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Beef Cattle Sciences

Impacts of Cow Nutritional Management During Gestation on Performance of the Offspring[1]

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Synopsis

Management to increase cow body condition score during gestation benefits weaning weight of the offspring.

Summary

This experiment evaluated the importance of cow nutritional status [body condition score (**BCS**) 4 or 6] and timing of nutritional intervention (increase BCS from 4 to 6) during gestation on productive parameters of the in utero offspring. Three hundred mature beef cows from the EOARC Burns were assigned to a fixed-time artificial insemination protocol using same from a single sire. Thirty days after AI, cows were evaluated for BCS and pregnancy status, and 100 pregnant cows were selected for the experiment. Within these 100 cows, 20 cows had BCS of approximately 6 and 80 cows had BCS of approximately 4. Cows were assigned to 5 nutritional managements: 1) cows with BCS 6 at pregnancy diagnosis were managed to maintain BCS 6 until calving (**PC**), 2) cows with BCS 4 at pregnancy diagnosis were managed to maintain BCS 4 until calving (**NC**), 3) cows with BCS 4 at pregnancy diagnosis were managed during the first trimester of gestation to achieve and maintain BCS 6 until calving (**T1**), 4) cows with BCS 4 at pregnancy diagnosis were managed during the second trimester of gestation to achieve and maintain BCS 6 until calving (**T2**), 5) cows with BCS 4 at pregnancy diagnosis were managed during the third trimester of gestation to achieve and maintain BCS 6 until calving (**T3**). During the first and second trimester of gestation, cows were maintained at the Northern Great Basin Experimental Range (NGBER, Riley, OR) grazing semiarid range pastures. During the third trimester of gestation and calving season, cows were maintained at the EOARC Burns, but returned to the NGBER after calving. During the calving season, calves were weighed immediately upon calving. Approximately 60 days after the end of the calving season, cow milk production was estimated by the weigh-suckle-weigh method. Calf body weight was collected at weaning. No differences were detected for calving rate and calf birth weight ($P \geq 0.46$). Cow milk production was also similar among treatments ($P = 0.42$). Weaning rate and calf age at weaning were also similar among treatments ($P \geq 0.14$). However, calf weaning weight was greater ($P \leq 0.05$) for cows that gained BCS during gestation (T1, T2, e T3 = average 581 lbs) compared with cows that did not gain BCS during gestation (PC and NC = average 554 lbs). In addition, calf weaning weight was similar ($P = 0.65$) between PC and NC cows (552 vs. 557 lbs). These results indicate that cows should gain BCS during gestation to optimize offspring weaning weight and overall efficiency in cow-calf systems.

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Introduction

The impacts of maternal nutrition on future offspring performance are mainly attributed to the availability of nutrients during critical periods of fetal growth (Funston et al., 2010). However, all the information available to date within this subject are still confusing, and research is still required to develop proper nutritional management for gestating beef cows to maximize offspring productivity.

Research from the OSU-EOARC (Bohnert et al., 2012; funded by the Oregon Beef Council in 2008), evaluated performance of the progeny from pregnant cows managed to attain body condition score (**BCS**) 6 (adequate nutrition) or 4 (inadequate nutrition) during the last trimester of gestation. Calving and weaning rates were, respectively, 90% and 88.3% for BCS 4 cows, and 100% and 99.1% for BCS 6 cows, demonstrating that inadequate nutrition during late gestation reduces the birth and weaning of live calves. Further, calves born from BCS 6 cows were heavier at weaning (418 vs. 405 lbs). These increases in weaning rate and productivity resulted in U$ 72 increase in net return per BCS 6 cow if calves were sold at weaning.

However, in this study (Bohnert et al., 2012), cows were supplemented or nutrient-deprived during mid-gestation to achieve BCS 6 or 4 during the last trimester of gestation, respectively. Therefore, it is unknown if the advantages reported for BCS 6 cows were due to their adequate BCS during late gestation, supplementation during mid-gestation, or a combination of both. It is also important to consider changes in cow nutritional requirements during gestation when developing nutritional programs to exploit offspring performance. Cow nutritional requirements are the lowest during mid-gestation, when cows are non-lactating (upon weaning) and fetal growth is still marginal. Consequently, supplementation to increase BCS and ensure adequate nutritional status is more efficient and economically viable in non-lactating beef cows during mid-gestation compared with lactating cohorts or cows in the last trimester of the pregnancy.

Based in this rationale, this experiment evaluated the importance of cow BCS and timing of BCS increase (from 4 to 6) during gestation on productive parameters of the in utero offspring.

Materials and Methods

Three hundred Angus × Hereford multiparous and lactating cows were assigned to a fixed-timed artificial insemination (**AI**) protocol using semen from a single Angus sire. Thirty days after AI, cows were evaluated for BCS and pregnancy via transrectal ultrasonography, and 100 cows diagnosed as pregnant were selected for the experiment. Within these 100 cows, 20 cows had BCS of 6 and 80 cows had a BCS of 4. Based on cow BCS, as well as age, body weight, and days post-partum, cows were assigned to the following management schemes:

1) **PC** (adequate nutrition during gestation): cows with BCS 6 at pregnancy diagnosis and nutritionally managed to maintain BCS 6 until calving.
2) **NC** (inadequate nutrition during gestation): cows with BCS 4 at pregnancy diagnosis and nutritionally managed to maintain BCS 4 until calving.
3) **T1**: cows with BCS 4 at pregnancy diagnosis and managed during the 1st trimester of gestation to achieve and maintain BCS 6 until calving.
4) **T2**: cows with BCS 4 at pregnancy diagnosis and 1st trimester of gestation, and managed during 2nd trimester of gestation to achieve and maintain BCS 6 until calving
5) **T3**: cows with BCS 4 at pregnancy diagnosis, 1st and 2nd trimesters of gestation, and managed during 3rd trimester of gestation to achieve and maintain BCS 6 until calving.

Cow management calendar is described in Table 1. Cows were offered forage-based diets, but were supplemented with dried distillers' grains to increase BCS from 4 to 6, and to maintain BCS 6.

Table 1. Cow management calendar

Day relative to AI	Event	Herd location
30	Pregnancy diagnosis	Range (NGBER)
95	Beginning of 2nd trimester of gestation + weaning of existing offspring	Range (NGBER)
190	Beginning of 3rd trimester of gestation	Pastures (EOARC Burns)
285	Beginning of calving season	Pastures (EOARC Burns)
345	Cow milk production evaluation	Range (NGBER)
480	Weaning	Range (NGBER)

Table 2. Actual BCS change during the experiment

Item	NC	T1	T2	T3	PC	*P* =
1st trimester	4.51	4.43	4.46	4.49	5.70	< 0.01
BCS increase, 1st to 2nd trimester	*0.08*	*1.02*	*0.06*	*0.13*	*0.07*	*< 0.01*
2nd trimester,	4.60	5.46	4.52	4.60	5.77	< 0.01
BCS increase, 2nd to 3rd trimester	*0.09*	*0.57*	*1.58*	*0.19*	*0.37*	*< 0.01*
3rd trimester	4.73	6.00	6.09	4.76	6.14	< 0.01
BCS increase, 3rd trimester to calving	*0.12*	*0.07*	*0.07*	*1.09*	*0.13*	*< 0.01*
Calving	4.86	6.07	6.16	5.86	6.27	< 0.01

Cow milk production was estimated by the weigh-suckle-weigh method. Calf body weight was recorded at birth and weaning (Table 1).

Cow was considered the experimental unit for statistical analyses given that BCS was recorded and all cows met the BCS maintenance and change criteria (Table 2). All data were analyzed using the MIXED procedure of SAS (SAS Inst., Inc.; version 9.3) and Satterthwaite approximation to determine the denominator df for the tests of fixed effects. Significance was set at $P \leq 0.05$, and tendencies were determined if $P > 0.05$ and ≤ 0.10.

Results

As previously mentioned, Table 2 illustrates BCS change of cows within each management group, indicating that our treatments were successful in maintaining/changing cow BCS during specific periods of gestation. Upon calving, no differences were detected ($P \geq 0.46$) for calving rate (% of cows that calved a live calf) or calf birth weight (Table 3). No differences were also detected for cow milk production ($P = 0.42$).

Weaning rate (% of cows that weaned a live calf) and calf weaning age were similar ($P \geq 0.14$) among treatments (Table 3). Weaning weight were greater ($P \leq 0.05$) for calves from T1, T2, and T3 cows (average 581 lbs) compared with cohorts from NC and PC cows (average 554 lbs). In addition, calf weaning weight was similar ($P = 0.65$) between NC and PC cows, suggesting that maintaining cows at a stable BCS 6 during gestation does not improve offspring performance compared with cohorts with inadequate but also stable BCS 4. Collectively, these results indicate that cows should gain BCS during gestation, particularly during mid and late gestation, which likely increase nutrient flux to the fetus (Wu et al., 2006) and resulted in optimized performance of the offspring.

Conclusions

Results from this experiment indicate that cows should gain BCS during gestation to optimize offspring weaning weight and overall efficiency in cow-calf systems.

Table 3. Calving, milk production, and weaning results

Item	NC	T1	T2	T3	PC	*P* =
Calving results						
Calving rate, %	92.3	92.3	100.0	100.0	100.0	0.50
Calf birth BW, lbs	99.4	95.0	97.5	92.9	94.1	0.46
Milk production						
Daily milk yield, lbs/d	32.6	29.5	31.2	34.5	30.1	0.42
Weaning results						
Weaning rate, %	92.3	92.3	100.0	100.0	100.0	0.50
Calf weaning age, days	192	193	195	192	192	0.14
Calf weaning BW, lbs	557	572	590	581	552	0.04

Acknowledgements

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