Winter feeding systems and supplementation of beef cows in mid-gestation: Effects on cow/calf performance and subsequent steer feedlot performance

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This study examined the impact of winter feeding systems (bale grazing versus dry lot pen feeding) and DDGS supplementation on beef cow performance and pre- and post-weaning calf performance. Winter feeding systems or DDGS supplementation did not influence cow performance. In the feedlot, winter feeding systems or DDGS supplementation did not influence steer performance during the backgrounding phase. There was a tendency during the finishing phase toward greater final BW and ADG and lower feed-to-gain ratio in steers from supplemented cows. Winter feeding system or DDGS supplementation did not influence carcass characteristics. Results show that winter feeding systems such as bale grazing do not negatively impact cow performance and subsequent steer feedlot performance.

Summary

The impact of winter feeding systems (bale grazing versus dry lot pen feeding) and DDGS supplementation on cow/calf performance and steer feedlot performance was evaluated. The study was divided into a bale grazing/dry lot phase and a feedlot phase. During the bale grazing/dry lot phase, 100 cows in mid-gestation were allocated to four replicated treatments as follows: a) bale-grazing grass hay, b) bale-grazing grass hay plus corn DDGS, c) dry lot pen feeding grass hay, and d) dry lot pen feeding grass hay plus DDGS. After weaning, 40 steers (five from each replicate) were shipped to the Carrington Research Extension Center for finishing. Cow performance was not influenced ($P \geq 0.05$) by winter feeding system or supplementation. As well, winter feeding system or supplementation did not influence ($P \geq 0.05$) calf birth weights, weaning weights, weaning age, and ADG. In the feedlot, final weights, ADG, and feed-to-gain ratios were not influenced ($P \geq 0.05$) by winter feeding system or supplementation during the backgrounding phase. There was, however, a tendency during the finishing phase toward greater final BW ($P = 0.12$) and ADG ($P = 0.11$) and lower ($P = 0.14$) feed-to-gain ratio in steers from supplemented cows. Carcass characteristics, namely hot carcass weight, marbling, backfat thickness, ribeye area, and yield grade, were not influenced ($P \geq 0.05$) by feeding system and supplementation. Results show that winter feeding systems such as bale grazing do not negatively impact cow performance and subsequent steer feedlot performance. Supplementation with DDGS may not be necessary when good-quality grass hay is offered to cows in mid-gestation.

Introduction

Spring calving season in North Dakota traditionally extends January to May. In this system, cows are in mid- to late gestation in fall to early winter. Maternal nutrition during gestation plays an essential role in proper fetal development as well as long-term growth, health, and reproductive performance of offspring (Funston et al., 2010). Therefore, nutritional management during mid- and late gestation is critical, and diets should contain adequate energy, protein, and minerals to meet nutrient requirements of the pregnant cow. This is easily accomplished in wintering pens where animals can be fed balanced diets as total mixed rations. Meeting nutrient requirements of animals kept in extended grazing systems can be a challenge since diets are forage-based. In such situations, nutrient requirements can be met through provision of good-quality forages and appropriate feed supplements. Corn DDGS is commonly fed as a supplement in extended grazing systems. As a supplement, corn DDGS compares favorably with supplements such as soybean meal

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and canola meal since corn DDGS is a good source of protein, fat, phosphorus, and readily digestible fiber.

Studies examining the effect of supplementing cows in mid- to late gestation on steer performance have reported variable results, probably due to differences in stage of pregnancy, type of supplement offered, level of supplementation, and environmental conditions. Pre-partum supplementation of cows during late gestation with cottonseed meal did not impact calf performance and subsequent carcass characteristics (Mulliniks et al., 2012). In other studies (Larson et al., 2009), however, late gestation cow supplementation improved calf weaning weights and steer carcass characteristics. A long-term study (Larson et al., 2009) reported trends toward greater final weights and ADG in steers and changes in carcass characteristics following cow supplementation during late gestation. This study was conducted with cows in mid-gestation to examine the impact of winter feeding systems and supplementation on beef cow performance, calf performance, and steer feedlot performance and carcass characteristics.

Experimental Procedures

Animal handling and care procedures were approved by the North Dakota State University Animal Care and Use Committee. This study was conducted with non-lactating pregnant Angus cows that had been bred by artificial insemination with semen from five bulls. The study had two phases: a bale grazing/dry lot phase and a feedlot phase. During the bale grazing/dry lot phase, 100 non-lactating pregnant Angus-cross beef cows were divided into 8 groups of similar average body weight to evaluate four systems: a) bale grazing grass hay only, b) bale grazing grass hay with corn DDGS supplementation, c) pen feeding grass hay only and, d) pen feeding grass hay with corn DDGS supplementation. Bale grazing was conducted in 1.3 ha paddocks that were separated by three-strand, high-tensile wire electric fencing. Pen-fed cows were kept in dry lot pens that were surrounded by wooden windbreaks on 3 sides of the pen. All cows were fed grass hay round bales (8.6% CP, 57.2%; TDN; Table 1). For supplemented cows, corn DDGS (31.2% CP, 75.3% TDN; Table 1) was delivered twice weekly and fed in bunks.

Table 1. Chemical composition (mean ± SD; % DM) of grass hay and corn DDGS fed to cows.

Item	Grass hay	Corn DDGS[1]
CP	8.6 ± 0.62	31.2 ± 1.21
TDN	57.2 ± 0.84	75.3 ± 1.46
NDF	62.0 ± 0.70	31.0 ± 2.02
ADF	40.8 ± 1.08	14.5 ± 2.60
Ca	0.63 ± 0.08	0.06 ± 0.01
P	0.20 ± 0.04	1.04 ± 0.04
Mg	0.21 ± 0.01	0.41 ± 0.01
K	1.94 ± 0.08	1.30 ± 0.09
S	0.19 ± 0.03	0.71 ± 0.06

After weaning in late October, 40 steers (five from each replicate) were shipped to a feedlot for finishing. To eliminate pen effects and maintain in-utero treatment effects, steers were managed as one group. Upon arrival at the feedlot, steers were implanted with Synovex Choice (100 mg trenbolone acetate; 14 mg estradiol benzoate; Zoetis, NJ). Steers were fed a backgrounding diet (14.4% CP and 69.7% TDN; Table 2) for approximately 60 days before receiving a finishing diet (13.3% CP and 81.3% TDN; Table 2), which was fed for 126 days.

Feeding steers was accomplished using "clean bunk" feeding management. The goal of clean bunk management is for all feed delivered to a pen to be consumed daily, with bunks being empty for a certain period of time prior to next feeding, without restricting feed intake. The steers were fed once daily at approximately 09:00 each day, and feed bunks were targeted to be empty of feed by the

Table 2. Ingredient and chemical composition of diets fed to steers.

Ingredient, %	Backgrounding ration	Finishing ration
Corn grain	20.5	68.3
Modified Distillers	19.8	13.4
Corn silage	32.3	9.4
Straw	23.5	6.8
Supplement[1]	3.0	1.3
Limestone	0.9	0.8
DM, %	56.4	69.8
Chemical composition		
Crude Protein	14.4	13.3
NEg, Mcal/kg	0.91	1.19
TDN	69.7	81.3
NDF	32.7	17.7
ADF	22.2	8.9
EE	3.9	4.3
Ash	8.2	3.5
Ca	0.6	0.4
P	0.5	0.4
Mg	0.3	0.2
K	1.0	0.8
S	0.3	0.3

[1]Trace mineral premix, vitamin ADE premix, and monensin.

following morning. Amount of feed delivered to bunks each week was based on bunk clearance from the previous week. Feed intake was estimated as the daily feed consumed by steers divided by number of steers in the pen. Steers had *ad libitum* access to fresh water, mineral supplement, and salt blocks. Steer weights were taken at 28-day intervals. Steers remained in the feedlot for 186 days (60-day backgrounding and 126-day finishing phase) before shipping to a commercial abattoir for harvest and carcass quality data collection.

Results and Discussion

Initial cow BW were similar (P = 0.92) among treatments (Table 3). Winter feeding system and supplementation did not influence ($P \geq 0.05$) final cow BW and ADG. Initial cow BCS were similar (P = 0.97) among treatments. Final BCS and change in BCS were not influenced ($P \geq 0.05$) by winter feeding system or supplementation (Table 3). These findings are consistent with studies (Mulliniks et al., 2012) in which pre-partum cow supplementation did not influence cow performance. However, other studies have reported beneficial effects of pre-partum cow supplementation (Larson et al., 2009; Marshall et al., 2013; Wilson et al., 2015). Differences among studies could be due to differences in forage fed since cows fed higher quality forage may be in a more positive nutrient balance, and their progeny may be less susceptible to nutrient restriction during prenatal development (Wilson et al., 2015). In this study, the grass hay (8.6% CP and 57.2% TDN) likely met the energy and CP requirements of dry cows in the middle one-third of pregnancy.

Calf performance is shown in Table 4. There was no difference ($P \geq 0.05$) in calf birth weights, weaning weights, weaning age, and ADG among treatments. Studies that have reported greater calf weaning weights following pre-partum cow supplementation attribute this effect to alterations in fetal growth (Marshall et al., 2013). Supplemented cows consume more nutrients and readily surpass nutrient requirements necessary for fetal growth and gain during later stages of pregnancy (Marshall et al., 2013). In the feedlot, final weights, ADG, and feed-to-gain ratios were not influenced ($P \geq 0.05$) by treatment during the backgrounding phase. There was a tendency during the finishing phase toward greater final weight (P = 0.12) and ADG (P = 0.11) and lower (P = 0.14) feed-to-gain ratio in steers from supplemented cows. This finding is similar to Larson et al. (2009) who reported a trend for greater final weight and ADG in steers from supplemented cows. There was no difference ($P \geq 0.05$) in hot carcass weight, marbling, backfat thickness, ribeye area, and yield grade among treatments (Table 4). These findings are consistent with studies (Marshall et al., 2013; Wilson et al., 2015) that have reported that cow supplementation in late gestation does not influence carcass characteristics. The greater ($P \leq 0.05$) ribeye area in steers from cows overwintered in the dry lot relative to bale-grazed pasture is difficult to explain as all other carcass characteristics between the winter feeding systems were similar. Changes in carcass characteristics are more likely to occur as a result of differences in nutrient supply rather than feeding systems.

Results show that winter feeding systems such as bale grazing do not negatively impact cow performance and subsequent steer feedlot performance. Supplementation with DDGS may not be necessary when good-quality grass hay is offered to cows in mid-gestation.

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Table 3. Performance of cows kept in two winter feeding systems and fed grass hay or grass hay supplemented with corn DDGS.

	Diet[1] (D)			Feeding System[2] (S)			*P*-value		
	Hay	H-DDG	SE	BG	DL	SE	D	S	D x S
Initial weight, lb	1404	1402	29.0	1404	1402	29.0	0.92	0.93	0.92
Final weight, lb	1558	1569	29.3	1565	1561	29.3	0.70	0.89	0.57
ADG, lb/d	1.89	2.02	0.09	1.92	1.98	0.09	0.18	0.53	0.20
Initial BCS	5.8	5.8	0.07	5.8	5.8	0.07	0.71	0.83	0.61
Final BCS	6.2	6.1	0.08	6.2	6.1	0.08	0.77	0.41	0.46
BCS change	0.40	0.35	0.05	0.41	0.35	0.05	0.34	0.12	0.07

[1]Hay = grass hay; H-DDG = Hay plus corn DDGS
[2]BG = bale grazing; DL = dry lot pen feeding

Table 4. Performance of steers from cows kept in two winter feeding systems and fed grass hay or grass hay supplemented with corn DDGS.

	Diet[1] (D)			Feeding System[2] (S)			*P*-value		
	Hay	H-DDG	SE	BG	DL	SE	D	S	D x S
Birth to weaning									
Birth weight, lb	89	90	3.7	88	91	3.7	0.96	0.37	0.58
Weaning weight, lb	607	623	18.6	616	614	18.6	0.40	0.92	0.15
Weaning age, d	189	190	1.4	189	190	1.4	0.21	0.49	0.61
ADG, lb/d	2.75	2.80	0.10	2.80	2.75	0.10	0.56	0.67	0.17
Backgrounding phase									
Initial weight, lb	670	690	18.0	675	685	18.0	0.24	0.59	0.09
Final weight, lb	866	882	21.8	867	881	21.8	0.49	0.55	0.21
ADG, lb/d	3.28	3.18	0.13	3.20	3.26	0.13	0.46	0.67	0.66
Feed:gain	7.12	7.45	0.32	7.35	7.22	0.32	0.31	0.69	0.69
Finishing phase									
Initial weight, lb	866	882	21.8	867	881	21.8	0.49	0.55	0.21
Final weight, lb	1354	1399	29.9	1360	1393	29.9	0.14	0.27	0.17
ADG, lb/d	3.87	4.10	0.15	3.91	4.06	0.15	0.11	0.28	0.43
Feed:gain	7.30	6.89	0.27	7.26	6.94	0.27	0.14	0.24	0.42
Overall									
Initial weight, lb	670	690	18.0	675	685	18.0	0.24	0.59	0.09
Final weight, lb	1354	1399	29.9	1360	1393	29.9	0.14	0.27	0.17
ADG, lb/d	3.68	3.81	0.15	3.69	3.81	0.15	0.27	0.28	0.61
Feed:gain	7.22	6.98	0.22	7.23	6.97	0.22	0.31	0.25	0.60
Carcass characteristics									
HCW, lb	819	819	23.1	819	819	23.1	0.97	0.99	0.54
Marbling	536	540	28.7	530	546	28.7	0.88	0.57	0.98
Yield grade	3.4	3.4	0.2	3.5	3.3	0.2	0.76	0.12	0.63
Backfat, in	0.64	0.68	0.04	0.67	0.64	0.04	0.29	0.59	0.85
Ribeye area, in^2	13.3	13.4	0.38	13.0	13.8	0.38	0.88	0.05	0.13

[1]Hay = grass hay; H-DDG = Hay plus corn DDGS
[2]BG = bale grazing; DL = dry lot pen feeding

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