Growth and Performance of Terminal Sired Calves Grazing Range or Meadow Pasture

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Summary with Implications

Multiparous dams were assigned to be bred by artificial insemination or natural service to bulls with terminal traits. Additionally, the cow-calf pairs grazed upland range or sub-irrigated meadow from June 1 to weaning in November. Two weeks after weaning, calves entered the feedlot as calf-feds. Natural service range calves had the lightest weaning weights, final live weights, and hot carcass weights. Additional days on feed may be required for natural service range calves to reach similar body weights and carcass characteristics as other treatments. Average daily gain and feed conversion was improved in calves that grazed range pastures prior to feedlot entry. Estrus synchronization and artificial insemination may be an effective way to increase body weights and carcass characteristics of calves that graze range pastures prior to feedlot entry.

Introduction

Ideally, there are two distinct breeding objectives within the cow-calf sector: terminal or maternal. Terminal breeding objectives are focused on growth rate targeted to a desired endpoint, feed intake, increased carcass quality, and male fertility. Maternal breeding objectives focus on longevity, moderate size, adaptation to the production environment, milk production, maternal instinct, and female fertility. Terminal and maternal breeding traits can be antagonistic as retaining replacement females from sires with desirable terminal traits could increase cow size thereby increasing nutrient requirements and potentially decrease profits (*2010 Nebraska Beef Cattle Report*, pp. 29–30). As cost of production increases, it is important to select genetics suitable to the production environment (*2019 Nebraska Beef Cattle Report*, pp. 21–23). The environment within the Nebraska Sandhills is comprised of native upland range and sub-irrigated meadow pastures with distinct nutrient profiles (*1997 Nebraska Beef Cattle Report*, pp. 3–5). Producers should have a distinct breeding objective that matches their production environment to maximize profit. Therefore, the objective of this study was to evaluate the growth and performance of calves sired by terminal bulls grazing upland range or sub-irrigated meadow pastures and their subsequent feedlot performance.

Procedure

Dam Management

One hundred twenty-four Simmental × Red Angus crossbred March-calving cows from the Nebraska Ranch Practicum teaching herd at the Gudmundson Sandhills Laboratory (GSL) were utilized in this study. Cows were randomly assigned within cow age, ranging from 3 to 11 years old, to be bred to a terminal bull by artificial insemination (AI) or terminal bulls used for natural service (NS). Additionally, cows were assigned to graze either upland range (RNG) or sub-irrigated meadow (MDW) from June 1 until weaning in November. Bull selection was based off a terminal index; a composite of economically relevant traits focused on growth and carcass characteristics. Dams remained in their respective treatment for the duration of the study. Treatments were assigned 1 yr prior to data collection. Dams were diagnosed for pregnancy on September 5 via transrectal ultrasonography (Aloka, Hitachi Aloka Medical America Inc., Wallingford, CT) and overwintered as a single cohort on MDW pasture and supplemented with meadow hay (7 to 7.5% crude protein). After calving, cows were supplemented with hay and 1 lb of dried distillers grain-based supplement (27% crude protein) until May 15.

Dams allotted to AI were synchronized using the 7 d Co-Synch + controlled internal drug release (CIDR) protocol. On d 0 cows received a 2-mL i.m. injection of gonadotropin-releasing hormone (GnRH; Factrel; 100µg gonadorelin hydrochloride; Zoetis Animal Health, Parsippany, NJ) and a CIDR (EAZI-BREED CIDR; 1.35 g progesterone; Zoetis Animal Health, Parsippany, NJ). On d 7, CIDRs were removed and cows received a single injection of prostaglandin. Sixty to sixty-six hours later, cows received a 2-mL i.m. injection of GnRH and were inseminated. Dams assigned to AI were bred to a black, half-blood Simmental × Angus bull with a terminal index of 82.6 which ranks him in the top 5% of his breed. Clean-up bulls were placed with the AI dams 7 d after AI on June 10 and remained with the cows until July 20. Sixty-seven percent of the dams conceived to AI; therefore, data from AI dams that did not conceive to AI were removed from the analysis.

Bull placement for the NS breeding treatment coincided with AI on June 3. Dams assigned to the NS breeding treatment were not synchronized. Crossbred Simmental × Red Angus bulls, with an average terminal index of 70.4 which collectively ranks them in the top 43% according to their breed. Bulls remained with the NS dams for a 45 d breeding season. The average bull to cow ratio over the 3 yr of the study was 1:16.

Calf Management

At birth, calves received a 7-way clostridial vaccine (Alpha 7, Boehringer Ingelheim, Duluth, GA). At branding in April, bull calves were castrated and all calves received vaccinations for infectious bovine rhinotracheitis, bovine viral diarrhea types I and II, bovine

Table 1. Effect of artificial insemination (AI) or natural service (NS) and upland range (RNG) or sub-irrigated meadow (MDW) grazing on post-natal calf growth

	TREATMENT					P-value[1]		
	AI-MDW	AI-RNG	NS-MDW	NS-RNG	SEM	BRD	GRZ	B × G
n	24	18	31	30				
Body Weight, lb								
Birth	83	89	82	80	3.27	0.16	0.44	0.15
May	191	192	191	186	5.92	0.63	0.72	0.52
June	253	252	258	247	7.91	0.99	0.34	0.48
July	340	329	352	326	11.8	0.69	0.06	0.44
Sep	492[ab]	502[ab]	513[a]	474[b]	15.5	0.84	0.26	0.05
Weaning WDA[2], lb/d	2.77[a]	2.70[a]	2.80[a]	2.53[b]	0.09	0.29	<0.01	0.09
Weaning	617[a]	601[a]	622[a]	564[b]	15.5	0.30	<0.01	0.09
205[3]-d	490	471	496	443	12.7	0.40	<0.01	0.11

[ab] Means within a row with dissimilar superscripts are significantly different ($P < 0.10$).

[1]BRD = breeding treatment main effect, GRZ = grazing treatment main effect, B × G = breeding × grazing treatment interaction.

[2]WDA = weight per day of age.

[3]Common age 205 d weaning weight.

parainfluenza virus-3, bovine respiratory syncytial virus, Mannheimia haemolytica, and Pasteurella multocida (Vista Once SQ, Merck, Kenilworth, NJ); and a 7-way clostridial vaccine (Vision 7, Merck, Kenilworth, NJ). At weaning in November, all calves received one dose of Vista Once SQ and a second dose 14 d later. A 7-way clostridial vaccine with somnus (Vision 7 Somnus, Merck, Kenilworth, NJ) was also given at this time.

Calf body weight (BW) was measured at birth, May, June, July, September, and at weaning. A common age 205 d weaning weight (WW) was calculated using the formula: ([WW- birth BW]/[Julian d of age at weaning—Julian d of birth] ×205 = 205 d avg. WW). Calves remained at GSL for 2 wk after weaning in a drylot and received *ad libitum* hay. Calves were then transported to the feedlot at the West Central Research and Extension Center (WCREC), North Platte.

Post-weaning Calf Management

Steer and heifer calves entered the WCREC feedlot in mid-November as calf-feds. Calves were weighed, received an electronic identification tag, implanted with Synovex Choice (Zoetis Animal Health, Parsippany, NJ) and were separated into pens by sex. Head per pen ranged from 18 to 30 head over the 3 yr of the study. Calves were started on a diet consisting of 20% dry-rolled corn, 35% prairie hay, 35% wet corn gluten feed and 10% supplement (dry matter basis). Over 21 d, calves were adapted to a common finishing diet consisting of 48% dry-rolled corn, 7% ground prairie hay, 38% wet corn gluten feed and 7% supplement (dry matter basis). Diets were fed *ad libitum* throughout the feeding period. Calves were re-implanted approximately 105 d prior to harvest with Synovex Plus (Zoetis Animal Health, Parsippany, NJ). A pour on insecticide was also given at this time (Clean-Up II, Bayer Animal Health, Kansas City, MO). Diets were fed twice daily and individual feed intakes were recorded using a GrowSafe feeding system (GrowSafe Systems Ltd., Airdrie, AB, Canada) after diet adaptation period until 1 d prior to slaughter and was used to measure dry matter intakes (DMI). Body weights were measured on December 13 and 14, and the average of both weights was used for the initial BW. Final BW was calculated using hot carcass weights (HCW) adjusted to a common dressing percentage of 63%. Initial BW and Final BW were used to calculate average daily gain (ADG) and feed to gain (F:G) over the 182 d feeding period. All calves were finished to similar days on feed.

Calves were harvested in mid-June each year (Tyson Fresh Meats, Lexington, NE). Carcass data were collected 24 h following harvest. Carcass data included HCW, backfat (BF), calculated yield grade (YG), *longissimus* muscle area (LMA), and marbling.

Statistical analysis

Data were analyzed as a 2 × 2 factorial with factors being breeding system (AI or NS) and grazing treatment (RNG or MDW) using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC, version 9.4). Individual calf was considered the experimental unit. The model included year and sex as fixed effects and Julian birthdate was included as a covariate. A P—value < 0.10 was considered significant.

Results

Pre-Weaning Calf Growth

Calf growth during the grazing period is reported in Table 1. Breeding and grazing treatments did not affect calf BW at birth, May, or in June ($P \geq 0.12$). Grazing treatment impacted calf BW in July, weaning weight per day of age, and adjusted 205 d average weaning weight ($P \leq 0.06$) with calves grazing MDW weighing more than calves grazing RNG. A breeding × grazing treatment interaction was observed for calf BW in September and at weaning. In September, NS-MDW calves had the greatest BW, AI-RNG and AI-MDW were intermediate, and NS-RNG had the lightest BW ($P = 0.05$). At weaning, NS-RNG calves had the lightest BW ($P \leq 0.09$); all other treatment groups had similar BW. Previous research conducted at the same location from 2015 to 2018 utilizing bulls with maternal

Table 2. Effect of artificial insemination (AI) or natural service (NS) breeding and upland range (RNG) or sub-irrigated meadow (MDW) grazing on feedlot performance of calf-feds[1]

	TREATMENT					P-value[2]		
	AI-MDW	AI-RNG	NS-MDW	NS-RNG	SEM	BRD	GRZ	B × G
% Steers	50	55	45	53				
Arrival BW[3], lb	599	573	599	533	15.7	0.21	<0.01	0.11
Initial BW[4], lb	707[a]	689[a]	714[a]	616[b]	19.4	0.10	<0.01	0.01
ADG, lb/d	3.54	3.80	3.63	3.66	0.10	0.77	0.09	0.18
DMI, lb/d	20.1	20.2	20.0	19.2	0.50	0.30	0.42	0.32
F:G, lb:lb	5.75	5.32	5.51	5.29	0.13	0.32	<0.01	0.33
Final BW[5], lb	1352[a]	1381[a]	1374[a]	1281[b]	32.2	0.24	0.23	0.02

[ab] Means within a row lacking a common superscript differ ($P < 0.10$).

[1]Calves entered feedlot 2 wk after weaning.

[2]BRD = breeding treatment main effect; GRZ = grazing treatment main effect; B × G = breeding x grazing treatment interaction.

[3]Calf BW at arrival to the West Central Research and Extension Center.

[4]Calf weight at GrowSafe entry.

[5]A common dressing percent of 63% was used to calculate final BW from HCW.

Table 3. Effect of artificial insemination (AI) or natural service (NS) breeding and upland range (RNG) or sub-irrigated meadow (MDW) grazing on carcass performance of calf-feds[1]

	TREATMENT					P-value[2]		
	AI-MDW	AI-RNG	NS-MDW	NS-RNG	SEM	BRD	GRZ	B × G
HCW, lb	851[a]	870[a]	865[a]	807[b]	20.3	0.24	0.23	0.02
Backfat, in	0.58	0.54	0.61	0.48	0.04	0.66	0.02	0.18
Marbling[3]	535	556	524	485	25.6	0.12	0.66	0.14
USDA yield grade	2.86[a]	2.91[a]	3.03[a]	2.48[b]	0.17	0.46	0.07	0.03
LMA[4], in	14.8	14.5	14.5	13.9	0.50	0.37	0.26	0.70
Choice$^-$ or greater, %	88	100	97	83	10	0.98	0.98	0.98
Choice^0 or greater, %	53[ab]	72[a]	50[ab]	30[b]	12	0.10	0.97	0.08

[abc] Means within a row lacking a common superscript differ ($P < 0.10$).

[1]Calves entered feedlot 2 wk after weaning.

[2]BRD = breeding treatment main effect; GRZ = grazing treatment main effect; B × G = breeding × grazing treatment interaction.

[3]Marbling: Small^{50} = 450, Modest^{00} = 500, Modest^{50} = 550.

[4]LMA = *Longissimus* muscle area.

traits reported similar calf BW at birth in March and pre-breeding in May from dams that grazed MDW after parturition until July 20 (*2018 Nebraska Beef Cattle Report*, pp. 15–17); however, numerical differences for calf BW at weaning in November were 62 lb greater in the current study. The WW difference in the current study could be attributed to the duration of the grazing period or the genetic potential of the sires utilized in each individual study.

Post-Weaning Calf Performance

Calf-fed feedlot performance is reported in Table 2. Grazing treatment influenced calf weight ($P < 0.01$) when calves were received at WCREC with MDW calves having greater BW then RNG calves. A breeding × grazing treatment interaction was observed when the calves entered the GrowSafe System with NS-RNG calves having lighter BW than all other treatment groups. Treatment influenced ADG during the feeding period with RNG calves having greater ADG compared with MDW calves ($P = 0.09$). Dry matter intakes were not influenced by breeding or grazing treatments. Grazing treatment influenced F:G with RNG calves having improved feed conversion compared with MDW calves. The observed improvement in ADG and F:G ratios within the RNG calves during the feeding period may be due to a compensatory gain. A breeding × grazing treatment interaction was observed for final live weights with NS-RNG calves having the lightest final live weights; all other treatment groups were similar.

Adjusted carcass performance is reported in Table 3 and contains both steer and heifer data. *Longissimus* muscle area was similar among all treatments ($P \geq 0.26$). A breeding × grazing treatment interaction was observed for HCW and YG ($P \leq 0.03$). Grazing treatment prior to feedlot entry influenced BF with MDW calves having more BF than RNG calves ($P = 0.02$). Marbling scores were similar for all treatment groups. The percentage of carcasses that graded choice or greater did not differ among treatments. There was a breeding × grazing treatment interaction (*P* < 0.08) for the percent of carcasses grading upper two-thirds choice with the AI-RNG calves having the most, intermediate for the NS-MDW and AI-MDW, and NS-RNG had the least amount of carcasses grading upper two-thirds choice.

Conclusion

Differences in forage quality between native upland range and sub-irrigated meadow did not seem to influence the growth of the AI sired calves during the grazing treatment. Differences observed within the NS breeding treatment may be due to differences in genetic potential of the sires, or the forage quality available during the grazing season. Because the AI sire had a higher terminal index compared with the bulls selected for NS, it was expected the AI sire progeny would have increased growth and performance; however, the progeny in the NS-MDW treatment group had similar growth and performance when compared with the AI sire's progeny. It is likely that larger differences in calf growth and performance would have been observed if there had been a larger difference in the genetic potential of the sires. Additional days on feed may have increased final live weights, BF thickness, and YG of the NS-RNG calves. An economic evaluation of the current study may clarify advantages and disadvantages.

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