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Effects of Calf Age at Weaning on Cow and Calf Performance and Feed Utilization in an Intensive Production System

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Summary

The effects of calf weaning age on cow and calf performance, reproduction, and feed utilization were investigated in a two-year study. Early weaning increased cow BW in January. Pregnancy rates were not impacted by calf age at weaning. Dry matter intake (DMI) was similar between normal-weaned cow-calf pairs and early-weaned cows and calves. Feed requirements and utilization were comparable between early- and normal-weaned pairs when fed high energy diets, implying weaning decisions should be made on the basis of management rather than feed efficiency.

Introduction

When conditions dictate the necessity of feeding cows in a drylot setting, limit feeding high-energy diets can reduce feed costs without negatively impacting performance (*2009 Nebraska Beef Cattle Report*, pp. 11-12). Early weaning calves reduces cow maintenance requirements 30-40%, spares available forage, and may have positive effects on reproduction (*Journal of Animal Science*, 68:1438-1446). Previous studies have demonstrated that early-weaned calves are efficient at converting feed to gain (*Journal of Animal Science*, 77:323-329), and that early weaning reduces the total feed energy required by a cow-calf pair (*Journal of Animal Science*, 64:15-22). Given these data, if cow-calf pairs are managed in an intensive (semi- or total-confinement) system, then early weaning may be logical. The objectives of this research were to evaluate the impact of early weaning on: 1) cow-calf performance and reproduction and 2) the feed utilization of developing a weaned calf to 205 days of age.

Procedure

Multiparous (4.6 ± 1 year), crossbred (Red Angus × Red Poll × Tarentaise × South Devon × Devon), lactating beef cows (n = 156) with summer-born calves at side were utilized in a two-year experiment conducted at both the University of Nebraska–Lincoln Agricultural Research and Development Center (ARDC) feedlot located near Mead, Neb., and the Panhandle Research and Extension Center (PHREC) feedlot at Scottsbluff, Neb. The trial was a randomized complete block design with a 2 × 2 factorial arrangement of treatments. Each year, cows were blocked by pre-breeding BW (Heavy, Medium, and Light), stratified by calf age, and assigned randomly within strata to one of four treatments with three replications (pens) per treatment per year (total n = 24 pens). Treatment factors included 1) calf age at weaning: early weaned (EW) at 91 ± 18 days of age or normal weaned (NW) at 203 ± 16 days of age, and 2) research location: eastern (ARDC) or western (PHREC) Nebraska. Cows remaining in the herd for two consecutive years were assigned to the same treatments each year.

Prior to the beginning of the experiment each year, cows within locations were managed as a common group while calving in June and July in earthen feedlot pens without access to shade. Post-calving, cows

Table 1. Ingredient and nutrient composition of diets fed to all cows and calves from October to January by location and year.[1]

	Year 1		Year 2	
Ingredient, %	ARDC	PHREC	ARDC	PHREC
Corn silage	—	—	40.0	40.0
MDGS	56.5	—	36.5	—
WDGS	—	58.0	—	38.0
Cornstalks	40.0	—	20.0	—
Wheat straw	—	40.0	—	20.0
Supplement[2]	3.5	2.0	3.5	2.0
Calculated Composition				
CP, %	19.0	18.8	16.1	15.3
TDN, %	80.0	80.0	78.0	78.4
Ca, %	0.75	0.77	0.58	0.81
P, %	0.50	0.49	0.44	0.41

[1]All values presented on a DM basis.
[2]Supplements contained limestone, trace minerals, vitamins and formulated to provide 200 mg/cow daily monensin sodium.

Table 2. Daily DMI by weaning treatment and year.

	Year 1		Year 2	
Item	EW[1]	NW[2]	EW[1]	NW[2]
Cow	15.0	—	15.5	—
Calf	8.5	—	9.3	—
Cow-calf pair	—	22.8	—	24.9
Total	23.5	22.8	24.8	24.9

[1]EW = early weaned at 91 days of age.
[2]NW = normal weaned at 203 days of age.

Table 3. Performance of cows by location and weaning treatment.

	ARDC		PHREC			*P*-value		
Item	EW[4]	NW[5]	EW[4]	NW[5]	SEM	Weaning[1]	Location[2]	W × L[3]
Cow BW, lb								
October	1201	1180	1227	1212	114	0.26	0.08	0.85
January	1206	1166	1302	1232	104	0.02	<0.01	0.51
Cow BW change, lb	5	-14	74	20	23	<0.01	<0.01	0.15
Cow BCS[6]								
October	5.5	5.5	5.2	5.2	0.3	1.00	<0.01	0.59
January	5.4	5.3	5.6	5.6	0.4	0.60	0.03	0.60
Cow BCS change[6]	-0.1	-0.2	0.4	0.4	0.2	0.38	<0.01	0.38
Pregnancy, %	89.9	85.4	92.5	95.2	6	0.88	0.25	0.50

[1]Fixed effect of calf age at weaning.
[2]Fixed effect of location.
[3]Calf age at weaning × location interaction.
[4]EW = early weaned at 91 days of age.
[5]NW = normal weaned at 203 days of age.
[6]BCS on a 1 (emaciated) to 9 (obese) scale.

Table 4. Performance of calves by location and weaning treatment.

	ARDC		PHREC			*P*-value		
Item	EW[4]	NW[5]	EW[4]	NW[5]	SEM	Weaning[1]	Location[2]	W × L[3]
Calf BW[6], lb								
October	280	277	288	267	8	0.13	0.92	0.22
January	475[b,c]	510[a]	499[a,b]	461[c]	11	0.90	0.19	<0.01
Calf ADG, lb	1.73[b,c]	2.06[a]	1.86[b]	1.70[c]	0.18	0.09	0.02	<0.01

[1]Fixed effect of calf age at weaning.
[2]Fixed effect of location.
[3]Calf age at weaning × location interaction.
[4]EW = early weaned at 91 days of age.
[5]NW = normal weaned at 203 days of age.
[6]Actual weights.
[a-c]Within a row, least squares means without common superscripts differ at $P \leq 0.05$.

were limit-fed high energy distillers grains-based diets to meet nutrient requirements for lactation. Upon trial initiation (approximately Oct. 5), EW calves were weaned at 91 days of age and fed separately from their dams within each location. Normal-weaned calves remained with their dams and were weaned approximately Jan. 28 at 203 days of age. Two-day consecutive cow BW measurements were recorded to determine weight change from October to January. Body condition score was assessed visually by the same experienced technician at the same time weights were taken. Two-day consecutive calf BW measurements were collected to evaluate gain from October through January. Prior to collecting weights, all pairs were limit-fed for five days prior to initiation and upon completion of the trial to minimize variation in gastrointestinal tract fill.

From October through January, EW cows within each location were limit-fed 15.0 (year 1) or 15.5 (year 2) lb DM/cow daily a diet designed to meet maintenance energy requirements for a nonlactating cow (Table 1). Concurrently, EW calves within each location were offered *ad libitum* access to the same diet as the cows. Normal-weaned cow-calf pairs were limit-fed the equivalent amount of DM by adding the DMI of the EW cows and calves. Intake was not partitioned between the NW cow and calf. Consequently, the total DMI between either the EW cows and calves or the NW pairs was intended to be equal and increased due to growth and diet consumption by the calf. All cattle were pen-fed once daily in concrete fence line feed bunks with the following bunk space allotments: 2 feet per EW cow, 1 foot per EW calf, and 3 feet per NW cow-calf pair.

Cows were exposed to fertile Simmental × Angus bulls at a bull:cow ratio of 1:10 for 60 days beginning Sept. 26, and breeding occurred in the pens. Pregnancy was diagnosed via ultrasound 60 days after bull removal.

Data were analyzed as a randomized complete block design with pen as the experimental unit. Model fixed effects included calf age at weaning, location, and the weaning × location interaction. Since the proportion of steer and heifer calves was unequal among treatments, calf sex was initially included as a covariate for all variables tested and was subsequently removed if not significant. Block and year were included in all analyses as random effects, and significance was declared at $P \leq 0.05$.

Results

Early-weaned calves across locations had a daily DMI of 8.5 lb (year 1) and 9.3 lb (year 2) from October through January (Table 2). This amount was adjusted weekly and added to the 15.0 lb (year 1) or 15.5 lb (year 2) DM fed to the EW cows to derive the total amount fed to the NW pairs. Therefore, the EW cows and calves consumed 23.5 and 24.8 lb total DM/day in year 1 and 2, respectively. The NW pairs consumed 22.8 and 24.9 lb DM/day, for year 1 and 2, respectively. As a result, on average approximately 18.5 lb (year 1) and 19.5 lb (year 2) of TDN was supplied to both EW and NW treatments.

Cow performance and reproduction variables are presented in Table 3. The weaning age by location interaction for cow BW in January was not significant. Cows at PHREC had significantly greater BW than ARDC cows, and EW cows had greater BW in January than cows that nursed their calves. Likewise, there was no significant weaning age by location interaction for cow BW change, and EW cows gained more BW than

(Continued on next page)

NW. Additionally, cows at PHREC outgained those at ARDC ($P \leq 0.05$). Despite these changes in cow BW, there was no significant interaction or weaning age effect for January BCS or BCS change. Interestingly, regardless of weaning date, PHREC cows gained 0.4 BCS units while ARDC cows lost about 0.2 BCS units between October and January. The weaning age by location interaction was not significant for cow pregnancy rate nor were there significant effects of location or weaning.

Calf BW and gain data are presented in Table 4. By design, BW was similar among treatments in October. There were significant weaning age by location interactions for both ADG and ending January BW. At PHREC, EW calves gained significantly more and had greater January BW than NW, whereas at ARDC, calves nursing their dams had improved gain and ending BW over those early-weaned.

The positive response in cow BW and BW change from early weaning is logical as calf removal diverts intake energy from lactation towards body tissue storage (i.e., BCS). Why BCS did not respond to early weaning is interesting, but in general these changes in BW and BCS are numerically small and may have limited biological significance. Greater improvement in BW and BCS from early weaning would likely be seen in thin (BCS < 5.0) or young (2 to 3-year-old) cows. The pregnancy rates also suggest mature cows in adequate BCS prior to the onset of the breeding season may have limited reproductive response to early weaning. It is not clear why significant location effects were observed, but this may be related to inherent variance that can be present when genetically identical cowherds are managed similarly. Differences in weather conditions between locations throughout the trial may have contributed to the location effects. Although we assume equal energy values (43% TDN, DM) for cornstalks and wheat straw, potential differences in digestibility between these forages may also exist.

As both DMI and cow-calf performance were relatively similar between EW and NW pairs, feed utilization was comparable. When feed utilization is expressed as lb of calf gain per lb of TDN intake by the pair, EW and NW pairs on average had values of 0.094 and 0.099, respectively. Early weaning appears to have marginal effect on cow performance and reproduction when pairs are limit-fed high energy diets, provided BCS is acceptable (≥ 5.0) prior to the beginning of the breeding season, as in the current study. Early-weaned calves fed wet, high-energy diets with distillers grains have comparable ADG to those not weaned. Our data suggest that early weaning does not reduce the feed energy requirements necessary to support the pair. Therefore, decisions on early-weaning should be made on a management and forage availability basis as opposed to feed efficiency.

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