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Summary

October weaned cows had greater average BCS and BW compared to December weaned cows; however, the level of supplementation on winter range did not impact BCS or BW. Subsequent pregnancy rates (96.5% - 98.5%) were not influenced by weaning date or any winter treatments. Steer progeny showed no differences in feedlot entry BW, final BW, DMI, ADG, or carcass characteristics; and there were no differences in percentage cycling before breeding or in pregnancy rates of heifer progeny.

Introduction

Dormant forage does not meet the high nutrient demands of the pregnant cow in the last trimester of pregnancy. Research has determined that only 0.31 lb DM/animal/day of supplemental ruminally degradable protein is necessary to maintain BCS of gestating cows grazing winter range (*1996 Nebraska Beef Cattle Report,* p. 14). Supplementation of 1.0 lb DM/animal/day (42% CP) increased BCS and percentage of live calves at weaning compared to cows not receiving supplemental protein, but had little impact on pregnancy rate (*2006 Nebraska Beef Cattle Report,* p. 7). Adjusting the weaning date of a spring calving system may also help maintain cow BCS on winter range (*2002 Nebraska Beef Cattle Report,* p. 3). However, in that study, researchers were unable to detect a difference in pregnancy rates, possibly because cows were not weaned late enough in the year.

The objectives of the current study were to evaluate long-term effects of prepartum protein supplement and weaning date, and the potential interactions, on cow reproduction, heifer progeny growth and reproduction, and steer progeny growth, feedlot performance, and carcass characteristics.

Procedure

Cow-calf Management

Two years of an ongoing three-year trial used crossbred, March calving cows and calves at University of Nebraska–Lincoln Gudmundsen Sandhills Laboratory. Cows were stratified by age and assigned to the following treatments: 1) cows were weaned in early October (N) or early December (L); 2) between approximately Dec. 1 to Feb. 28, cows received the equivalent of 0.0, 1.0, 2.0 lb DM/animal/day of a protein supplement (Table 1) on dormant upland range (WR), or corn residue grazing with no supplement (CR). Supplement was delivered three times/week on a pasture (88 acre) basis. After the December weaning each year, dams were relocated to dormant upland range pastures, or transported to corn residue fields. Cows were managed together for calving and fed *ad libitum* hay. After calving, all cows were fed 1.0 lb DM/animal/day of protein supplement before turn-out to pastures. At the time of breeding, cows were relocated to upland range pastures and managed as a common group until subsequent December weaning. Estrous was synchronized and cows were artificially inseminated (6 days) with semen from the same two bulls each year, and then placed with bulls for 45 days. Cows were removed from the study only if reproductive failure, calf death, or injury occurred. Replacement females were stratified by age and allotted randomly to treatment of removed cows. No further treatments were imposed on heifer or steer calves. October weaned calves were relocated to cool season meadows and supplemented to gain the equivalent of nonweaned contemporaries until the December wean date. Data reported for cows and calves were collected in 2009 (n = 144) and 2010 (n = 161).

Table 1. Composition and nutrient analysis of supplement[1].

Item	DM, %
Ingredient	
Dried distillers grains with solubles	62.0
Wheat middlings	11.0
Cottonseed meal	9.0
Dried corn gluten feed	5.0
Molasses	5.0
Calcium carbonate	3.0
Trace minerals and vitamins	3.0
Urea	2.0
Nutrient	
CP	31.6
Undegradable intake protein, % CP	47.6
TDN	89.4

[1]formulated inclusion of 80 mg/animal/day monensin.

Heifer Management

After December weaning, October and December weaned heifers were relocated to subirrigated meadows and fed 1.0 lb DM/animal/day of supplement (Table 1) as a common group. At the time of breeding, heifers were moved to upland range pastures to graze for the remainder of the year. Blood samples were collected twice, 10 days apart prior to placement with bulls. Heifers were considered cycling if blood serum progesterone concentrations were > 1 ng/mL. Estrus was synchronized 108 hours after bulls were initially placed with heifers for 45 days. Data reported for heifer growth and reproduction were collected in 2010 (n = 68).

Steer Management

After December weaning, October and December weaned steers were fed *ad libitum* hay in a dry lot for approximately 14 days as a common group. Steers were then transported to the feedlot at West Central Research and

(Continued on next page)

Table 2. Effects of winter wean date and winter grazing treatment during the last third of gestation on cow body condition score (BCS), BW, pregnancy rate, and calf BW.

	October[1]				December[2]				*P*-value[3]		
Item	WR0	WR1	WR2	CR	WR0	WR1	WR2	CR	Wean	Winter	W x W
Cow BCS											
October	5.1	5.2	5.1	5.2	5.3	5.2	5.1	5.4	0.15	0.13	0.15
December	5.1	5.3	5.2	5.3	4.9	4.7	4.9	4.8	< 0.01	0.90	0.13
Pre-calve	4.6	5.1	5.2	5.5	4.6	4.7	5.2	5.4	0.01	< 0.01	0.16
Pre-breed	4.9	5.1	5.1	5.3	5.0	4.9	5.1	5.2	0.82	< 0.01	0.06
Cow BW											
October, lb	1075	1101	1066	1112	1075	1051	1070	1104	0.30	0.15	0.43
December, lb	1049	1068	1026	1071	987	960	987	1007	< 0.01	0.33	0.33
Pre-calve, lb	1055	1108	1123	1216	1020	1020	1104	1161	< 0.01	< 0.01	0.44
Pre-breed, lb	963	1026	998	1057	971	945	1004	1046	0.24	< 0.01	0.18
Pregnancy rate, %	96.1	99.0	98.0	96.9	96.9	98.0	99.0	97.9	0.77	0.52	0.88
Calf BW											
Birth, lb	75[bc]	79[ab]	79[a]	77[abc]	71[d]	73[cd]	79[ab]	79[ab]	0.02	< 0.01	0.03
October, lb	434	480	474	489	425	445	478	472	0.01	< 0.01	0.10
December, lb	502[b]	542[a]	531[a]	551[a]	452[c]	467[c]	502[b]	493[b]	< 0.01	< 0.01	0.03

[abcd]Within a row, means without a common superscript differ ($P < 0.05$).
[1]dams weaned in October: grazed winter range without supplement (WR0); grazed winter range and received 1.0 lb DM/animal daily 32% CP supplement (WR1); grazed winter range and received 2.0 lb DM/animal daily 32% CP supplement (WR2); grazed corn residue without supplement (CR).
[2]Dams weaned in December: grazed winter range without supplement (WR0); grazed winter range and received 1.0 lb DM/animal daily 32% CP supplement (WR1); grazed winter range and received 2.0 lb DM/animal daily 32% CP supplement (WR2); grazed corn residue without supplement (CR).
[3]Wean = weaning date main effect; Winter = winter grazing treatment main effect; W x W = wean date x winter grazing treatment interaction.

Extension Center, where they were limit fed 5 days at 2.0% BW, weighed two days consecutively, and adapted to a common finishing diet fed for 176 days. Steers were assigned to one of eight pens based on weaning date and winter grazing treatment of the dam. Synovex S was administered at feedlot entry, followed by Revalor S approximately 100 days before harvest. Dry matter intake and F:G of treatment group within pen was adjusted by % BW DMI of feedlot pen. Data reported steer progeny growth and carcass characteristics were collected in 2010 (n = 64).

The experiment was completely randomized with treatments arranged in an unstructured 2x4 factorial design. Winter treatments were applied on a pasture basis, and both October and December weaned dams were maintained in a single pasture; pasture or cornstalk residue was not limiting at anytime. Therefore, each group of weaned cows within pasture served as the experimental unit; pasture was replicated three times within the year. Data were analyzed with the GLIMMIX procedure of SAS (SAS Inst., Inc., Cary, N.C.). Model fixed effects included weaning date, winter grazing treatment, and weaning date x winter grazing treatment interaction. Year was considered a random effect for cow and calf variables. Probability values less than 0.05 were considered significant.

Results

The interaction between weaning date and winter grazing treatment was not significant for variables measured in the dams. Effects of weaning date and winter grazing treatment for dams are reported in Table 2. Body condition of cows was not different at the time of October weaning. However, N dams maintained BCS until the time of December weaning; whereas L cows lost BCS during that time. A similar pattern was observed with cow BW. October weaned dams had lower BW and BCS ($P = 0.02$) before calving, but were not different from L dams at the time of breeding. Thus, subsequent pregnancy rates for cows were similar among weaning treatments. Prior to calving and breeding, CR cows had the greatest ($P < 0.01$) BCS and BW. However, subsequent pregnancy rates were not different, regardless of winter grazing treatments applied during the third trimester of gestation.

An interaction ($P = 0.03$) for effects of weaning date and winter grazing treatment occurred for calf birth BW and calf BW in December. Progeny born to N dams receiving 2.0 lb supplement on WR had the heaviest ($P < 0.01$) birth BW, except when compared to contemporaries born to WR dams receiving 1.0 lb supplement. Whereas progeny born to L dams on WR without supplementation had the lightest birth BW ($P < 0.01$), except when compared to progeny born to L dams receiving 1.0 lb supplement on WR. In October, progeny born to N dams had greater ($P = 0.02$) BW than progeny born to L dams. Cows grazing WR without supplement had the lightest ($P < 0.01$) calves in October, when all other winter grazing treatments were similar.

An interaction ($P < 0.01$) for effects of weaning date and winter grazing treatment was found for steer progeny F:G in the feedlot (Table 3). Steer progeny were similar in feedlot entry BW, final BW, feedlot DMI, feedlot

Table 3. Effects of wean date and winter grazing treatment during the last third of gestation of dams on progeny growth and performance.

Item	October[1]				December[2]				P-value[3]		
	WR0	WR1	WR2	CR	WR0	WR1	WR2	CR	Wean	Winter	W x W
Steer progeny											
Initial BW, lb	482	562	507	551	529	488	522	518	0.56	0.76	0.20
DMI, lb/day	21.6	23.8	22.9	24.0	25.1	22.9	24.7	24.0	0.19	0.91	0.24
ADG, lb	3.39	3.52	3.63	3.68	3.44	3.63	3.83	3.72	0.47	0.34	0.97
F:G	6.33	6.76	6.29	6.58	7.35	6.29	6.41	6.41	0.36	0.14	< 0.01
HCW, lb	740	806	786	819	773	773	822	806	0.85	0.51	0.74
LM, in^2	13.05	13.44	13.48	14.03	13.36	13.06	13.38	13.13	0.48	0.88	0.70
FT, in	0.55	0.57	0.56	0.63	0.44	0.56	0.65	0.64	0.91	0.14	0.45
MB	506	536	483	486	488	533	501	526	0.54	0.46	0.67
YG	2.56	2.58	2.52	2.58	2.00	2.52	2.70	2.78	0.75	0.48	0.48
Heifer progeny											
December BW, lb	454	502	544	511	434	458	463	487	< 0.01	0.04	0.41
Pre-breed BW, lb	604	656	676	681	562	601	604	610	< 0.01	0.04	0.88
Post-wean ADG, lb	0.95	0.97	0.81	1.06	0.79	0.91	0.88	0.77	0.07	0.77	0.22
Pregnancy BW, lb	747	789	804	817	709	756	681	762	< 0.01	0.12	0.31
Summer ADG, lb	1.04	0.95	0.93	0.99	1.06	1.04	0.53	1.10	0.74	0.21	0.40
Pregnancy BCS	5.7	5.8	5.8	5.8	5.6	5.9	5.3	6.0	0.39	0.19	0.23
Cycling rate, %	27.3	45.5	57.1	55.6	50.0	0.0	37.5	28.6	0.97	0.96	0.43
Pregnancy rate, %	63.6	63.6	85.7	66.7	58.3	100.0	57.1	83.3	0.98	0.79	0.64

[abcd]Within a row, means without a common superscript differ ($P < 0.05$).
[1]Dams weaned in October: grazed winter range without supplement (WR0); grazed winter range and received 1.0 lb DM/animal daily 32% CP supplement (WR1); grazed winter range and received 2.0 lb DM/animal daily 32% CP supplement (WR2); grazed corn residue without supplement (CR).
[2]Dams weaned in December: grazed winter range without supplement (WR0); grazed winter range and received 1.0 lb DM/animal daily 32% CP supplement (WR1); grazed winter range and received 2.0 lb DM/animal daily 32% CP supplement (WR2); grazed corn residue without supplement (CR).
[3]Wean = weaning date main effect; Winter = winter grazing treatment main effect; W x W = wean date x winter grazing treatment interaction.
[4]$Small^{00}$ = 400.
[5]Calculated from December weaning date to subsequent average breeding date (161 days).
[6]Calculated from average breeding date to subsequent October weaning date (139 days).
[7]Considered cycling if blood serum progesterone concentrations were > 1 ng/mL.

ADG, and carcass characteristics. Previous data (*2009 Nebraska Beef Cattle Report,* p. 5) reported steers born to protein supplemented dams on winter range to have greater final BW, MB, and percentage Choice or greater than nonsupplemented cows. Numerically these data agree with previously reported data.

December and pre-breeding BW of heifers born to N dams were greater ($P < 0.01$) than L heifers. However, there were no differences in percentage cycling before breeding or pregnancy rates. Level of supplement provided to dams had no effect on post-weaning heifer ADG or reproduction. Earlier research (*2009 Nebraska Beef Cattle Report,* p. 5) found a trend for heifers born to dams receiving 1.0 lb DM/animal/day supplemental protein to have greater pregnancy rates than nonsupplemented dams, when three years of data were evaluated. A similar numerical trend was observed in these data. Statistical contradictions may be due to lack of power in one year of data.

Cows weaned in December had decreased BW and BCS with similar pregnancy rates compared to cows weaned in October. Winter grazing management of cows in the third trimester of pregnancy had minimal impact on pregnancy rates. One year of progeny data indicate that weaning date, level of supplementation, and any corresponding interactions may have minimal effect on steer and heifer calves.

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