Proceedings, Western Section, American Society of Animal Science

Vol. 57, 2006

EFFECTS OF EARLY WEANING ON COW PERFORMANCE, GRAZING BEHAVIOR, AND WINTER FEED COSTS IN THE INTERMOUNTAIN WEST

D. W. Bohnert[1], D. C. Ganskopp[2], D. D. Johnson[2], and S. J. Falck[2], M. L. Merrill[1], and A. A. Clark[1]
Eastern Oregon Agricultural Research Center, Oregon State University[1] and ARS-USDA[2], Burns, OR 97720.

ABSTRACT: Our objective was to determine the influence of early weaning (EW) and traditional weaning (TW) on cow performance and grazing behavior in a 2 yr study. In addition, cow winter feed costs were compared. Each year, 156 cow/calf pairs (78 steer calves and 78 heifer calves) were used in a randomized complete block design. Cows were stratified by calf sex, BCS, and age and assigned randomly to one of two treatments (TRT) and one of three 810-ha pastures. Two cows from each TRT and pasture were fitted with global positioning system collars each year (6 cows/TRT/yr) to evaluate grazing behavior. The EW calves were removed from dams at approximately 130 d, while TW calves grazed with their dams until approximately 205 d of age. All cows were removed from pastures following TW and placed in six separate 25 ha pastures. The same cow groups (blocks) remained intact; however, EW and TW cows were separated and randomly allotted to pastures. All cows were fed to attain a similar BCS (minimum of 5) by approximately 1 mo prior to calving. The TW cows lost 0.8 BCS and 40 kg while the EW cows gained 0.1 BCS and 8 kg from EW to TW ($P < 0.01$). After winter feeding (approx. 110 d), there was no difference between EW and TW cow BCS ($P = 0.52$). However, winter feed costs were $29 greater ($P < 0.01$) for TW compared with EW cows. Grazing time, distance traveled, and number of visits to water were unaffected ($P > 0.10$) by TRT. However, the proportion of each pasture visited by EW cows tended to be greater than that of TW cows ($P = 0.08$). Results indicate that EW improves cow BCS entering the winter feeding period, thereby, decreasing winter feed costs. Cow grazing behavior was minimally affected by weaning treatment.

Key words: Alternative, Economics, Management

Introduction

Early weaning (EW) spring born calves can yield heavier calves compared with calves left alongside their dams on sagebrush-bunchgrass range until mid-October (Wallace and Raleigh, 1961). Other benefits include: 1) the cow does not have the additional nutrient demand of lactation and shouldn't lose as much body condition; 2) the total number of animal units on the range is decreased, thereby extending the number of days cows can remain on range without hay feeding; and 3) dry-gestating cows may cover more range and be better distributed over the grazing area.

In a recent Cattle-Fax® survey of 500 producers in 41 states (Cattle Fax®, 2005), the annual cost to carry a cow averaged $315. When cow cost was compared by region, the northwest had the highest. The annual costs by region were southwest - $270, southeast - $282, southern plains - $317, midwest - $326, and northwest - $379. The primary reason for the greater expense was winter feed costs. This represents an expense of somewhere between $75 and $180 per cow. This is a major disadvantage for northwest ranchers compared with other areas of the country. Consequently, the ability to compete with other regions of the United States may depend on how effectively northwest cow/calf producers can reduce winter-feed costs while maintaining acceptable levels of performance.

Winter feed costs normally include the cost of harvested forage and supplement necessary to sustain, or increase, cow BCS prior to calving. This is necessary to optimize conception rate and to maintain a 365-d calving interval (Herd and Sprott, 1986). The objective of this study was to compare the effects of early weaning and traditional weaning (TW) on cow performance, grazing behavior, and subsequent winter feed costs.

Materials and Methods

Experimental Sites

Grazing research was conducted in 2004 and 2005 using three 810-ha pastures at the Northern Great Basin Experimental Range, 52 km west-southwest of Burns, OR. Vegetation has been described previously (Ganskopp, 2001).

Both years, winter feeding of cows was conducted at the Eastern Oregon Agricultural Research Center, 6 km south of Burns, OR, in six 25-ha native flood meadow pastures that had been harvested for hay the previous summer.

Available standing crop in each pasture at the Northern Great Basin Experimental Range was measured at the beginning and conclusion of the grazing period each year by clipping 20 randomly (randomized from pasture UTM coordinates) placed 1-m^2 quadrats in each pasture. Clipped herbage was dried at 55°C for 48 h and weighed for determination of standing crop.

Experimental Design

One hundred fifty-six spring-calving Angus x Hereford cows (78 with steer calves and 78 with heifer calves; cow age 6 ± 0.1 yr) were used each year. Experimental design was a randomized complete block and was approved by the Institutional Animal Care and Use Committee at Oregon State University. The study was initiated on 2 August 2004 and 3 August 2005 and concluded 15 February 2005 and 10 February 2006 (approximately 1 month prior to calving) for year 1 and 2, respectively. One wk prior to EW, cows were stratified by calf sex, BCS, and age and assigned randomly to one of two weaning treatments and one of three pastures. All animals were then managed in common pastures as a single group until the date of EW. Early-weaned calves (39 steers/yr; 39 heifers/yr) were 130 ± 1 d of age at EW (early August of each year) and traditional-weaned calves (39 steers/yr; 39 heifers/yr) were 207 ± 1 d of age at TW (late October of each year). All cows were weighed and evaluated for BCS following an overnight shrink (16 h) at EW and TW. Also, calves were weighed at EW and TW following a 16-h shrink (overnight).

Early-weaned calves were removed from dams at EW. Early-weaned cows and TW cows and calves were returned to their respective pastures at the Northern Great Basin Experimental Range approximately 1 wk after EW. In 2004 and 2005, each pasture had 26 EW cows and 26 TW cow/calf pairs. Water and mineral/salt placement within each pasture were maintained in the same location throughout both years. A mineral/salt mix (7.3% Ca, 7.2% P, 27.8% Na, 23.1% Cl, 1.5% K, 1.7 % Mg, .5% S, 2307 ppm Mn, 3034 ppm Fe, 1340 ppm Cu, 3202 ppm Zn, 32 ppm Co, 78 ppm I, 85 ppm Se, 79 IU/kg vitamin E, and 397 kIU/kg vitamin A) was available free choice.

Six cows from each treatment each year (2 cows•pasture^{-1}•treatment^{-1}•year^{-1}) were fitted with global positioning system (**GPS**) collars (Lotek GPS_2200 Collars; Lotek, 115 Pony Drive, Newmarket, Ontario, Canada, L3Y7B5) to obtain data related to grazing behavior. Collars are equipped with head fore/aft and left/right motion sensors, a temperature sensor, and a GPS unit. The collars were programmed to take position readings at 5-min intervals for three 7-d periods evenly distributed between EW and TW dates each year to estimate grazing time (h/d), distance traveled (m/d), frequency of visits to water (visits/wk), maximum distance from water (m/d), and cow distribution (percentage of ha occupied•pasture^{-1}•wk^{-1}). Collar data were retrieved after each 7-d period, downloaded to a computer, and converted from latitude/longitude to Universal Transverse Mercator as described by Ganskopp (2001). Grazing time was estimated through generation of a prediction model for each cow. Each collared cow was visually observed for 8-12 h. Activities monitored included: grazing, resting (standing or lying down), and walking. Prediction models for estimating grazing time were developed via forward stepwise regression analysis for each cow (S-Plus 2000, Mathsoft Inc., Seattle, WA). The dependent variable was grazing time (min/5 min interval) and the independent variables from GPS collar data included: head fore/aft and left/right movement sensor counts, their sum, ambient temperature, and the distance traveled (m) by the cow within each 5-min interval. Distance traveled (used for predicting grazing time and distance traveled/d) is likely underestimated because straight-line pathways were assumed between successive coordinates. Cow distribution within pastures was estimated with Geographic Information System software (Idrisi32 For Windows, Clark Univ., Worcester, MA) using 1-ha grids.

All cows were removed from the three Northern Great Basin Experimental Range pastures following weaning of the TW calves, palpated for determination of pregnancy, and pregnant cows placed in the six separate pastures at the Eastern Oregon Agricultural Research Center. The same cow groups (blocks) were maintained from the Northern Great Basin Experimental Range pastures to the Eastern Oregon Agricultural Research Center pastures; however, EW and TW cows were separated and randomly allotted (by previous blocking structure) to pastures. The amount of hay, alfalfa, and inputs specifically associated with each cow group were recorded daily. The EW and TW cows were fed to attain a similar BCS (minimum of 5) by mid-February (approximately 1 mo prior to calving).

The winter feed costs associated with each weaning treatment were compared for economic analysis. The costs used in 2003-2004 were: 1) meadow hay - $60/ton; 2) alfalfa - $90 ton; 3) diesel fuel - $2.00/gallon; 4) labor - $7.25/hr. The costs used in 2005-2006 were: 1) meadow hay - $60/ton; 2) alfalfa - $90 ton; 3) diesel fuel - $2.50/gallon; 4) labor - $7.50/hr. The amount of fuel and labor used was determined as 1 gallon and 0.75 h per each hay feeding or supplementation event.

Before the study, calves were vaccinated with Vira Shield® 5 and Clostri Shield® 7 (Novartis Animal Health US, Inc.) at approximately 30 d of age. Two weeks prior to weaning calves were vaccinated with Vira Shield® 5 + Somnus and a Clostri Shield® 7 booster. At weaning, calves received a booster of Vira Shield® 5 + Somnus.

Approximately 1 mo prior to calving, all cows were vaccinated with Vira Shield® 5 and Clostri Shield® 7. Also, all cows were vaccinated with Vira Shield® 5 + VL5 (Novartis Animal Health US, Inc.) at TW.

Statistics

Available standing crop, cow and calf performance data, and cow and calf economical data were analyzed as a Randomized Complete Block using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC). The model included treatments (EW and TW), pasture (n = 3), and year (n=2). A Fisher's protected LSD ($P \leq 0.05$) was used for mean separations (Fisher, 1966).

The experimental design for cow behavioral data (grazing time, distance traveled, frequency of visits to water, maximum distance from water, and cow distribution) was a randomized complete block with 2 yr, three replications/yr (pastures) and two factors: treatments (EW and TW) and sampling periods (n = 3). Data were analyzed as a split-split-plot using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC) with the effects of year and year*treatment analyzed using treatment*year*pasture as the error term and the effect of treatment was analyzed using pasture*treatment as the error term (Petersen, 1985). A Fisher's protected LSD was used as previously to separate treatment means.

Results and Discussion

Standing Forage and Forage Quality

Initial and final standing crop at the Northern Great Basin Experimental Range was unaffected (P > 0.30) by pasture. However, sampling date (beginning or end of grazing period) and year had an effect (P < 0.01) on standing crop, with herbage in August averaging 362 kg/ha compared with 242 in November. In addition, standing crop in 2005 averaged 366 kg/ha compared with 239 in 2004. There were no year*pasture or year*sampling date interactions (P > 0.74). The increase in standing forage in 2005 was expected due to increased precipitation. Precipitation for the crop year (September through June) in 2004 and 2005 was 81% (219 mm) and 95% (259 mm) of the 21-year average (272 mm; Burns, OR; NCDC, 2006), respectively.

Standing crop CP was greater (P < 0.01) in 2004 than 2005 (4.2% vs, 3.3%; DM basis) but not affected by sampling date or pasture (P > 0.05). In addition, there were no year*pasture or year*sampling date interactions (P > 0.05). This agrees with other research demonstrating that annual forage quality is improved with below average compared with normal to above average crop year precipitation (Ganskopp and Bohnert, 2001).

Behavior

Weaning treatment did not influence time spent grazing, resting, or walking by cattle (*P* > 0.25; Table 1). In addition, distance traveled (m/d), average distance to water (m/d), and weekly visits to water were similar for EW and TW cows (*P* > 0.20). However, the percentage of the pasture occupied each week tended to be greater (*P* = 0.08) for EW than cow/calf pairs. The greater pasture distribution for EW cows agrees with the 1 hr numerical increase observed in their daily grazing time. We are not aware of other research evaluating the effects of weaning on grazing behavior of beef cows. Nevertheless, Rosiere et al. (1980) reported that forage intake of 2-yr old heifers grazing blue grama summer range was 67% of the intake of 2-yr old lactating cows with calves at their side. To increase intake, the heifers had to either consume a higher digestibility diet or graze longer and, potentially, a larger proportion of the pasture. This agrees with the numerical increase in grazing time and tendency for increased pasture distribution by EW cows in the current study.

Cow Performance

During the grazing period between EW and TW, BCS of EW cows increased 0.1 while TW cows lost 0.8 (*P* < 0.01; Table 2). Similarly, weight change during the same period was 8 and -40 kg for EW and TW cows, respectively (*P* < 0.01). These results agree with other research that has demonstrated increased cow weight and/or BCS with EW compared with TW (Short et al., 1996; Story et al., 2000). During the winter feeding period, TW cows gained 0.8 more BCS and 31 kg compared with EW cows (*P* < 0.01).

Total cow BCS change tended (P = 0.07) to be greater, and overall weight change was greater (P < 0.01) for EW compared with TW cows, but the differences were not deemed physiologically important (0.1 BCS and 17 kg, respectively).

Total feed costs for EW cows during the winter feed period were $136.66 compared with $165.52 for TW cows (*P* < 0.01; data not shown). The greater cost associated with TW cows was due to the alfalfa (and related costs) needed to attain a similar BCS (minimum BCS of 5) to EW cows by 1 mo prior to calving.

Implications

Early weaning calves of spring calving cows at approximately 130 days of age will improve cow body condition score entering the winter feeding period and decrease winter feed costs compared with cows traditionally weaned at approximately 205 days of age in the Intermountain West. However, the overall economic effect of early weaning is dependent on a number of factors including timing and amount of precipitation, calf performance during the late summer and early fall, seasonal disparities of calf prices, and costs associated with winter feeding (feedstuffs, labor, and fuel).

Literature Cited

Cattle-Fax®. 2005. Cattle-Fax® Update, July 8, 2005. 37:1-8.

Fisher, R. A. 1966. The design of experiments. 8th ed. Hafner, New York.

Ganskopp, D. 2001. Manipulating cattle distribution with salt and water in large arid-land pastures: a GPS/GIS assessment. Appl. Anim. Behav. Sci. 73:251-262.

Ganskopp, D., and D. Bohnert. 2001. Nutritional dynamics of 7 northern Great Basin grasses. J. Range Mange. 54:640-647.

Herd, D. B., and L. R. Sprott. 1986. Body condition, nutrition and reproduction of beef cows. Texas Agric. Ext. Serv. B-1526:1-11.

Petersen, R. G. 1985. Design and analysis of experiments. Marcel Dekker, Inc. New York.

Rosiere, R. E., J. D. Wallace, and R. D. Pieper. 1980. Forage intake in two-year old cows and heifers grazing blue grama summer range. J. Range Manage. 33:71-73.

Short, R. E., E. E. Grings, M. D. MacNeil, R. K. Heitschmidt, M. R. Haferkamp, and D. C. Adams. 1996. Effects of weaning, supplement, and sire breed of calf during the fall grazing period on cow and calf performance. J. Anim. Sci. 74:1701-1710.

Story, C. E., R. J. Rasby, R. T. Clark, and C. T. Milton. 2000. Age of calf at weaning of spring-calving cows and the effect on cow and calf performance and production economics. 78:1403-1413.

Wallace, J. D., and R. J. Raleigh. 1961. Effect of time of weaning on winter performance of Hereford calves. Proc. West. Sect. Am. Soc. Anim. Sci. 12:41-45.

NCDC. 2006. National Climate Data Center. Available: http://www.ncdc.noaa.gov/oa/ncdc.html. Accessed March 27, 2006.

Table 1. Influence of weaning treatment on grazing behavior of cows pastured on sagebrush-bunchgrass range in southeastern Oregon[a]

Item	Early-Weaned	Traditional-Weaned	SEM	P-value
Grazing Time, h/d	9.57	8.68	0.240	0.37
Resting Time, h/d	13.62	14.68	0.240	0.26
Walking Time, h/d	0.77	0.73	0.041	0.49
Distance Traveled, m/d	6032	5630	132.3	0.21
Avg. Distance to water, m/d	1245	1173	52.7	0.25
Weekly visits to water	5.7	6.1	0.34	0.53
Distribution, %[b]	21	18	0.7	0.08

[a] Early- and traditional-weaned calves were weaned at 130 ± 1 d and 207 ± 1 d of age, respectively. Grazing behavior was measured from early weaning to traditional weaning; therefore, only traditional-weaned cows had calves at their side.
[b] Percentage of ha occupied per pasture each week

Table 2. Influence of weaning treatment on cow performance[a]

Item	Early-Weaned	Traditional-Weaned	SEM	P-value
Grazing Period[b]				
Initial BCS	5.0	5.1	0.02	0.14
Final BCS	5.1	4.3	0.04	< 0.01
BCS Change	0.1	-0.8	0.04	< 0.01
Initial Wt., Kg	499	499	2.4	0.96
Final Wt., Kg	507	459	3.1	< 0.01
Wt. Change, Kg	8	-40	1.9	< 0.01
Hay Feeding Period[c]				
Initial BCS	5.1	4.3		
November BCS	5.3	4.8	0.03	< 0.01
December BCS	5.6	5.1	0.05	< 0.01
January BCS	5.4	5.1	0.08	0.06
February BCS	5.3	5.3	0.06	0.52
Hay Feeding BCS Change	0.2	1.0	0.07	< 0.01
Initial Wt., Kg	507	459		
November Wt., Kg	550	511	2.5	< 0.01
December Wt., Kg	569	536	3.4	< 0.01
January Wt., Kg	576	549	6.6	0.03
February Wt., Kg	584	567	4.0	0.02
Hay Feeding Wt. Change, Kg	77	108	2.4	< 0.01
Total BCS Change	0.3	0.2	0.04	0.07
Total Wt. Change, Kg	85	68	1.9	< 0.01

[a] Early- and traditional-weaned calves were weaned at 130 ± 1 d and 207 ± 1 d of age, respectively. Grazing behavior was measured from early weaning to traditional weaning; therefore, only traditional-weaned cows had calves at their side.
[b] The initial BCS and weights occurred at early weaning (early August) and Final BCS and weights occurred at traditional weaning (Late October).
[c] Hay feeding began in late October following traditional weaning and concluded in mid-February each year, with BCS and weights obtained approximately every 28 d. Initial BCS and weights were obtained at traditional weaning (same as grazing period final BCS and weights above). The early-weaned cows received only meadow hay (13.9 kg/hd daily; DM basis) while the traditional-weaned cows received meadow hay (13.6 kg/hd daily; DM basis) plus alfalfa (3.55 kg/hd three days a week; DM basis).