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Effects of Early or Conventional Weaning on Beef Cow and Calf Performance in Pasture and Drylot Environments

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Abstract

During widespread drought, pasture availability and productivity are reduced. This, coupled with increasing land prices and lease rates, has prompted the evaluation of alternative management strategies that decrease grazing pressure on perennial pasture or reduce feed and pasture costs. Weaning early and moving cows from pasture to a drylot environment is used commonly for reducing grazing pressure on perennial pastures. A premature end to lactation reduces cow nutrient requirements and reduces grazing pressure. Removal of the calf further reduces grazing pressure, as calves are significant consumers of forage dry matter (DM) during mid and late lactation. The combination can be used to extend grazing by 0.4 d for each d weaning is executed earlier than normal. Early weaning may result in calves having less value at weaning compared to calves weaned at conventional ages. Retaining ownership of young calves through backgrounding can be useful for increasing their value. Limit-feeding non-lactating cows or cow-calf pairs in confinement can also reduce grazing pressure on pastures, while maintaining cow body condition score (BCS) or body weight (BW). Previous research conducted at the location of this study found that limit-feeding non-lactating cows at 1.9% BW achieved acceptable gains in BW, BCS, and rump fat. Therefore, the objective of our study was to evaluate the performance of beef cows and calves subject to a 56-d early or conventional weaning period in either pasture or drylot environments.

Keywords

beef cows, concentrate, early weaning, pasture

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Introduction

During widespread drought, pasture availability and productivity are reduced. This, coupled with increasing land prices and lease rates, has prompted the evaluation of alternative management strategies that decrease grazing pressure on perennial pasture or reduce feed and pasture costs. Weaning early and moving cows from pasture to a drylot environment is used commonly for reducing grazing pressure on perennial pastures. A premature end to lactation reduces cow nutrient requirements and reduces grazing pressure. Removal of the calf further reduces grazing pressure, as calves are significant consumers of forage dry matter (DM) during mid and late lactation. The combination can be used to extend grazing by 0.4 d for each d weaning is executed earlier than normal. Early weaning may result in calves having less value at weaning compared to calves weaned at conventional ages. Retaining ownership of young calves through backgrounding can be useful for increasing their value. Limit-feeding non-lactating cows or cow-calf pairs in confinement can also reduce grazing pressure on pastures, while maintaining cow body condition score (BCS) or body weight (BW). Previous research conducted at the location of this study found that limit-feeding non-lactating cows at 1.9% BW achieved acceptable gains in BW, BCS, and rump fat. Therefore, the objective of our study was to evaluate the performance of beef cows and calves subject to a 56-d early or conventional weaning period in either pasture or drylot environments.

Experimental Procedures

Animals

Spring-calving Angus-cross cows (n = 167; initial BW = 1321 ± 120.2 lb; 5 ± 2.4 yr; initial BCS = 5.5 ± 0.54) and calves (n = 167; initial BW = 450 ± 58.9 lb; 153 ± 15 d of age) were used in this study. By approximately 60 d of age, all calves were vaccinated against clostridial diseases (Ultrabac 7; Pfizer Animal Health, Exton, PA) and steers were castrated. At the initiation of the study on August 19, cow-calf pairs were stratified by calf age, cow BW, and cow BCS and assigned randomly to 1 of 4 weaning treatments with 4 pen or pasture replicates/treatment. Treatments were as follows: weaning

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at 153 d of age followed by 56 d of limit feeding in confinement for both cow and calf (E-D), confinement of cow and calf together for a 56-d period of limit feeding followed by weaning at 209 d of age (C-D), weaning at 153 d of age followed by a 56-d grazing period for both cow and calf (E-P), and a 56-d grazing period with cow and calf together followed by weaning at 209 d of age (C-P).

Drylot Treatments

Cows and calves assigned to E-D and C-D were placed into the feedlot for 56 d. Calves assigned to E-D were separated from their dams and placed in feedlot pens (n = 4, minimum area = 215 ft^2/calf; bunk space = 1.5 ft/calf) and provided ad libitum access to water via concrete tanks. Calves were fed a weaning diet (Table 1) formulated to promote a 2.2 lb average daily gain (ADG) at a dry matter intake (DMI) of 2.5% of BW. Bunks were evaluated each morning at 6:30 am, and feed was delivered once daily at 7:00 am. Bunks were managed using a slick-bunk management method to minimize feed refusals. If all feed delivered to a pen was consumed, delivery at the next feeding was increased to approximately 102% of the previous delivery. Diet samples were collected from bunks weekly and frozen at -4°F. Samples were composited by weight at the conclusion of the study and submitted to a commercial laboratory (SDK Laboratories, Hutchinson, KS) for analysis of DM, CP, neutral detergent fiber (NDF), and acid detergent fiber (ADF) (Table 1). Diet net energy (NE) values were calculated from detergent fiber analyses using equations.

Cows assigned to E-D were separated from their calves and placed in earth-floor pens (n = 4, minimum area = 1,000 ft^2/cow; linear bunk space = 2.13 ft/cow) and provided ad libitum access to water via concrete tanks. Cows were limit-fed a roughage-based diet at 1.6% of initial BW (Table 2). Feed was delivered once daily at 7:00 am. Diet samples were collected from bunks weekly and frozen (-4°F). Diet samples were composited by weight at the conclusion of the study and submitted to a commercial laboratory (SDK Laboratories, Hutchinson, KS) for analysis of DM, CP, NDF, and ADF (Table 2). Diet NE values were calculated from detergent fiber analyses using equations.

Cows and calves assigned to C-D were placed as pairs into feedlot pens (n = 4, minimum area = 1,000 ft^2/cow; bunk space = 2.13 ft/cow) and provided ad libitum access to water via concrete tanks. Cows were limit-fed a forage-based diet at 2.0% of initial BW that was formulated to meet nutrient requirements of pregnant cows in late lactation. Calves assigned to C-D were offered the same diet fed to E-D (Table 1) at a daily DM allowance of 2.0% of initial BW. Creep panels were used to allow calves undisturbed access to the weaning diet. Cow and calf bunks were evaluated each morning at 6:30 am and feed was delivered once daily at 7:00 am. Diet samples were collected from bunks weekly and frozen (-4°F). Samples were composited by weight and nutrient composition was analyzed as previously described.

Pasture Treatments

Cows and calves assigned to E-P and C-P were placed onto the native pastures for 56 d. Calves assigned to E-P were separated from their dams and placed in feedlot pens for 4 d (n = 4, minimum area = 215 ft^2/calf; bunk space = 1.5 ft/calf) and provided ad libitum access to water via concrete tanks. Calves were fed native prairie hay ad libitum.

Hay was delivered once daily at 7:00 am. On the afternoon of d 4, calves were released into 1 of 4 assigned pastures. Each pasture (27 ± 1.0 acres) provided continual access to surface water and was stocked at 2.0 acres/calf for 56 d.

Two permanent 328-ft transects were established in each pasture at the onset of the study in order to estimate forage quality and aboveground forage biomass. Pasture forage quality and biomass were estimated by clipping all plant material from within randomly-placed sampling frames (2.69 ft^2; n = 10/pasture) at a height of 0.39 inch on 8/19, 9/16, and 10/14. Range forage samples were dried in a forced-air oven (122°F; 96 h) and weighed to estimate biomass availability. Samples were subsequently composited by sampling date on an equal-weight basis at the conclusion of the experiment and submitted to a commercial laboratory (SDK Laboratories, Hutchinson, KS) for analysis of DM, CP, NDF, and ADF (Table 3).

Cows assigned to E-P were separated from their calves and placed in feedlot pens for 4 d (n = 4, minimum area = 1,000 ft^2/cow; bunk space = 2.13 ft/cow) and provided ad libitum access to water via concrete tanks. Cows were fed the same prairie hay offered to E-P calves for ad libitum intake during this period. Hay was delivered once daily at 7:00 am. Cows were released into assigned pastures on the afternoon of d 4 and remained there 56 d. Each pasture (n = 4, 37 ± 1.0 acres) was stocked at 3.0 acres/cow and provided continual access to surface water. Pasture forage quality (Table 3) and total forage biomass (Table 4) were collected, as previously described, on 8/19, 9/16, and 10/14.

Cows and calves assigned to C-P were placed as pairs directly onto native range pasture (n = 4, 37 ± 1.0 acres) for 56 d. Pastures were stocked at 4.0 acres/pair and provided continual access to surface water. Pasture forage quality (Table 3) and total forage biomass (Table 4) were collected as previously described on 8/19, 9/16, and 10/14.

Final Phase

Following the 56-d study period, cows and calves were individually weighed. Animals assigned to E-P and C-P were transported to the feedlot. Cows and calves assigned to C-P and C-D were separated at that time and assigned to a new pen (n = 4 pens/treatment for cows, 4 pens/treatment for calves). To equalize gut-fill between treatments, all calves were fed a common diet (Table 1) at 2.0% of BW for 7 d and all cows were fed a common diet (Table 2) at 1.6% of BW for 7 d.

Data Collection

Calf BW was individually measured on d 0, 28, 56, and 63. Cows were weighed individually on d 0 and 63. Cows and calves were weighed at 6:00 am prior to feed delivery. Cow BCS was assigned by two trained observers using a 9-point scale (1 = emaciated, 9 = obese) on d 0 and 63. Also on d 0 and 63, rump fat thickness of cows was measured ultrasonically at the midpoint between the hip bone and pin bone using an Aloka 500V (Aloka Co., Ltd., Wllingford, CT) B-mode instrument equipped with a 3.5-MHz general purpose transducer array (UST 5021-12mm window). Cattle Performance Enhancement Company (CPEC, Oakley, KS) software was used to collect ultrasound images. Rump fat thickness was estimated with procedures that incorporated image analysis software integral to the CPEC software.

Results and Discussion

Forage Biomass

Available pasture forage biomass was greater ($P \leq 0.01$) for E-P calves than for either E-P cows or C-P cow-calf pairs for the duration of our study (Table 4). This was expected because of lesser grazing pressure afforded by calves compared with either cows or cow-calf pairs. There were no differences ($P \geq 0.21$) in available forage biomass between pastures with C-P cow-calf pairs or E-P cows at any time during our study. Range-forage biomass declined in quantity throughout the study in all treatments.

Calf Performance

Calf BW was not different ($P \geq 0.06$) between treatments at the beginning of the study or on d 28 (Table 4). On d 63, there was an interaction ($P = 0.05$) between diet and weaning treatment. Calves managed in confinement, both weaned and non-weaned, had greater BW than calves managed on pasture. Calves suckling their dams had greater BW than weaned, unsupplemented calves grazing native pastures. Average daily gains were influenced by diet and weaning treatments (diet × weaning – $P \leq 0.03$). In general, calves managed in confinement and fed concentrate-based diets (i.e., E-D and C-D) had greater ADG than unsupplemented calves maintained on pasture (i.e., E-P and C-P). Weaned calves on pasture had lesser ($P < 0.01$) ADG than suckling calves on pasture from d 0 to 28 and from d 0 to 63.

Cow Performance

Cow BW, BCS, and rump-fat thickness were not different ($P \geq 0.36$) between treatments at the beginning of the study (Table 5). Cow BW on d 63 was greatest ($P < 0.01$) for non-lactating cows on pasture, intermediate for non-lactating cows fed in confinement and least for cows that continued to suckle calves. Overall BW change was influenced by both diet and weaning status (diet × weaning – $P = 0.05$). Non-lactating cows maintained on pasture had lesser BW loss than other treatments; BW loss by confined, non-lactating cows and lactating cows maintained on pasture was less than that by confined lactating cows. Cow BCS on d 63 and BCS change from d 0 to 63 were influenced ($P < 0.01$) by diet and weaning status. Non-lactating cows fed in confinement had lesser BCS on d 63 and greater BCS loss from d 0 to 63 than all other treatments.

Trends in BW and BCS may be interpreted to indicate that DMI of the cows assigned to the E-D treatment was not adequate to maintain BW or BCS; however, rump-fat data do not support this conclusion. Rump-fat depth on d 63 was greater ($P < 0.01$) for non-lactating cows maintained on pasture than for lactating cows in either pasture or drylot environments; non-lactating cows in confinement were intermediate to and not different from these treatments (Table 5). Similarly, change in rump-fat depth was greatest (diet × weaning - $P < 0.01$) for non-lactating cows on pasture and least for lactating cows in either pasture or drylot environments. Non-lactating cows maintained in confinement were intermediate to and different from these treatments.

Implications

Results were interpreted to indicate that early weaning spared cow BW and rump fat compared to weaning at conventional calf ages. Performance of cows was acceptable when either limit-fed under drylot conditions or maintained in a pasture environment. Conversely, calf performance was generally greater in confinement than on pasture.

Table 1. Composition of the diet fed to early-weaned calves in confinement

Ingredient composition	% DM
Sorghum silage	21.9
Dry rolled sorghum grain	63.4
Wet distillers grains	6.1
Soybean meal	5.1
Supplement[1]	3.4
Nutrient composition[2]	DM basis
CP, % DM	18.1
NE_m, Mcal/kg DM	1.81
NE_g, Mcal/kg DM	1.09

[1]Supplement contained ammonium sulfate, limestone, urea, salt, Rumensin 90 (300 mg/hd/d), Tylan 40 (90 mg/hd/d), and a trace-mineral premix.
[2]Nutrient analysis conducted by SDK Laboratories, Hutchison, KS.

Table 2. Composition of the diet fed to beef cows in confinement

Ingredient composition	% DM
Ground hay[1]	80.6
Dry rolled sorghum grain	10.4
Wet distillers grains	7.9
Calcium carbonate	0.30
Salt	0.30
Vitamin and mineral premix	0.30
Nutrient composition[2]	DM basis
CP, % DM	13.2
NE_m, Mcal/kg DM	1.68

[1]Native prairie hay blended with forage sorghum hay.
[2]Nutrient analysis conducted by SDK Laboratories, Hutchison, KS.

Table 3. Nutrient composition of range forage grazed by cows and calves

Sampling date	CP, % DM	NDF, % DM	ADF, % DM
		Calves, early weaned	
August 19	6.8	71.1	46.2
September 16	5.9	76.2	51.2
October 14	5.5	74.9	51.6
		Cows, early weaned	
August 19	6.2	71.6	45.8
September 16	5.5	76.7	51.1
October 14	4.6	77.2	52.4
		Cow-calf pairs, conventionally weaned	
August 19	5.8	70.4	44.6
September 16	5.2	74.9	49.3
October 14	5.4	75.1	50.5

Table 4. Forage biomass available to weaned calves, non-lactating cows, and cow-calf pairs during a 56-d grazing period

Date	Weaned calves[1]	Non-lactating cows[2]	Cow-calf pairs[3]	SEM
	------------------ lb forage DM/ 100 lb BW ------------------			
August 19	812.3[a]	443.3[b]	356.2[b]	65.65
September 16	806.5[a]	389.9[b]	317.9[b]	54.04
October 14	661.1[a]	345.2[b]	345.2[b]	49.07

[1]Calves were early weaned in a pasture environment and not supplemented for 56 d (4 pastures; 12 or 13 calves/ pasture).

[2]Dams of early-weaned calves in a pasture environment and not supplemented for 56 d (4 pastures; 12 or 13 cows/ pasture).

[3]Cow-calf pairs grazed together in a pasture environment and not supplemented for 56 d (4 pastures; 8 or 9 pairs/ pasture).

[a,b]Within a row, means without a common superscript differ ($P \leq 0.01$).

Table 5. Performance of beef calves that were weaned early or paired with dams in either confinement or pasture environments

Item	Weaned calves, confined[1]	Non-weaned calves, confined[2]	Weaned calves, pasture[3]	Non-weaned calves, pasture[4]	SEM	*P*-value		
						Diet	Weaning	Diet × weaning
Initial BW, lb	459	452	456	450	4.1	0.83	0.50	0.99
d 28 BW, lb	534	538	500	536	4.6	0.07	0.06	0.16
d 63 BW, lb	611	628	498	560	5.0	< 0.01	< 0.01	0.05
ADG d 0-28, lb	2.65	3.09	1.54	3.09	0.05	< 0.01	< 0.01	< 0.01
ADG d 28-63, lb	2.20	2.65	-0.66	0.66	0.04	< 0.01	< 0.01	0.03
ADG d 0-63, lb	2.43	2.87	0.66	1.76	0.04	< 0.01	< 0.01	< 0.01

[1]Calves were weaned in a drylot environment and fed a growing diet 56 d (4 pens; 8 or 9 calves/pen).
[2]Cow-calf pairs confined together in a drylot environment fed complete diets for 56 d (4 pens; 8 or 9 pairs/pen).
[3]Calves were weaned in a pasture environment and not supplemented for 56 d (4 pastures; 12 or 13 calves/pasture).
[4]Cow-calf pairs grazed together in a pasture environment and were not supplemented for 56 d (4 pastures; 12 or 13 pairs/pasture).
[a,b,c,d]Within a row, means without a common superscript differ ($P \le 0.01$).

Table 6. Performance of pregnant beef cows in confinement and pasture environments either post-weaning or while suckling calves

Item	Post-weaning, confined[1]	Suckling, confined[2]	Post-weaning, pasture[3]	Suckling, pasture[4]	SEM	*P*-value		
						Diet	Weaning	Diet × weaning
BW, lb								
d 0	1351	1329	1316	1329	19.0	0.37	0.85	0.36
d 63	1285	1224	1314	1257	18.7	<0.01	<0.01	0.93
Change, d 0-63	-66.1	-106.7	-2.2	-74.3	7.89	< 0.01	< 0.01	0.05
BCS								
d 0	5.5	5.4	5.5	5.5	0.08	0.56	0.78	0.47
d 63	4.5[a]	5.0[b]	5.1[b]	5.0[b]	0.07	<0.01	<0.01	<0.01
Change, d 0-63	-1.0[a]	-0.4[b]	-0.4[b]	-0.6[b]	0.70	<0.01	<0.01	<0.01
Rump fat depth, mm								
d 0	5.43	5.67	4.91	5.44	0.054	0.49	0.48	0.78
d 63	6.69[ab]	6.05[a]	8.33[b]	5.89[a]	0.057	0.19	< 0.01	0.12
Change, d 0-63	1.262[b]	0.393[c]	3.411[a]	0.449[c]	0.030	< 0.01	< 0.01	< 0.01

[1]Cows were weaned in a drylot environment and fed a growing diet 56 d (4 pens; 8 or 9 cows/pen).
[2]Cow-calf pairs confined together in a drylot environment fed complete diets for 56 d (4 pens; 8 or 9 pairs/pen).
[3]Cows were weaned in a pasture environment and not supplemented for 56 d (4 pastures; 12 or 13 cows/pasture).
[4]Cow-calf pairs grazed together in a pasture environment and were not supplemented for 56 d (4 pastures; 12 or 13 pairs/pasture).
[a,b,c]Within a row, means without a common superscript differ ($P \le 0.01$).