Influence of Weaning Date (Early or Normal) on Performance, Health, and Carcass Characteristics of May-born Angus Calves

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Impact Statement
This study investigates the effects of two different weaning dates (early or normal) on calf performance, health, and carcass characteristics of May-born Angus calves during the backgrounding phase while at Southwest Feeders, Hettinger, ND in the fall of 2006. In this study, weaning date did not negatively affect average daily gain, dry matter intake, feed conversion, calf health and mortality, or carcass characteristics of early-weaned calves. Early weaning of May-born calves appears to be a viable production option for cattle producers who calve between April 15 and June 15.

Introduction
The western Dakota region of the northern Great Plains is characterized by a semi-arid climate with an agricultural base consisting of dryland farming and beef cattle production. Cow-calf production is an important agricultural enterprise to this region. According to NASS (2005), the Dakotas had a beef cattle inventory of over 5.23 million head worth over $5.4 billion to the two states' economies. A vast majority of area cattle producers produce calves in the early spring months and typically sell their calf crops in the fall at weaning time. During the past six years, this region has been impacted by drought, which has drastically reduced feed supplies used for cattle during the winter-feeding period. One management tool regional cattle producers have utilized to overcome decreased feed supplies is to early wean calves. Besides drought, other reasons producers chose to early wean their calves included poor quality or short supply of available feed, poor milking cows or first calf heifers, or late-calving cows (Myers et al., 1999). Most university research on early weaning has focused on early-spring (March) calving cowherds; little research has evaluated the impacts of early weaning on late-spring (May-June) born calves. This paper details research conducted the fall of 2006 on calves that were early weaned or normal weaned and how this management practice affects subsequent calf growth performance, health, and carcass characteristics of calves.

Materials and Methods
A backgrounding performance study was conducted the fall of 2006 to evaluate the effects of weaning date (early or normal) on calf performance, health, and carcass characteristics. This study was conducted at Southwest Feeders, Hettinger, ND, using 48 Angus-bred steer and heifer calves from the NDSU Hettinger Research Extension Center's May-calving cowherd. On Sept. 19, 2006, the calves were randomly assigned to either the early weaning (EW; Sept. 19, 2006 wean date) or the normal weaning (NW; Nov. 15, 2006 wean date) group. Each weaning group had 24 steer and heifer calves assigned per date. The normal wean calves were left on pasture until their respective weaning date. Creep feed was not fed to either group of calves while on pasture. Early wean (EW) calves were brought to NDSU Hettinger Research Extension Center's Southwest Feeders feedlot after morning gathering and weighing. EW calves weighed 417 pounds and averaged 139 days of age at weaning. The normal wean calves were weaned in November. NW calves weighed 559 pounds and averaged 197 days of age. Calves were fed a dry-hay, total-mixed ration (EW and NW receiving rations; Table 1) for

the first 14 days post-arrival at the feedlot. The hay sources utilized in the receiving diets were chopped to a 2.5-inch length prior to feeding by a custom hay processor.

Weaned calves.

Table 1. Dietary ingredient and nutrient compostion of diets fed to Early Wean (EW) and Normal Wean (NW) calves

Item	EW Receiving Diet	NW Receiving Diet	Growing Diet
Diet Composition			
Whole Shell Corn, % DM	43.4	39.9	43.8
Barley Silage, % DM	---	---	30.05
Mixed Hay, % DM	---	35.9	---
Alfalfa-grass Hay, % DM	22.15	---	---
Oat Hay, % DM	13.05	12.3	13.25
Barley Hay, % DM	12.8	---	---
Protein Supplement [1], % DM	7.15	5.2	7.02
44% Soybean meal, % DM	---	4.5	2.88
Deccox® med. crumbles, % I	1.45	1.6	2.2
Calcium Carbonate, % DM	---	0.6	0.8
Nutrient Density			
DM, %	94.22	95.8	63.26
Ash, % DM	8.06	10.5	9
CP, % DM	14.3	13.2	13
ADF, % DM	26.2	26.3	24.3
NDF, % DM	45.6	48.3	41.05
Ca, % DM	0.87	0.75	0.59
P, % DM	0.38	0.43	0.48
K, % DM	1.79	1.84	1.9
Nitrate, ppm	1,200	2,500	1,950
NE_m, Mcal/lb [2]	0.79	0.77	0.8
NE_g, Mcal/lb [2]	0.54	0.51	0.54
Rumensin®, $mg \cdot hd^{-1} \cdot d^{-1}$	256	256	320
Deccox®, $mg \cdot hd^{-1} \cdot d^{-1}$	154	154	206

[1] 27% Commercial supplement (as fed): 27% CP, min Ca 2.0%, min P 0.70%, min K 0.7%, min Vit A 27,000 IU/lb, min Vit D_3 1,7000 IU/lb, min Vit E 100 IU/lb and Rumensin 225 mg/d.
[2] Calculated analyses.

At the start of the 92-day backgrounding study, calves were weighed, stratified by BW and sex, and allotted randomly to one of 12 pens (4 animals/pen; 6 replicates/weaning treatment) with pen serving as the experimental unit (n = 6). The growing diet was composed of barley silage, whole-shell corn, oat hay, 44% soybean meal, calcium carbonate (limestone), Deccox™ medicated crumbles (for coccidiosis prevention), MGA® pellets (for heat suppression), and a commercial protein supplement pellet containing Rumensin® (growing ration; Table 1). Target gain for the backgrounding diet was 2.5 pounds; the diet formulations were isonitrogenous and isocaloric at the start of the study. Fenceline feed bunks were read daily at 0700 hours and slick bunk management was used to determine individual pen daily feed allotment. Calves were fed diets once daily commencing at 0800 hours and had continual access to water. Initial and final weights were determined using average unshrunk weights from two consecutive weigh days by weighing each individual animal prior to daily feeding. All calves were fed aureomycin medicated crumbles at 10 mgs/lb of body weight (the treatment level for prevention of bovine respiratory disease [BRD] complex) for the first eight days in the feed yard.

All calves were vaccinated for bovine rhinotracheitis virus, parainfluenza-3 virus, bovine respiratory syncytial virus and bovine diarrhea virus (types 1 and 2; Bovi-Shield® Gold 5; Pfizer Animal Health, NY, NY), clostridial diseases and Mannheimia hemolytica bacterin-toxid (One Shot Ultra™ 7, Pfizer Animal Health, NY, NY). Calves were also poured with an anthelmintic (Dectomax Pour On, Pfizer Animal Health, NY, NY) at processing for internal and external parasite control. Calves were implanted with a Ralgro® implant (36 mg zeranol; Schering-Plough Animal Health Corporation, Kenilworth, NJ) at the trial start.

Calves were observed each morning at 0800 hours by experienced personnel for signs of respiratory and/or other diseases. Two or more clinical signs of disease (depression, lack of fill, occasional soft cough, physical weakness or altered gain, and ocular or nasal discharge) were required to designate a calf as sick and eligible for further clinical review and therapeutic antibiotic treatment. Due to some calves showing intermittent nasal discharges and weather temperature extremes during the course of the study, calves were revaccinated on day 53 (EW calves) and day 69 (NW calves) for respiratory diseases (IBR, BRSV, PI_3, BVD Types I and II) and Hemophilus somnus using a modified live vaccine (Express™ 5-HS, Boehringer-Ingelheim Vetmedica, Inc, St. Joseph, MO).

Interim calf weights were measured on day 36, 52, and 64 to evaluate growth performance and health status of calves. Diet samples were collected on day 14, 32, 54, 67, and 78. Diet samples were composited by pen and analyzed for dry matter (DM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), calcium (Ca), phosphorus (P), potassium (K) and nitrate concentration by a commercial laboratory (Midwest Laboratories, Omaha, NE) using AOAC (2000) procedures. The commercial laboratory used is certified by the National Forage Testing Association. On January 16, 2007, the backgrounded steers were shipped to the NDSU Carrington Research Extension Center (NDSU-CREC) in Carrington, ND for final finishing. Calves were fed a 61 Mcal finishing ration (DM basis) as one large group at the NDSU-CREC for a period of approximately 112 days. The finishing ration was composed of corn, field peas, distillers grains, calcium carbonate, straw as a roughage source, and a supplement containing Rumensin®; calves were not implanted during the finishing period. These calves were harvested at two commercial slaughter facilities (Barton Meats, Carrington, ND and Tyson Foods, Dakota City, NE) and individual carcass data was collected and analyzed.

All data for feedlot performance was analyzed as a randomized complete design using generalized least squares (PROC MIXED, SAS Institute, Cary, NC). Pen was considered the experimental unit for all data. Mean separation was accomplished using Least Significant Difference and means were considered to be significantly different at the $P < 0.05$ level. The North Dakota State University Animal Care and Use Committee approved the care and handling of the animals used in this study.

Results and Discussion

Weather conditions during the feeding period were close to ideal with very little moisture, keeping pens dry throughout the feeding period; however, daytime and nighttime temperatures had some extreme temperature swings. For the month of October 2006, the day time highs ranged from 27.8º F to 81.1º F and the night time lows ranged from 9.8º F to 50.5º F (NDAWN, 2006). In November 2006, day time highs ranged from 6.1º F to 74.8º F with night time lows ranging from -7.1º F to 47.6º F (NDAWN, 2006). During December 2006, daytime highs ranged from 11º F to 59.3º F with nighttime lows ranging from -16.3º F to 27º F (NDAWN, 2007). Due to these temperature swings, all calves were fed aureomycin medicated crumbles to prevent BRD when approximately half the steers on test had nasal discharges; this occurred on day 44-46, day 64-66 and day 90-92 during the background test. On day 73, the feedlot was subjected to high winds at speeds of over 40 mph, which caused a dust storm. Approximately twelve calves (three EW calves and nine NW calves, respectively) had to be pulled and treated due to signs of respiratory illness and elevated body temperatures (> 104º F) two days after the wind event. This did not significantly influence veterinary medical costs for either treatment group (P = 0.86). Veterinary medical costs averaged \$14.94 ± 0.44 per head (Table 2). One steer from the EW group died during the backgrounding study due to severe bloat. Additionally, one steer from the NW group was treated multiple times for an abscess located on the middle posterior aspect of the right ear. Treatments due to respiratory illness were not significantly different among treatments (P = 0.10; Table 2).

Table 2. The influence of weaning date on backgrounding steer performance and carcass characteristics.

Item	EW [1]	NW [1]	SEM [2]	*P*-value [3]
Steer performance				
Initial Wt., lbs.	478	591	1.41	< 0.0001
Final Wt., lbs.	782	736	8.05	0.004
Weight gain, lbs.	299	144	5.37	< 0.0001
ADG, lbs.	3.24	3.43	0.11	0.24
DMI, lbs./d	17.7	17.5	0.42	0.71
DMI, % BW	2.82	2.65	0.07	< 0.10
Feed conversion, lb./lb.	5.51	5.25	0.18	0.35
Feed costs, $/hd	148.27	65.11	3.03	< 0.0001
Vet med, $/hd	15.37	14.5	3.5	0.86
Feed cost of gain, $/lb.	0.52	0.47	0.02	0.11
Total cost of gain, $/lb.	0.57	0.58	0.04	0.76
Respiratory treatment, %	12.5	33.33	0.08	< 0.10
Mortality, %	4.17	0	0.03	0.35
Carcass characteristics				
Live wt. at slaughter, lbs.	1075	1042	18.6	0.24
HCW, lbs.	649	625	13.2	0.23
Marbling number	483	465	14.8	0.43
Backfat, in.	0.56	0.53	0.05	0.68
Ribeye area, $in.^2$	11.8	11.08	0.43	0.27
Kidney, pelvic, and heart fat, %	2.41	2.5	0.53	0.29
USDA Yield Grade (adjusted)	3.04	3.19	0.22	0.65

[1] Early wean (EW) = September 19, 2006;
Normal Wean (NW) = November 15, 2006.
[2] Standard Error or Mean; n=6.
[3] *P*-value for separation of treatment means.

Calves' initial body weights (BW) were significantly different ($P < 0.0001$) at the start of the study: EW calves weighed 478 pounds and NW calves weighed 591 pounds, respectively. At the end of the backgrounding period, EW calves were 6.25% heavier than the NW calves: EW calves gained 299 pounds while NW calves gained only 144 pounds ($P < 0.004$; Table 2). Calf weight gain was directly influenced by the number of days on feed: EW calves spent 50 days more on higher energy rations (based on weaning date) as compared to the NW calves (EW= 92 d compared to NW = 42 d, respectively). Despite the longer time on feed for EW calves, average daily gain (ADG) was not significantly different among treatments (3.24 vs. 3.43, EW and NW respectively; $P = 0.24$). Additionally, weaning date did not affect dry matter intakes (DMI 17.7 pounds vs. 17.47 pounds.; $P = 0.71$) or feed conversion (5.51 lb/lb vs. 5.25 lb/lb, EW and NW, respectively; $P = 0.35$) for the calves. Early wean calves did have higher feed costs per head ($148.27 compared to $65.11 for NW calves) due to spending a longer time period in the feedlot; however, feed cost of gain and total cost of gain was not statistically different ($P = 0.76$) during the course of the backgrounding period (Table 2).

Calf weaning date did not negatively influence carcass characteristics for EW and NW calves. Calves had similar live weights at slaughter (1075 vs. 1042 pounds, EW and NW, respectively; $P = 0.24$) and hot carcass weights (HCW) were not statistically different ($P = 0.23$; Table 2). Additionally, marbling number scores for the EW calves averaged 483 and 465 for the NW calves ($P = 0.43$; marbling number scores for average choice range from 450 to 499). The EW calves marbling scores ranged from low to high choice marbling, with two EW calves achieving prime and one select. NW calves marbling scores ranged from select to high choice marbling with five NW calves scoring select and one prime (data not reported). Ribeye area (REA), back fat (BF), and kidney, pelvic, and heart fat percentage (KPH) were not statistically different among treatments ($P > 0.27$). Ribeye area ranged from 11.08 in.^{2} to 13.37 in.^{2} for the EW calves and 9.5 in.^{2} to 12.50 in.^{2} for the NW calves (data not reported). Back fat values for the EW calves ranged from 0.33 in. to 0.72 in. compared to NW calves BF values ranging from 0.42 in. to 0.61 in. Kidney, pelvic, and heart fat percentage values for EW calves ranged from 2.25% to 2.50% with NW calves KPH percentage ranging from 2.33 to 2.63 inches (data not reported). USDA yield grades (adjusted for HCW, BF, REA, and KPH) were not different among treatments ($P = 0.29$). EW calves adjusted yield grades ranged from 2.38 to 3.74, while NW calves adjusted yield grades ranged from 2.40 to 3.58 (data not reported).

Implications

Early-wean calves were younger and lighter weight at weaning; however, EW calves were heavier at the conclusion of this study as compared to NW calves. Weaning date did not affect ADG, DMI, or feed conversions of EW calves; additionally, early weaning of May-born calves did not influence calf health (morbidity) and mortality. Similarly, weaning date showed no effect on calf carcass characteristics in this study. Early weaning of May-born calves appears to be a viable production option for cattle producers who calve between April 15 and June 15. Additional research is needed to continue assessing the effects of early weaning on May-born calves during the backgrounding and finishing phases of feedlot feeding.

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