Effects of Body Condition and Bovine Somatotropin on Estrus and Reproductive Performance of Postpartum Brahman-influenced Beef Cows[1]

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Story in Brief

Influence of body condition (BC) and bovine somatotropin (bST) on estrous characteristics and fertility were examined in postpartum Brahman-influenced cows. Cows (n = 99) were managed for low (BCS = 4.3 ± 0.1) or moderate (BCS = 6.1 ± 0.1) BC at parturition and treated with bST every 2 wk for 6 wk beginning 35 d prior to breeding (d 0) or no bST (control). Cows received a controlled internal drug-releasing (CIDR) device containing progesterone on d -7. On d 0, CIDR were removed, and cows received prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$). Estrous behavior was detected by radiotelemetry. Ultrasonography was performed on d 70 to determine pregnancy. First-service conception (56 vs. 26%) and pregnancy (30 vs. 12%) rates were increased ($P < 0.05$) in bST-treated vs. control cows during the first 3 d of the breeding season. During the first 30 d of the breeding season, first-service conception rate was greater ($P = 0.01$) for bST-moderate BC (67%) vs. control-moderate BC (21%) cows. Interval to conception was lower ($P = 0.04$) for bST-moderate BC vs. control-moderate BC cows. Cumulative 70-d breeding season pregnancy rate was lower ($P = 0.02$) for low BC (50%) vs. moderate BC (73%) cows. Percentage of cows detected in estrus was decreased ($P = 0.05$) for cows in low BC compared with moderate BC cows with cows in low BC having decreased ($P < 0.01$) intensity of estrus. Body condition may influence estrous behavior in postpartum Brahman-influenced cows, and bST may increase reproductive performance of thin, Brahman-influenced cows.

Introduction

Energy intake regulates ovarian function in beef cattle (Wettemann et al., 2003), and greater BCS at calving improves reproductive performance of beef cows (Lake et al., 2005). Growth hormone (GH) serves as an endocrine mediator of nutritional status on reproduction (Hess et al., 2005), and treatment with bovine somatotropin (bST) increases insulin-like growth factor-I (IGF-I) in beef cattle (Bilby et al., 1999). Nutritionally induced changes in GH and IGF-I may partially explain the infertility and anestrus in undernourished cattle (Chase et al., 1998). Nutrient restriction uncouples the positive relationship of the GH-IGF-I axis with increased concentrations of GH and reduced IGF-I (Butler et al., 2003); IGF-I may be involved in informing the reproductive axis of the nutritional status in cattle (Meikle et al., 2004). Effects of bST on reproductive performance of dairy cattle have been reported (Santos et al., 2004); however, less is known of the effects of body condition (BC) and bST on estrous characteristics and reproductive performance in beef cattle, especially Brahman-influenced cows. Objectives were to evaluate the effects of BC and bST on estrous characteristics and reproductive performance in postpartum Brahman-influenced cows.

Experimental Procedures

All cows were managed as described in a companion report (Flores et al., 2006). Spring-calving crossbred (1/4 to 3/8) multiparous Brahman-influenced cows were managed to achieve low or moderate BC at parturition. Cows grazed stockpiled and spring-growth, endophyte-infected tall fescue (*Festuca arundinacea* Schreb.) pastures to obtain desired BC at a stocking rate of either 1 cow/0.8 acres (low BC) or 1 cow/2 acres (moderate BC) for approximately 162 d prior to initiation of treatment. Mean BCS of low (n = 50; mean BW = 931.0 ± 34.8 lb) and moderate (n = 49; mean BW = 1,168.9 ± 35.3 lb) BC cows was 4.3 ± 0.1 and 6.1 ± 0.1 (1 = emaciated to 9 = obese), respectively.

Beginning 32 ± 2 d postpartum, cows within each BC were randomly assigned to treatment with or without bST in a 2 x 2 factorial arrangement. Control cows received no treatment, and treated cows were administered bST (500 mg, s.c.; Posilac, St. Louis, Mo.) on d -35, -21, and -7. On d -7, estrus was synchronized utilizing CIDR-$PGF_{2\alpha}$ as previously described (Flores et al., 2006). On d 0 (start of 70-d breeding season), all cows were fitted with a radiotelemetry (Heatwatch, HW; DDx Inc., Denver, Colo.) transmitter, and estrous activity was recorded during the first 30 d of the 70-d breeding season. Cows that lost their HW transmitter following initiation of estrus were removed from the statistical analyses for synchronization rate and estrous characteristics but were included in analyses determining the proportion of cows in estrus and interval to estrus after treatment. Cows were exposed to bulls (1 bull/21 cows) during a 70-d breeding season. Ultrasound (Aloka SSD 500 V ultrasound scanner equipped with a 7.5 MHz linear array transrectal transducer; Aloka Co. Ltd., Wallingford, Conn.) was performed on d 70 to determine pregnancy.

Synchronization rate was defined as the number of cows that exhibited behavioral estrus as detected by HW during the first 3 d of the breeding season following treatment, divided by the total number of cows in each group. First service conception rate was defined as the number of cows detected in estrus via HW that became pregnant, divided by the total number of cows with a HW-

[1] Names are necessary to report factually on available data; however, the USDA does not guarantee or warrant the standard of the product, and the use of the name by the USDA implies no approval of the product to the exclusion of others that may be suitable. This work was supported in part by USDA, Agricultural Research Service cooperative agreement #58-6227-8-040.

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detected estrus during the first 3 and 30 d of the breeding season. Date of first service conception was determined by subtracting 285 d from calf birthdate. Pregnancy rate was defined as the number of cows that became pregnant during the first 3 d and the entire 70-d breeding season divided by the total number of cows in each group.

Data were analyzed by ANOVA as a 2 x 2 factorial arrangement of treatments within a completely randomized design and cow being the experimental unit. The effect of treatment, BC, and the interaction on mean interval to estrus, duration of estrus, number of mounts received, quiescence between mounts, and interval to conception was analyzed with the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.). Categorical data were analyzed with the CATMOD procedure of SAS.

Results and Discussion

Percentage Detected in Estrus and Interval to Estrus. Treatment and (or) BC did not influence ($P > 0.10$) the percentage of cows detected in estrus during the first 3 d of the breeding season (Table 1). Cows in estrus during the first 3 d of the breeding season were assumed to be synchronized in response to CIDR-$PGF_{2\alpha}$ treatment. Synchronization rate averaged 51% (50/99). During the first 30 d of the breeding season, BC influenced ($P = 0.05$) the percentage of cows detected in estrus (Table 2). A greater percentage of moderate BC cows (82%) were detected in estrus during the first 30 d of the breeding season compared with low BC cows (64%). Interval to first detected estrus was not ($P > 0.10$) influenced by treatment and (or) BC and mean interval to first detected estrus was 7.0 ± 2.0 d.

Estrous Characteristics. Mean duration of estrus was not influenced by treatment and (or) BC ($P > 0.10$) and duration of estrus was 6.4 ± 1.2 h. However, cows in low BC had decreased ($P = 0.01$) mean number of mounts received (11.6 ± 4.1 vs. 22.0 ± 3.6) and increased ($P = 0.001$) mean quiescence between mounts (0.8 ± 0.1 vs. 0.4 ± 0.1 h) than moderate BC cows during estrus.

First-service Conception and Pregnancy Rates and Interval to Conception. First-service conception rate during the first 3 d of the breeding season was influenced ($P = 0.02$) by treatment (Table 1). Low (43%) and moderate (69%) BC cows treated with bST had greater first-service conception rates than low (40%) and moderate (15%) BC control cows. Similarly, pregnancy rate during the first 3 d of the breeding season was influenced ($P = 0.04$) by treatment (Table 1). Pregnancy rates were greater for moderate (36%) and low (24%) BC cows treated with bST than low (16%) or moderate (8%) BC control cows during the first 3 d of the breeding season. The improved fertility of low and moderate BC cows treated with bST may be attributed to enhanced follicular growth (Flores et al., 2006). Furthermore, concentrations of GH and IGF-I were increased in bST-treated cows, suggesting the GH:IGF-I axis was re-coupled in low BC cows treated with bST (Flores et al., 2006). An interaction ($P = 0.01$) between treatment and BC was detected for first-service conception rate during the first 30 d of the breeding season (Table 2). First-service conception rates were greater for bST-moderate BC cows (67%) compared with control-moderate BC cows (21%), with no differences among bST-low BC cows (38%) and control-low BC cows (38%). More ($P = 0.02$) cows in moderate BC became pregnant (73%) than cows in low BC (50%) during the breeding season. Interval to conception following CIDR-$PGF_{2\alpha}$ was influenced by a treatment x BC interaction ($P = 0.04$). Interval to conception was lower for bST-moderate BC (12.0 ± 3.1 d), control-low BC (16.8 ± 3.7 d), and bST-control (17.1 ± 4.0 d) cows, compared with moderate BC-control (25.9 ± 3.0 d) cows.

Implications

Body condition influenced estrous behavior in postpartum Brahman-influenced cows, and bST increased reproductive performance of thin, Brahman-influenced cows. Treatment of low and moderate BC Brahman-influenced cows with bST prior to initiation of the breeding season may aid in maintaining a yearly calving interval.

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Table 1. Influence of body condition (BC) and bovine somatotropin (bST) on synchronization rate, first-service conception rate, and pregnancy rate of Brahman-influenced cows during the first 3 d of the breeding season[1].

	Treatment						
	Control		bST		P value		
Variables	Low BC[2]	Moderate BC[3]	Low BC	Moderate BC	Trt[4]	BC	Trt x BC
No. of cows	25	24	25	25	-	-	-
Synchronization rate[5], %	40 (10/25)	54 (13/24)	56 (14/25)	52 (13/25)	0.31	0.29	0.13
First-service conception rate[5], %	40 (4/10)	15 (2/13)	43 (6/14)	69 (9/13)	0.02	0.33	0.16
Pregnancy rate[5], %	16 (4/25)	8 (2/24)	24 (6/25)	36 (9/25)	0.04	0.88	0.24

[1]Cows were treated with or without bST (500 mg s.q.) every 2 wk for 6 wk prior to the initiation of the breeding season.
[2]Low BC (BCS = 4.2 ± 0.1)
[3]Moderate BC (BCS = 6.1 ± 0.1)
[4]Trt = Control (no bST) vs. bST
[5]Number of observations in parentheses

Table 2. Influence of body condition (BC) and bovine somatotropin (bST) on the percentage of Brahman-influenced cows detected in estrus, cumulative first-service conception rate during the first 30 d of the breeding season, and cumulative 70-d breeding season pregnancy rate[1].

	Treatment						
	Control		bST		P value		
Variables	Low BC[2]	Moderate BC[3]	Low BC	Moderate BC	Trt[4]	BC	Trt x BC
No. of cows	25	24	25	25	-	-	-
Estrus[5], %	64 (16/25)	79 (19/24)	64 (16/25)	84 (21/25)	0.73	0.05	0.73
First-service conception rate[5], %	38 (6/16)	21 (4/19)	38 (6/16)	67 (14/21)	0.02	0.75	0.01
Pregnancy rate[5], %	48 (12/25)	79 (19/24)	52 (13/25)	68 (17/25)	0.63	0.02	0.39

[1]Cows were treated with or without bST (500 mg s.q.) every 2 wk for 6 wk prior to the initiation of the breeding season.
[2]Low BC (BCS = 4.2 ± 0.1)
[3]Moderate BC (BCS = 6.1 ± 0.1)
[4]Trt = Control (no bST) vs. bST
[5]Number of observations in parentheses