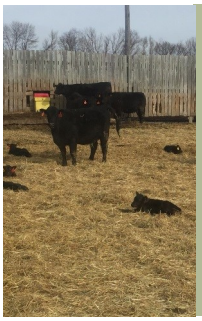

The Relationship between Creep Feeder Appearance Pre-weaning and Calf Intake, Gain and Feed Efficiency Post-weaning

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The objectives of this study were to determine the effect of preweaning creep feeding behavior on post-weaning feeding behavior, performance and carcass characteristics.

Summary

Suckling crossbred Angus steers (n = 32) at the Central Grasslands Research Extension Center (Streeter, N.D.) were fitted with transmission beacons on collars to determine the effect of preweaning creep feeding behavior on post-weaning feeding behavior, performance and carcass characteristics. Preweaning data included number of days visiting creep feeders and total minutes at the feeder.

Calves then were weaned and acclimated to finishing diets and an Insentec feeding system (which recorded feed intake and behavior) for a 24-day transition period, followed by a 172-day finishing period. Carcass characteristics were collected upon slaughter at a commercial abattoir.

Steer attendance at creep feeders was categorized as FREQUENT (attending greater than 80 percent of days) or INFREQUENT (attending less than 80 percent of days). Post-weaning feeding behavior data were summarized by 1) ration transition period (24 days) and 2) first 28 days on the finishing ration.

The effects of creep feeder attendance on post-weaning feeding behavior and carcass characteristics were analyzed using the GLM procedure of SAS. During the 24-day transition period, frequent creep feeder visitors ate more meals ($P = 0.05$) but had reduced time per meal, intake per meal and dry-matter intake (DMI) ($P \leq 0.03$), compared with infrequent visitors.

During the first 28 days of finishing, frequent creep feeder visitors spent more time eating and ate more meals, compared with infrequent visitors ($P \leq 0.01$), but infrequent visitors ate more DMI per meal and ate faster ($P \leq 0.04$). The frequency of creep feeder attendance had no impact on DMI, average daily gain (ADG), gain-to-feed (G:F) during the feeding period, or on carcass weight, marbling or loin-eye area ($P \geq 0.19$).

However, backfat and yield grade were greater for frequent visitors ($P \geq 0.03$), compared with infrequent steers. Overall, data indicate that preweaning creep feeder attendance influenced postweaning feeding behavior and carcass characteristics.

Introduction

Supplementing nursing calves has been used to increase preweaning weight gains (Tarr et al., 1994; Loy et al., 2002), reduce grazing pressure and improve intake at weaning (Reed et al., 2006). Increased weaning weights of calves can increase the gross income of many cow-calf production systems that sell calves at weaning (Martin et al., 1981; Tarr et al., 1994).

Additionally, creep feeding has been found to alter behavior by training calves to recognize milled feed and availability of feed from mechanical devices (Pritchard, 2013). Utilization of such devices can help producers understand feeding behavior and monitor calf performance in grazing settings.

Electronic ID systems have been used largely to qualify calves for export programs and, to a lesser extent, manage calves in feedlot scenarios. However, systems that integrate electronic identification on a ranch level into future decisions about cattle management are not available. Development of such systems could result in many improvements in management of cattle and could result in management or feeding approaches to improve the efficiency of production of calves and of beef.

The use of electronic monitoring systems in the beef industry has been limited and primarily has been used in research settings to examine the effects on feed intake in relation to cattle growth performance (Islas et al., 2014), health status (Wolfger et al., 2015) or animal movement in extensive pasture settings (Schauer et al., 2005). These technologies could be adapted easily for use in beef cattle production systems to monitor activity, feeding or drinking behavior, or as tools for monitoring inventories in intensive or extensive production systems.

Tremendous potential exists for utilizing these types of technologies to predict cattle performance that will allow for the development of precision management programs. Therefore, the objectives of this study were to evaluate the effect of preweaning creep feeding behavior on post-weaning feeding behavior, performance and carcass characteristics.

Animal Procedures

Suckling crossbred Angus steers (n = 32) at the Central Grasslands Research Extension Center (Streeter, N.D.) were fitted with transmission beacons on collars. Each beacon contained an accelerometer, and upon movement, transmitted data to receiver gateways placed at the feeders. All calves had access to creep

feeders equipped with beacon gateways that sent data through a cellular network to a cloud platform.

Pre-weaning data included number of days visiting creep feeders and total minutes at the feeder. Only 32 working beacons were recorded for the creep feeding period (24 days) prior to the steers being shipped to the Beef Cattle Research Complex (BCRC) in Fargo, N.D.

Upon weaning, weights were recorded and calves were shipped to the BCRC. Steers were acclimated to finishing diets and an Insentec feeding system (Hokofarm Group B.V., the Netherlands), which recorded feed intake and behavior during a 24-day transition period, followed by a 172-day finishing period.

Upon completion of the trial, data from the Insentec feed system were combined with the creep feeder beacon data. Feed intake and behavior were summarized by day for each individual steer. Steer attendance at creep feeders was categorized as FREQUENT (attending greater than 80 percent of days) or INFREQUENT (attending less than 80 percent of days). Post-weaning feeding behavior data were summarized by 1) ration transition period (24 days) and 2) first 28 days on finishing ration.

Carcass characteristics were collected upon slaughter at a commercial abattoir; hot carcass weight data were obtained following animal slaughter, whereas marbling score, backfat, longissimus area, kidney, pelvic, heart fat (KPH) and yield grade were taken after carcasses were chilled in the cooler.

All procedures were conducted in accordance to the rules of the North Dakota State University Institutional Animal Care and Use Committee.

Analysis

All data were analyzed for the effects of creep feeder attendance on post-weaning feeding behavior and carcass characteristics using the GLM procedure of SAS (9.4; SAS Institute Inc., Cary, N.C.). Differences were determined using the least square means and considered significant at $P < 0.05$.

Results and Discussion

For October, beacons were recording appearance or the number of visits per calf at the creep feeders. The number of visits for the duration of the month can be observed in Figure 1 (see next page). Overall, the feeders were visited at least 28 times during a period throughout the day. The maximum number of visits was 99 times in one day.

Data for feeding behavior are reported in Table 1. Steers in the frequent category attended feeders an average of 90.6 percent of days; whereas, steers in the infrequent category attended feeders an average of 62.5 percent of days. During the 24-day transition period (Table 2), frequent creep feeder visitors ate more meals ($P = 0.05$) but had reduced time per meal, intake per meal and DMI ($P \leq 0.03$), compared with infrequent visitors. Steers that were more frequent visitors to the creep feeder attended the feedlot bunks within the first seven days upon arrival to the BCRC a greater percentage of time, compared with infrequent visitors (59 vs. 37 percent, respectively).

During the first 28 days of finishing, frequent creep feeder visitors spent more time eating and ate more meals, compared with infrequent visitors ($P \leq 0.01$), but infrequent visitors ate more DMI per meal and ate faster ($P \leq 0.04$). Frequency of creep feeder attendance had no impact on DMI, ADG, G:F over the feeding period, or on carcass weight, marbling or loin-eye area ($P \geq 0.19$).

Studies of creep feeding calves for 28 days showed no advantage to feedlot performance and carcass characteristics or when calves were on creep feed for longer amounts of time (Tarr et al., 1994). Data for carcass characteristics are reported in Table 3. Backfat and yield grade were greater for frequent visitors ($P \geq 0.03$), compared with infrequent steers. Studies of calves gaining similarly to the calves in this study have shown mixed results regarding backfat thickness, with increased time on creep feed resulting in greater fat thickness (Tarr et al., 1994).

Overall, data indicate that preweaning creep feeder attendance influenced post-weaning feeding behavior and carcass characteristics.

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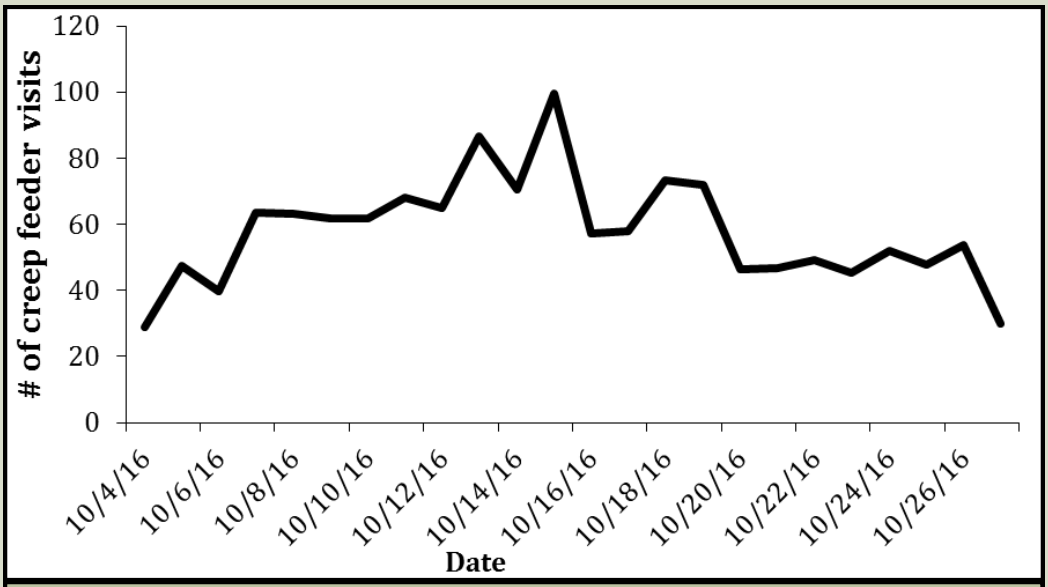

Figure 1. Number of creep feeder visits by suckling crossbred Angus steers.

Table 1. Impact of frequency of creep feeder visits on growth performance and feeding behavior in crossbred Angus steers during the first 28 days on feed.

	Visiting frequency category[1]			
Item	**Frequent**	**Infrequent**	**SE**	***P*-Value**
No. of steers	13	11		
DMI[2], kg	6.41	6.53	0.298	0.768
ADG[3], kg	0.99	0.90	0.149	0.663
G:F	0.153	0.130	0.149	0.446
Time spent eating, min.	158.4	126.4	7.91	0.009
Visits	33.8	27.2	3.17	0.153
Meals	12.7	10.7	0.52	0.014
Time per visit, min.	5.86	6.83	0.80	0.406
Time per meal, min.	13.31	12.61	1.03	0.635
Kg per visit	0.248	0.371	0.037	0.031
Kg per meal	0.852	1.053	0.064	0.037
Kg per minute	0.066	0.086	0.003	<0.001

[1]Steers in the Frequent category attended feeders an average of 90.6 percent of days, whereas steers in the Infrequent category attended feeders an average of 62.5 percent of days.

[2]DMI = dry-matter intake

[3]ADG = average daily gain

Table 2. Impact of frequency of creep feeder visits on transition period feeding behavior of crossbred Angus steers.

	Visiting frequency category[1]			
Item	**Frequent**	**Infrequent**	**SE**	***P*-Value**
No. of steers	13	11		
Count 7 days	4.15	2.6	0.45	0.024
Count 17 days	17	16.9	0.06	0.264
Count 24 days	21.2	19.5	0.47	0.021
% Attend 7 days	0.59	0.37	0.06	0.024
% Attend 17 days	1.00	0.99	0.004	0.264
% Attend 24 days	0.88	0.81	0.02	0.264
Training (24 d)				
DMI[2], kg	5.29	6.15	0.26	0.031
Time spent eating, min.	93.12	102.08	6.98	0.375
Visit	39.3	33.4	3.07	0.200
Meal	13.97	12.43	0.52	0.048
Time per visit, min.	2.34	3.47	0.29	0.014
Time per meal, min.	6.55	8.33	0.54	0.029
Kg per visit	0.135	0.215	0.021	0.015
Kg per meal	0.371	0.507	0.024	0.001
Kg per minute	5.65	3.26	1.58	0.297

[1]Steers in the Frequent category attended feeders an average of 90.6 percent of days, whereas steers in the Infrequent category attended feeders an average of 62.5 percent of days.

[2]DMI = dry-matter intake

Table 3. Impact of frequency of creep feeder visits on carcass characteristics of crossbred Angus steers.

	Visiting frequency category[1]			
Item	**Frequent**	**Infrequent**	**SE**	***P*-Value**
No. of steers	13	11		
HCW[2], kg	367.1	356.4	8.6	0.389
Marbling score	487.4	445.3	21.7	0.186
Backfat, cm	1.40	1.02	0.09	0.013
Longissimus area, cm^2	84.13	84.83	1.93	0.800
KPH[3], %	2.02	1.88	0.052	0.067
Calculated yield grade	3.24	2.66	0.176	0.031

[1]Steers in the Frequent category attended feeders an average of 90.6 percent of days, whereas steers in the Infrequent category attended feeders an average of 62.5 percent of days.

[2]HCW = hot carcass weight

[3]KPH = kidney, pelvic and heart fat