Effect of Supplementation during the Breeding Season on a May-calving Herd in the Nebraska Sandhills

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Summary with Implications

Females in their first and second breeding season received either a 32% crude protein (DM) supplement or no supplement throughout the breeding season. Supplementation did not affect heifer BW, BCS, and pregnancy rate at pregnancy diagnosis. Supplementation impacted primiparous cow BW and BCS at pregnancy diagnosis, but did not affect pregnancy rates. Calf birth weight and dystocia rates were unaffected by supplementation for both heifers and primiparous cow. Calves nursing supplemented dams were heavier at weaning. Greater supplementation may be needed to affect pregnancy rate.

Introduction

In the northern Great Plains, early summer calving herds better match forage quality to nutrient requirements than those calving in spring. Early lactation occurs when forage crude protein (CP) and digestible energy (DE) are greatest, thus providing abundant energy and requiring fewer harvested feed inputs. Research has shown similar pregnancy rates among mature cows in June vs. March (2001 Nebraska Beef Cattle Reports, pp 8–9); however, May-calving heifers exhibit a decreased pregnancy rate in a May vs March-calving system (70 vs. 89%, respectively; 2017 Nebraska Beef Report, pp 8–10). As forage matures into late summer, both CP and total digestible nutrient (TDN) content decline, which corresponds with the breeding season of a May-calving herd. Although this breeding season occurs during greater ambient temperature, it does not affect pregnancy rates in older beef females in the Nebraska Sandhills. It is more likely the inability of younger females to physically consume enough low-quality forage, leaving them deficient in key nutrients, that causes a reduction in pregnancy rates. Inadequate protein or energy after calving and during the breeding season extends the postpartum interval and decreases pregnancy rates. We hypothesized supplementation of CP during the breeding season would improve pregnancy rates in heifers and primiparous cows by helping to meet nutrient demands. Therefore, the objective of this study was to determine effects of supplementing May-calving heifers and primiparous cows during the breeding season on growth and reproductive response.

Procedure

Heifers

A 4-yr study conducted at Gudmundsen Sandhills Laboratory, Whitman, NE, utilized May-born, crossbred (5/8 Red Angus, 3/8 Simmental) replacement heifers (n = 257). Heifers were randomly assigned to receive either no supplement (NS) or offered 1 lb/d of a dried distillers grain-based supplement (SUP; 32% CP, DM) beginning 2 wk prior to and throughout a 45-d breeding season while grazing upland range. Supplement was delivered 3 times/wk on a pasture (88 ac.) basis.

Heifers were blocked by development treatment (Springman et al., 2017 Nebraska Beef Report, pp. 8–10) and assigned to breeding treatment. Preceding the breeding season, BW was recorded and blood samples collected at d-10 and d 0 of the breeding season. A heifer with plasma progesterone concentration of greater than 1 ng/ml at either collection was considered pubertal.

Approximately July 22, bulls were placed with heifers (1:20 bull to cow ratio) for 45 d. Heifers were synchronized using a single $PGF_{2\alpha}$ (Lutalyse, Zoetis, Parsippany, NJ) injection 5 d after bulls were introduced. After the supplementation period, heifers were managed as a single herd and continued grazing upland Sandhills range. Pregnancy was diagnosed via transrectal ultrasonography (Aloka, Hitachi Aloka Medical America Inc., Wallingford, CT) and BW and BCS measured in October, a minimum of 45 d following bull removal. Prepartum BW and BCS was measured 14 d prior to an expected calving date of May 2. The first day 2 or more heifers calved was considered the start of the calving season, and was used to calculate percent calved in the first 21 d. A calving ease (CE) score (1 = no assistance to 4 = caesarian section) was assigned at parturition, with a score of 2 or greater considered dystocia. Calf birth weight, sex, and birth date were also recorded. Heifers were removed from the herd for reproductive failure, calf death, or injury.

Primiparous Cows

In a continuation of the heifer phase, 2-yr-old primiparous cows not previously removed (n = 135) were utilized to evaluate supplementation effects during their second breeding season. Primiparous cows were randomly assigned to either NS (n = 67) or SUP (2 lb/d; 32% CP, DM; n = 68).

Primiparous cows were synchronized with a single $PGF_{2\alpha}$ injection 5 days after being placed with bulls at a 1:20 bull to heifer ratio for 45 d, beginning approximately August 5. Primiparous cows were managed as a single herd prior to and after the breeding season, and as separate herds (NS or SUP) throughout the breeding season. Throughout the year, primiparous cows were maintained on Sandhills upland range. Pregnancy diagnosis was conducted via transrectal ultrasonography at weaning in November, a minimum of 45 d following bull removal. Prepartum primiparous cow BW and BCS was measured prior to an expected calving date of May 15. Percent of cows calving in the first 21 d was calculated similar to heifers. A CE score was assigned at birth, similar to heifers. Primiparous cows were removed from the herd for reproductive failure, calf death or injury.

Table 1. Effect of supplementation during the breeding season on heifer ADG, BW, BCS, and pregnancy rate in a May calving herd

	Treatment[1]		SEM	P–Value[2]
	NS	SUP		TRT
n	128	129		
BW, lb				
Prebreeding	677	675	7	0.88
Pregnancy diagnosis	772	785	7	0.10
Precalving	864	862	9	0.81
BCS[3]				
Pregnancy diagnosis	5.8	5.8	0.03	0.54
Precalving	5.2	5.2	0.04	0.28
ADG, lb/d				
Prebreeding to pregnancy diagnosis	0.95	1.1	0.04	0.05
Pregnancy diagnosis to precalving	0.51	0.42	0.02	0.16
Pubertal[4], %	67	67	4	0.96
Pregnancy rate, %	68	72	4	0.51
Calved in first 21 days, %	71	82	5	0.12
Dystocia[5], %	14	10	5	0.55
Weaned[6], %	56	60	5	0.64

[1]Heifers grazing upland range were offered either no supplement (NS) or the equivalent of 1 lb/hd 29% CP, SUP) supplement delivered 3 times/wk on a pasture basis (88 ac.) from July 22 to September 5.
[2]TRT: Breeding season treatment main effect.
[3]Body condition score (1 = emaciated to 9 = obese)
[4]Considered pubertal if blood serum progesterone concentration > 1 ng/ml.
[5]Percentage of females with a calving ease score of 2 or greater (1 = no assistance to 4 = caesarian section).
[6]Percentage of calves weaned per cow exposed.

Statistical Analysis

Supplement was provided on a pasture basis for heifers and primiparous heifers, so pasture was considered the experimental unit and breeding season supplementation the treatment. Data were analyzed utilizing the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.) Development treatment was included as a covariate in the model statement when analyzing heifer data. Data were considered significant ($P \leq 0.05$) and a tendency ($0.05 < P \leq 0.10$)

Results

Heifers

Heifers had a similar initial BW in July at prebreeding ($P = 0.88$, 670 ± 4 lb; Table 1). Pubertal status prior to breeding was similar ($P = 0.96$) between treatment groups prior to initiation of the study. Despite supplementation during the breeding season, heifer BCS was similar ($P = 0.28$) at pregnancy diagnosis in October; however, there was a tendency ($P = 0.10$) for SUP heifers to have a greater BW. This increase in BW corresponds with a greater ADG from July to October ($P = 0.05$). Percent of pregnant heifers was similar ($P = 0.51$) between treatments despite supplementation.

Prior to calving, heifers did not differ in BW or BCS ($P \geq 0.28$). From October to May, overwinter ADG for heifers was similar ($P = 0.16$) regardless of previous breeding season treatment. Percentage of heifers calving in the first 21 d of the calving season, a measure of early conception, was also similar between treatments ($P = 0.12$). Dystocia rates were similar ($P = 0.55$) between treatments. The percentage of calves weaned per heifer exposed was similar between groups ($P = 0.64$).

Primiparous Cows

Primiparous cows had a similar initial prebreeding BW ($P = 0.73$, 853 ± 7 lb; Table 2). Following breeding season supplementation, primiparous dams had a greater BW and BCS ($P < 0.01$) at pregnancy diagnosis. Dams who were not supplemented experienced a decline in BW and BCS from July to October. It has been suggested the decline in BW and BCS, despite an increase in dry matter intake (DMI), is a byproduct of the primiparous cow's physical inability to consume enough low-quality forage during early lactation to meet the demands of growth and lactation. Pregnancy rates were not affected ($P = 0.41$) by breeding season treatment. The increase in BW for SUP dams at pregnancy diagnosis corresponds with a greater ADG ($P < 0.01$) throughout the breeding season.

Prior to calving, both groups of primiparous cows had similar BW ($P = 0.60$), due to the NS cow's greater overwinter ADG ($P < 0.01$). In contrast with pre-calving BW, SUP cows had a tendency ($P = 0.09$) to have a greater BCS, indicative of greater body reserves. Percentage of cows calving in the first 21 d was again similar ($P = 0.91$) between treatments. Dystocia rates for SUP and NS primiparous cows was similar ($P = 0.99$). The percentage of calves weaned per cow exposed was also similar ($P = 0.25$). From precalving to prebreeding, ADG was similar ($P = 0.18$) for previously supplemented primiparous cows.

Calf Performance

Calves born to previously supplemented heifers had similar birth BW ($P = 0.31$, Table 3). At prebreeding, calf BW was similar ($P = 0.95$) regardless of previous dam supplementation. Correspondingly, ADG from birth to prebreeding was similar ($P = 0.72$). At weaning, calves nursing SUP dams had a greater BW ($P < 0.01$) and gained 0.20 lb/d more ($P < 0.01$) throughout the breeding season than NS counterparts. The increase in first calf weaning weight and ADG, without adversely affecting dam BW or BCS, is likely due to calves consuming supplement directly, rather than nutrient partitioning by the dam.

Second calf birth BW was similar ($P = 0.17$, Table 3) by previous dam breeding season treatment. Additionally, second calf prebreed and weaning BW were similar ($P \geq 0.36$) among dam's prior treatment during the breeding season. Consistent with those responses, second calf ADG from birth to prebreeding and prebreeding to weaning did not differ ($P \geq 0.45$) between groups.

Table 2. Effect of supplementation during the breeding season on primiparous cow ADG, BW, BCS, and pregnancy rate in a May calving herd

	Treatment[1]		SEM	*P*–Value[2]
	NS	SUP		TRT
n	67	68		
BW, lb				
Prebreeding[3]	849	855	11	0.73
Pregnancy diagnosis	829	875	11	< 0.01
Precalving	948	957	13	0.60
Prebreeding[4]	983	1,010	15	0.19
BCS[5]				
Prebreeding[3]	5.3	5.3	0.05	0.89
Pregnancy diagnosis	5.0	5.3	0.06	< 0.01
Precalving	5.0	5.2	0.07	0.09
Prebreeding[4]	5.7	5.6	0.07	0.57
ADG, lb/d				
Precalving to prebreeding	0.02	0.04	0.04	0.81
Prebreeding to pregnancy diagnosis	-0.15	0.18	0.04	< 0.01
Pregnancy diagnosis to pre-calving	0.88	0.66	0.07	< 0.01
Precalving to prebreeding[6]	0.37	0.57	0.11	0.18
Pregnancy rate, %	75	81	6	0.41
Calved in first 21 days, %	84	83	6	0.91
Dystocia[7], %	0	0	31	0.99
Weaned[8], %	62	72	6	0.25

[1]Primiparous cows grazing upland range were offered either no supplement (NS) or the equivalent of 2 lb/hd (29% CP, SUP) supplement delivered 3 times/wk on a pasture basis (88 ac.) from August 5 to September 19.
[2]TRT: Breeding season treatment main effect.
[3]BW and BCS recorded preceding the breeding season as a primiparous cow.
[4]BW and BCS recorded preceding the breeding season as a 3-yr-old cow.
[5]Body condition score (1 = emaciated to 9 = obese).
[6]Precalving as a primiparous cow to prebreeding as a 3-yr old cow.
[7]Percentage of females with a calving ease score of 2 or greater (1 = no assistance to 4 = caesarian section)
[8]Percentage of calves weaned per cow exposed.

Table 3. Effects of breeding season treatment on calf BW and ADG in a May-calving herd

	Treatment[1]		SEM	*P*-Value[2]
	NS	SUP		TRT
First Calf[3]				
Birth weight, lb	64	64	0.9	0.31
Prebreeding weight, lb	209	209	7	0.95
Weaning weight, lb	366	390	7	< 0.01
Birth to prebreeding, lb/d	1.9	1.9	0.02	0.72
Prebreeding to weaning, lb/d	1.4	1.6	0.02	< 0.01
Second Calf[4]				
Birth weight, lb	79	75	1.5	0.17
Prebreeding weight, lb	205	212	7	0.36
Weaning weight, lb	408	419	13	0.47
Birth to prebreeding, lb/d	2.2	2.4	0.07	0.45
Prebreeding to weaning, lb/d	1.3	1.3	0.07	0.57

[1]Heifers and primiparous cows grazing upland range were offered either no supplement (NS) or a 29% CP supplement (SUP) delivered 3 times/wk on a pasture basis (88 ac.) for a 45-d breeding season. Heifers received 1 lb/hd supplement (beg. July 22), and primiparous cows received 2 lb/hd supplement (beg. August 5).
[2]TRT: Breeding season treatment as a primiparous cow main effect.
[3]Calf nursing NS or SUP primiparous cow.
[4]Calf nursing previously supplemented NS or SUP 3-yr-old cow.

Conclusions

Nutritional requirements for growing heifer calves (9% CP and 58% TDN, DM) are less than lactating primiparous cows (13% CP and 66% TDN, DM) based on the 2000 edition of Beef Cattle Nutrient Requirements. Despite an increase in CP availability, pregnancy rates were not improved in SUP females by supplementing bypass protein. Research conducted in the Nebraska Sandhills has indicated there may be a deficiency in degradable intake protein (DIP) for a May-calving herd. It is possible supplementation to meet DIP requirements may positively influence pregnancy rates. All groups of females were maintained at a BCS ≥ 5 throughout the year, which is sufficient for successful conception. Calves nursing supplemented dams had greater weaning BW likely due to direct consumption of supplement. A higher rate of supplementation and/or protein degradability may be needed to elicit a reproductive response.

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