period of 8.2 h between mounts. Currently we have not determined if long quiescent periods during estrus are related to chemical or behavior signals by the cow in estrus or the lack of another cow seeking estrous cows to mount.

The average interval from the onset of estrus to ovulation was 32.0 ± 4.7 h with a range of 22 to 43 h (Table 1). This is similar to the 28 to 32 h estimated for dairy cows by Trimberger in 1948. Nebel and McGillard (1995) determined that lactating Holstein cows ovulated 28 ± 5 h after the onset of estrus. The interval from the end of estrus to ovulation was 20.6 h and the variability of this relationship was similar to the variability in the interval from the onset of estrus to ovulation. The interval from the onset of estrus to ovulation was not related to the duration of estrus. For instance, the cow that was in estrus for only 2 h ovulated 29 h after the onset of estrus.

Ovulation occurred throughout the day and night. Ovaries were evaluated by ultrasonography every 4 h commencing at midnight. If an ovulatory follicle was present at one evaluation and absent at the next evaluation, the time of ovulation was considered to be midway between the two measurements (0200, 0600 etc.). Thus ovulations occurred at all possible times (Figure 3).

Frequent ultrasonography during and after estrus did not influence subsequent development of the corpus luteum. Concentrations of progesterone during the cycle after ultrasonography were similar to those during the previous cycle.

This study is continuing and estrous behavior and time of ovulation will be determined during the summer, winter and spring of 2 y. The HeatWatch[®] system is an effective method to determine estrous behavior in beef cows. Additional studies are needed to determine optimal time of insemination relative to the onset of estrus and ovulation to achieve maximal conception rates. We conclude from this first replication of the summer phase, that beef cows ovulate an average of 32 h after the onset of estrus and time of ovulation is not related to the duration of estrus.

Literature Cited

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Item	Range	Mean \pm SD
Duration of estrus, h	2 – 19	10.8 \pm 5.6
Number of mounts	4 – 52	22.9 \pm 15.3
Longest int. between mounts, h	.5 – 8.2	4.0 \pm 2.4
Onset of estrus to ovulation, h	22 – 43	32.0 \pm 4.7
End of estrus to ovulation, h	13 – 34	20.6 \pm 6.4

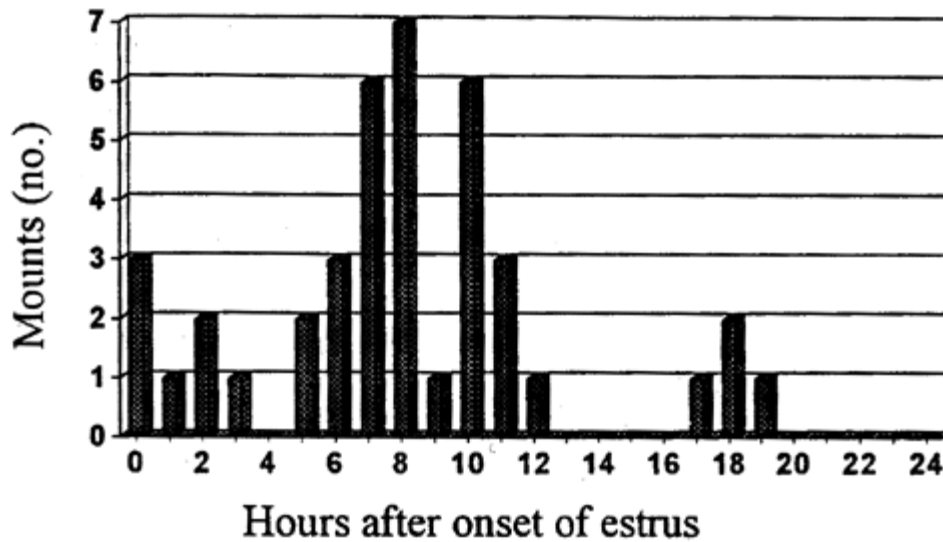


Figure 1. Frequency of mounts during estrus for a beef cow.

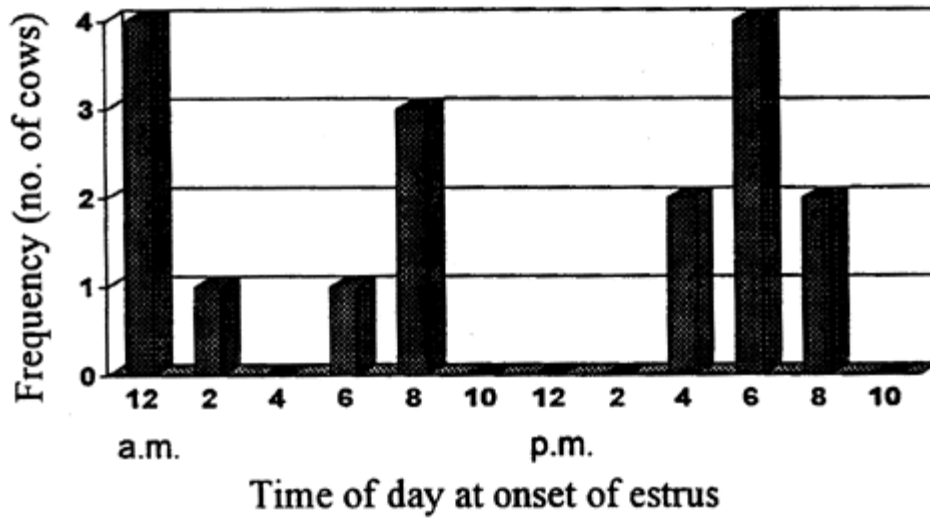


Figure 2. Distribution of time of day at the onset of estrus in beef cows.

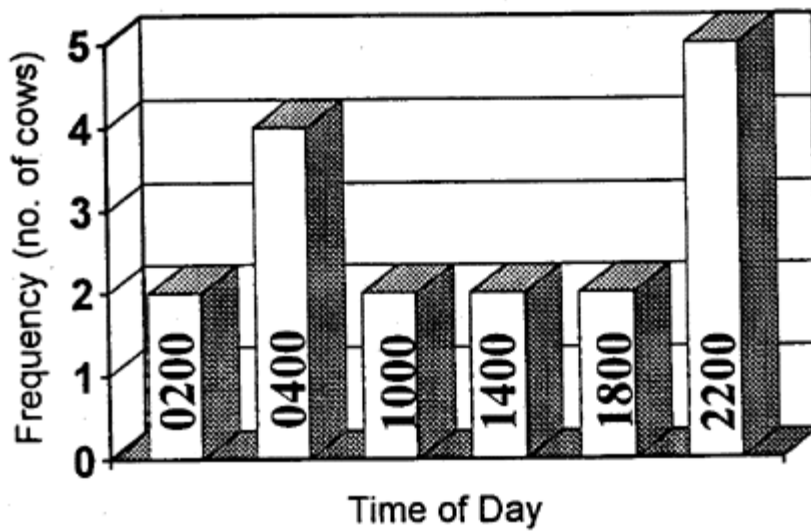


Figure 3. Distribution of time of ovulation in beef cows.