Confined Cow-Calf Production System and Post-Weaning Management Impact on Calf Production

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Summary with Implications

Calf performance was measured in a 3-yr study with a 2 × 2 factorial treatment design: 1) cow-calf production system (dry lot feeding or grazing corn residue) and 2) directly finishing calves or growing prior to finishing. Calves wintered on cornstalks were lighter at weaning than calves wintered in the dry-lot. However, following the finishing period, there were no effects of pre-weaning production system on final body weight or hot carcass weight. Calves directly adapted to a finishing diet had greater gain and improved efficiency compared to calves fed a grower diet prior to finishing. However, calves that were grown first produced 51 lb greater hot carcass weight. Directly finishing calves resulted in greater net profit as the extra hot carcass weight did not offset the cost of the additional 49 days in the feedlot. Wintering cows with calves on cornstalks instead of in a dry-lot resulted in lighter calves, but calves compensated in the feedlot.

Introduction

When traditional forage resources are limited, alternative beef production systems may be necessary. Research has demonstrated that year-round confinement of the cowherd can be used as an alternative to traditional pasture cow-calf production (*2015 Nebraska Beef Cattle Report,* pp. 15–18). In addition to alternative cow-calf production systems, different post-weaning management strategies may be implemented. Two common post-weaning systems are to either directly adapt calves to a finishing diet following weaning or grow the calves for a period of time prior to the finishing phase. Calves are commonly grown in an extensive system using grazed forages or crop residue. An alternative growing program consists of backgrounding calves in pens in which harvested forages are fed. The type of post-weaning management utilized can affect finishing performance and carcass characteristics. Research has indicated that calf-feds have improved feed efficiency, but yearlings gain faster and produce greater carcass weight (*2009 Nebraska Beef Cattle Report*, pp. 43–46). The objective of the current study was to evaluate cow-calf production system and post-weaning management on finishing performance and carcass characteristics of steer and heifer calves produced from an intensively managed cowherd.

Table 1. Composition of growing and finishing diets[1]

	Growing Diet		
Ingredient, % of diet DM	Year 1	Year 2	Year 3
Sweet Bran[1]	30	30	30
Wheat Straw	31	31	31
Modified distillers grains	35	-	-
Wet distillers grains	-	35	35
Supplement[2,3]	4	4	4
	Finishing Diet		
Ingredient, % of diet DM	Year 1	Year 2	Year 3
High moisture corn	50	51	51
Sweet Bran[1]	30	30	30
Wheat Straw	5	-	-
Grass Hay	-	5	5
Modified distillers grains	10	10	-
Wet distillers grains	-	-	10
Supplement[2,4]	5	4	4

[1]Sweet Bran sourced from Cargill Corn Milling, Blair, NE

[2]Supplement included limestone, trace minerals, and vitamin A,D,E premix

[3]Formulated for 200 mg/animal of Rumensin daily (Elanco Animal Health, Greenfield, IN)

[4]Formulated for 330 mg/animal of Rumensin and 90 mg/animal of Tylan daily (Elanco Animal Health)

Procedure

Summer-born steer (n = 114) and heifer (n = 95) calves [body weight (BW) = 582, standard deviation = 93 lb] were utilized in a study conducted over 3 years at the Eastern Nebraska Research and Extension Center (ENREC) feedlot. Calves were sourced from 2 cowherds maintained at either ENREC (124 calves) or the Panhandle Research and Extension Center (PREC; 85 calves). The study was completely randomized with a 2 × 2 factorial treatment design. Factors were 1) cow-calf production system and 2) post-weaning management.

Cow-calf Production System

Within each location, cowherds were maintained in confinement from approximately April to November during which the calving season occurred. In November,

cow-calf pairs were assigned randomly to one of two winter cow-calf production treatments: 1) dry-lot feeding (DLOT) or 2) corn residue grazing with supplementation (STALK). Cow-calf pairs assigned to the DLOT treatment were limit-fed a distillers and crop residue-based diet formulated to meet energy requirements of a lactating cow in early gestation. The amount of dry matter (DM) offered increased monthly to account for increasing intake of the growing calf. Cow-calf pairs assigned to the STALK treatment were hauled to irrigated cornstalk fields and supplemented with approximately 5.3 lb (range of 3.7 to 7.1 lb) of a distillers-based cube daily. Calves from both cow-calf production systems were weaned in April and received into the ENREC feedlot for post-weaning treatments.

Post-weaning Management

For post-weaning treatments, calves in the FINISH treatment were directly adapted to a concentrate finishing diet (Table 1) following weaning. In the GROW treatment, calves were fed a growing diet (Table 1) for approximately 76 days before being adapted to the same finishing diet as calves in the FINISH treatment.

Calves in the FINISH treatment began the finishing phase in April and were finished in November (196 DOF). Calves in the GROW treatment were fed a grower diet from April to July (76 DOF) and then adapted to a finishing diet for harvest in late December (169 DOF + 76). In year 1, calves were implanted with Revalor XS (steers; Merck Animal Health, Summit, NJ) or Revalor-IH (heifers; Merck Animal Health). Heifers were re-implanted with Revalor 200 (Merck Animal Health) approximately 100 days prior to harvest date. In years 2 and 3, all calves were implanted with Component TE-IS (steers; Elanco Animal Health) or Component TE-IH (heifers; Elanco Animal Health) at initial processing. All calves were then re-implanted with component TE-200 approximately 100 days before harvest. Ractopamine hydrochloride (Optaflexx; Elanco Animal Health) was included (300 mg/head daily) in the common finishing diet for the last 28 days on feed for all cattle every year.

Cattle were limit-fed a common diet for a minimum of 5 d prior to collecting initial body weight (BW) on 2 consecutive days. For calves in the GROW treatment, ending BW for the growing phase was used as initial BW for the finishing phase. To obtain a common physiological endpoint between treatments, ultrasonography was used to detect 12th rib fat thickness on GROW cattle approximately 40 d prior to projected harvest date each year. The ultrasound scans were then used to predict harvest date by targeting backfat thickness equal to FINISH cattle. On the day of harvest, hot carcass weight (HCW) and liver abscess scores were recorded. Following a 48-hour chill, 12th rib fat thickness, marbling score, and ribeye area were recorded. Final BW, average daily gain (ADG), and feed: gain (F:G) were calculated on a carcass-adjusted basis using a common dressing percentage of 63%.

Table 2. Economic assumptions applied to post-weaning management systems

	Treatments	
Item	FINISH[1]	GROW[2]
Growing phase		
Yardage, $/hd daily	-	0.45
Health, $/hd	-	15.00
Diet cost, $/ton	-	156.49
Interest, %	-	6.2
Finishing phase		
Yardage, $/hd daily	0.45	0.45
Health, $/hd	15.00	15.00
Diet cost, $/ton	188.15	188.15
Interest, %	6.2	6.2
Cattle Prices		
Feeder calf price[3], $/lb	1.53	1.53
Feeder calf price[4], $/lb	1.36	1.36
Selling price dressed basis[5], $/lb	1.83	1.83
Interest, %	6.2	6.2

[1]FINISH = calves directly adapted to finishing diet following weaning

[2]GROW = calves fed grower ration for 76 d diet prior to finishing phase

[3]10-yr average calf price for steers and heifers weighing 500–600 lb.

[4]10-yr average calf price for steers and heifers weighing 600–700 lb.

[5]10-yr average live cattle price adjusted to a 63% dressing percentage for calculation of selling price on a dressed basis

Economic Analysis

A 10-year (2007–2016) analysis was used to economically compare post-weaning management systems. An average price of $1.45/lb was used for the purchase of weaned steer and heifer calves (Table 2). A price slide of $17.23 per cwt was used to account for differences in weaning weights between cow-calf production systems. The costs of distillers grains and Sweet Bran were calculated as 100% the value of $4.59/bu corn. Base price for grass hay/wheat straw was $50 per ton plus $15/ton for processing. Supplement was priced at $200 per ton. An interest rate of 6.2% was applied to the total cost associated with each phase and half of the initial animal cost. Feedlot yardage was held constant at $0.45 per head per day for both treatments. Similarly, all cattle were charged $15 per head for health and processing fees. A live cattle price ($1.15/lb) was adjusted to a 63% dressing percentage to determine selling price ($1.83/lb) on a dressed basis. Cost of gain (COG) in each phase was calculated by dividing costs associated with each phase (not including purchase price of the animal) by the BW gained during the phase.

Data were analyzed using the mixed procedure of SAS (SAS Institute, Inc., Cary, N.C.) as a completely randomized design. Experimental unit was pen with cow-calf production system, post-weaning management, and the cow-calf × post-weaning interaction included in the model as fixed effects. Location and year were included as random effects. Because the proportion of steers and heifers varied within pen,

Table 3. Effects of post-weaning management & cow-calf production system on finishing performance and carcass characteristics

	FINISH[1]		GROW[2]			*P*-value		
	DLOT[3]	STALK[4]	DLOT[3]	STALK[4]	SEM	Post-weaning	Cow-calf	Int.[5]
Growing performance								
Days on Feed			76	76				
Initial BW, lb	-	-	623	551	17	-	0.02	-
Ending BW, lb	-	-	832	785	17	-	0.11	-
DMI, lb/d	-	-	17.5	18.3	1.2	-	0.09	-
ADG, lb	-	-	2.68	3.01	0.21	-	0.03	-
F:G[6]	-	-	6.47	5.98	-	-	0.07	-
Finishing performance								
DOF	196	196	169	169				
Initial BW, lb	615	554	832	785	21	<0.01	<0.01	0.62
Final BW[7], lb	1310	1298	1392	1368	33	<0.01	0.15	0.65
DMI, lb/d	20.7	21.1	21.9	22.7	0.8	<0.01	0.08	0.60
ADG, lb	3.55	3.81	3.27	3.48	0.11	<0.01	<0.01	0.80
F:G[6]	5.80	5.55	6.66	6.57	-	<0.01	0.02	0.15
Carcass characteristics								
HCW, lb	825	817	879	862	21	<0.01	0.15	0.64
Ribeye area, in^2	13.6	13.8	13.9	13.7	0.3	0.66	0.92	0.15
12th rib fat, in	0.55	0.52	0.60	0.60	0.04	0.06	0.65	0.65
Marbling[8]	424^a	422^a	438^a	491^b	15	<0.01	0.05	0.04
Calc. Yield Grade	3.3	3.1	3.4	3.4	0.2	0.04	0.44	0.33

[1]FINISH = calves directly adapted to finishing diet following weaning

[2]GROW = calves fed grower ration for 76 d diet prior to finishing phase

[3]DLOT = winter dry-lot feeding of cow-calf pair prior to weaning

[4]STALK = winter corn residue grazing of cow-calf pair prior to weaning

[5]Test for cow-calf production by post-weaning management interaction

[6] Feed to Gain (F:G) was calculated and analyzed as Gain to Feed

[7]Calculated on a carcass-adjusted basis using a common dressing % (63%)

[8]Marbling score: 400 = Small, 500 = Modest, etc.

proportion of steers within each pen was included as a covariate for all variables.

Results

Performance of GROW cattle during the growing phase is presented in Table 3. Initial BW was lighter for calves that had previously been wintered on cornstalks compared to calves wintered in the dry-lot ($P = 0.02$). However, STALK calves had greater ADG ($P = 0.03$) and tended to have greater dry matter intake (DMI; $P = 0.09$) and improved F:G ($P = 0.07$) compared to DLOT calves.

No significant cow-calf production by post-weaning management interactions were observed for any finishing performance variables tested ($P \geq 0.15$; Table 3). Cattle that were previously wintered on cornstalks had lighter initial BW entering the finishing phase than cattle that had been wintered in the dry-lot ($P < 0.01$). However, STALK cattle appeared to have a compensatory response characterized by greater ($P \leq 0.02$) ADG and lower F:G and a tendency ($P = 0.08$) for greater DMI during finishing compared to DLOT cattle. When evaluating the effects of post-weaning management on finishing performance, GROW cattle had greater initial BW, final BW, and DMI compared to FINISH cattle ($P < 0.01$). However, cattle in the FINISH treatment had increased ADG and subsequently improved F:G compared to GROW cattle ($P < 0.01$).

The GROW cattle had 51 lb greater HCW compared to FINISH cattle ($P < 0.01$; Table 3). Twelfth rib fat thickness tended to be greater for GROW cattle relative to FINISH cattle ($P = 0.06$). The GROW cattle also had greater yield grade than FINISH cattle ($P = 0.04$). The GROW cattle could have been fed fewer days in order to be harvested at an equal fat endpoint as the FINISH cattle, which would have resulted in a smaller difference in HCW between treatments.

Economic Analysis

No significant cow-calf production by post-weaning management interactions were observed for any economic variables tested ($P \geq 0.57$; Table 4). Due to differences in initial BW, initial purchase cost during the growing phase was greater if calves had previously been wintered in the dry-lot compared to calves wintered on cornstalks ($P = 0.04$; Table 4). Although no significant difference between treatments was observed for growing cost ($P = 0.26$), growing COG

Table 4. Economic analysis of cattle by post-weaning management and cow-calf production system

	FINISH[1]		GROW[2]			*P*-value		
Item, $/animal	DLOT[3]	STALK[4]	DLOT[3]	STALK[4]	SEM	Post-weaning	Cow-calf	Int.
Growing Phase								
Purchase Cost	-	-	894.80	835.70	15.34	-	0.04	-
Growing Cost[5]	-	-	163.65	167.07	9.32	-	0.26	-
Growing COG[6]	-	-	78.37	70.73	7.68	-	0.10	-
Finishing Phase						-		-
Purchase Cost	891.72	834.44	-	-	14.8	-	0.01	-
Finishing Cost[5]	513.45	521.47	468.09	476.53	21.63	<0.01	0.21	0.98
Finishing COG[6]	71.81	68.27	81.82	79.46	1.71	<0.01	0.01	0.57
Total System Cost								
Total Cost	513.45	521.47	631.74	643.60	26.48	<0.01	0.25	0.81
Total COG[6]	71.81	68.28	80.09	76.39	2.27	<0.01	0.01	0.95
Total Revenue	1502.56	1488.62	1585.23	1578.92	36.89	<0.01	0.46	0.78
Net Profit	97.19	132.03	59.58	99.04	20.71	0.01	0.01	0.86

[1]FINISH = calves directly adapted to finishing diet following weaning

[2]GROW = calves fed grower ration for 76 d diet prior to finishing phase

[3]DLOT = winter dry-lot feeding of cow-calf pair prior to weaning

[4]STALK = winter corn residue grazing of cow-calf pair prior to weaning

[5]Total diet, yardage, health, and interest cost during the growing or finishing phase

[6]Cost of gain (COG; $/cwt) calculated by dividing costs associated with each phase (animal purchase costs and interest on the animal not included) by the BW gained during the respective phase

tended ($P = 0.10$) to be lower for STALK calves as a result of greater daily gain during the growing phase.

Likewise, initial purchase cost and COG during the finishing phase was greater for DLOT calves compared to STALK calves ($P = 0.01$; Table 4). When evaluating the main effects of post-weaning management on finishing variables, finishing cost was greater ($P < 0.01$) for FINISH cattle compared to GROW cattle largely due to FINISH cattle having 27 more DOF during the finishing phase. Conversely, finishing COG was less ($P < 0.01$) for FINISH cattle compared to GROW cattle due to FINISH cattle having improved F:G during finishing.

For the economics of total system (weaning through harvest), STALK cattle had less overall COG ($P = 0.01$; Table 4), which was a reflection of the improved F:G observed for STALK cattle relative to DLOT cattle. Although similar revenue ($P = 0.46$) was generated between treatments, STALK cattle produced $37 greater net profit than DLOT cattle ($P = 0.01$) as a result of reduced initial purchase cost of STALK cattle (due to less BW). Because of increased HCW, GROW cattle generated $86 greater total revenue in relation to revenue received from FINISH cattle. However, FINISH cattle had decreased total cost and COG, which subsequently resulted in $35 greater net profit compared to GROW cattle ($P \leq 0.01$).

Previous research has shown growing cattle prior to finishing to be profitable. However, most of that work was done using grazed forages (grass, crop residues, or cover crops). Furthermore, these were calf-feds while much of the previous work has compared short and long yearlings. In the current analysis, the growing diet was 83% the cost of the finishing diet ($156/ton ÷ $188/ton). In order for net profitability to be equal between the GROW and FINISH treatments, the cost of the growing diet would need to be 58% ($108/ton) of the cost of the finishing diet.

Conclusion

Although calves wintered on cornstalks were lighter at weaning than drylot wintered calves, there were no significant differences in finished live weight or hot carcass weight due to pre-weaning management. Calves directly adapted to a finishing diet had greater gain and improved efficiency compared to calves fed a grower diet prior to the finishing phase. Although calves receiving the grower diet produced heavier carcasses, the extra days on feed made them less profitable than those calves directly placed on a finishing diet.

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