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Season Alters Estrous Behavior But Not Time of Ovulation in Beef Cows

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Story in Brief

Angus x Hereford cows were used to evaluate seasonal effects on estrous behavior and time of ovulation in the beef cow. The HeatWatch® system was used to observe estrous behavior for two consecutive estrous cycles in summer, winter, and spring seasons during two subsequent years. Estrous behavior was characterized by number of mounts, duration of estrus, and the longest interval between mounts. Transrectal ultrasonography was used to determine time of ovulation. Cows were mounted more times per estrus in winter than in summer or spring, and had longer periods of inactivity between mounts in summer when compared with winter and spring. During all seasons, more cows were mounted between 6:00 a.m. and noon than during other times of the day. Time of ovulation relative to the onset of estrus was not altered by season, and cows ovulated 31.1 ± .6 h after the onset of estrus. The onset of estrus is the best external sign to determine when to inseminate beef cows during all seasons.

Key Words: Beef Cow, Estrus, Ovulation, Artificial Insemination

Introduction

Twenty-one percent of beef operations are located in Texas and Oklahoma (Agricultural Statistics, 1999); however, only 8% of these operations and 6% of beef operations in the United States use artificial insemination (NAHMS, 1998). An increase in use of AI would allow more beef producers to use superior genetics and reduce the time interval for genetic change. Two major reasons for minimal use of AI by beef producers are time and labor (39%) and difficulty (20%), but only 3% of producers believe that AI does not work (NAHMS, 1998). Most of the current difficulties associated with AI in beef cows are due to an inability to detect estrous behavior and inseminate at the optimal time.

To achieve acceptable conception rates with AI, sperm must be deposited at the correct time relative to the time of ovulation. Estrous behavior is the best external sign as to when ovulation will occur. Greatest conception rates for AI in dairy cows occur with insemination at 4 to 12 h after the onset of standing estrus (Dransfield et al., 1998); this requires the accurate detection of the onset of estrus. Visual observation twice daily is the most common method used to identify estrous cows, but this method failed to detect estrus in 37% of beef heifers (Stevenson et al., 1996).

Dairy cows ovulate 27.6 ± .6 h after the onset of standing estrus (Walker et al., 1996), but time of ovulation in the beef cow has not been well defined. A better understanding of estrous behavior, ovulation, and factors which

alter their relation would allow producers to inseminate at the optimal time for maximal fertility, and ultimately allow more producers to benefit from AI.

Materials and Methods

Seasonal influences on estrous behavior and time of ovulation were evaluated in Angus x Hereford cows (n=18 to 21 each season/ year). Cows were managed each season in a 30 acre pasture with both natural and artificial shade. There were not any ponds in the pasture, and cows received water from a metal tank. Free choice hay and 20% range cubes were fed to maintain a body condition score (BCS 1=emaciated, 9=obese) of at least 5. Cows were synchronized with prostaglandin $F_{2\alpha}$1 before the first estrous cycle that was evaluated to ensure that only five or less cows were in estrus at one time. The HeatWatch® system was used to determine estrous behavior during two consecutive estrous cycles in summer (August, September), winter (December, January), and spring (April, May) seasons in subsequent years (yr 1 and 2). The HeatWatch® system is composed of a patch with a sensor that attaches to the tail head of a cow and sends a radio signal to a computer when a cow is mounted. This allows continuous monitoring of cows.

Estrous behavior was characterized by number of mounts, duration of estrus, and the longest interval between mounts. Onset of estrous behavior was defined as the first of three mounts within a 4-h time period, and end of estrus was identified as the last mount without a subsequent mount during the next 12 h. However, to ensure the last mount was actual estrous behavior, at least one mount had to occur within 3 h before the last mount. The first estrous cycle was used to quantify behavior, and the second cycle (non synchronized) was used to determine time of ovulation. Consecutive cycles were used to determine estrous behavior and time of ovulation because we were concerned that moving cows from the herd to evaluate the time of ovulation could alter estrous behavior. Progesterone was measured to determine that all estrous periods resulted in ovulation and normal luteal activity. Commencing 16 h after the onset of the second estrus, transrectal ultrasonography was performed every 4 h until ovulation, which was determined as 2 h before the dominant follicle was no longer present on the ovary. Data were analyzed by analyses of variance using the GLM procedure of SAS, and treatment means compared with the PDIFF statement of SAS.

Results and Discussion

Season and year altered average temperatures on the day of estrus (Table 1; $P<.01$). Average daily temperatures during the summer season were greater

in yr 2 (30.1°C) than yr 1 (25.2°C). The maximum daily temperature was greater than 41.7°C for 14 d during the summer of yr 2; however, the maximum temperature in yr 1 was less than 35°C throughout the season. Winter of yr 1 was milder than yr 2. There were 14 d during the winter of yr 2 when the minimum temperature was less than 0°C. During yr 1, there were only 5 d that the minimum temperature was less than 0°C.

Number of mounts received and longest interval between mounts were influenced by season (Table 2). Cows were mounted more times by herd mates in winter than in summer or spring ($P<.05$). Number of mounts was highly variable with individual cows receiving between 3 and 182 mounts per estrus. Cows were mounted more times in yr 1 than yr 2 (Table 3; $P<.05$). The milder summer and winter seasons in yr 1 could be responsible for the increased mounting activity. Length of estrus influenced the number of mounts a cow received. Cows that were in estrus longer than 15 h received 58.4 ± 4 mounts compared with 34.3 ± 4 mounts for cows in estrus less than 15 h ($P<.001$). More cows were mounted between 6:00 a.m. and noon (Figure 1, $P<.05$) than during the other 6-h periods of the day for all seasons.

Cows had longer intervals between mounts in summer than winter or spring (Table 2; $P<.05$). During the summer, intervals as long as 11 h between subsequent mounts were observed. Visual observation may be insufficient to identify cows that have long intervals between mounts or few mounts per estrus.

Duration of estrus was influenced by a season x year interaction (Figure 2; ($P<.05$). The length of estrus during the first summer season was significantly longer than during the winter season; however, during yr 2, summer was not different than winter. Also, duration of estrus was shorter in spring than winter in yr 2 but not during yr 1. The shortest estrus was .5 h and the longest was 36.3 h.

Season or year did not influence time of ovulation relative to the onset of estrus. Cows ovulated 31.1 ± .6 h after the onset of estrus. Dairy cows ovulate 27.6 ± .6 h after the onset of estrus (Walker et al., 1996). Genetics, social interaction, management, or experimental methods may explain the difference between time of ovulation in beef and dairy cows.

In conclusion, estrous behavior is highly variable and influenced by season of the year. Beef cows are mounted fewer times and have longer intervals between mounts during summer than winter seasons. More cows exhibit estrus between 6:00 a.m. and noon than during other times of the day. Some cows have an extremely short estrus (minimum of .5 h) with few mounts. Other cows have long intervals between mounts (maximum of 11 h). Beef cows ovulate 31.1 h after the onset of estrus, which is not

influenced by seasons.

Implications

Intensity of estrous detection should be increased during summer seasons. In order to maximize efficiency, estrous detection aids such as tail marking or KMAR® patches should be used to allow identification of cows with less intense estrus. Beef cows may ovulate later than dairy cows with respect to the onset of estrus; therefore, optimal time of insemination may also differ between dairy and beef cows.

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