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THE EFFECTS OF EARLY WEANING ON COW PERFORMANCE AND GRAZING BEHAVIOR IN THE INTERMOUNTAIN WEST

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ABSTRACT: Our objective was to determine the influence of early weaning (130 ± 2 d; EW) and traditional weaning (209 ± 2 d; TW) on cow performance and grazing behavior within three 810-ha pastures. In addition, cow winter feed costs were compared. One hundred fifty-six cow/calf pairs (130 ± 2 d lactation; 78 steer calves and 78 heifer calves) were used in a Randomized Complete Block design in this first year of a two-year study. Cows were stratified by calf sex, BCS, and age and assigned randomly to one of two treatments (TRT) and one of three pastures. Two cows from each TRT and pasture were fitted with global positioning system collars to evaluate grazing behavior. EW calves were allotted to one of three pens (17 x 21 m), in a manner consistent with their dams blocking allocation, and provided meadow hay daily at approximately 2.5% of BW (DM basis) from EW to TW (79 d). The TW calves grazed with their dams during this time. In addition, EW calves were provided 1.0 $kg \cdot hd^{-1} \cdot d^{-1}$ (DM basis) of a supplement formulated to contain 26% CP. 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. Cows were fed 110 d to attain a similar BCS (minimum of 5) by approximately 1 mo prior to calving. The TW cows lost 0.5 BCS and 44 kg while the EW cows gained 0.4 BCS and 12 kg from EW to TW ($P < 0.01$). After 110 d of feeding, there was no difference between EW and TW cow BCS ($P = 0.59$). However, winter feed costs were \$28 greater ($P = 0.07$) for TW compared with EW cows. Grazing time, distance traveled, number of visits to water, and cow distribution in rangeland pastures were unaffected ($P > 0.10$) by TRT. Results suggest that EW can improve cow BCS entering the winter feeding period, thereby, decreasing winter feed costs. Cow grazing behavior was not affected by weaning treatment.

Key words: Behavior, Cow, Economics, Management, Weaning

Introduction

Early weaning spring born calves can economically yield heavier calves compared with calves left alongside their dams on sagebrush-bunchgrass range until mid-October (Wallace and Raleigh, 1961). Also, early weaning has additional potential benefits. These include: 1) the cow does not have the additional nutrient requirement 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.

Annual winter feed costs in the Intermountain West often total \$100 to \$200 per cow, representing a significant economic hardship for cow/calf producers. 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 on cow performance, grazing behavior, and subsequent winter feed costs.

Materials and Methods

Experimental Sites

Grazing research was conducted in three 810-ha pastures at the Northern Great Basin Experimental Range, 72 km west-southwest of Burns, OR. Vegetation has been described previously (Ganskopp, 2001).

Post-weaning management of calves and winter feeding of cows was conducted at the Eastern Oregon Agricultural Research Center, 6 km south of Burns, OR. Early weaned (EW) calves were managed in a feedlot and bunk-fed. Winter feeding of cows took place in six 25-ha native flood meadow pastures that were previously harvested for hay.

Available standing crop in each pasture at the Northern Great Basin Experimental Range was measured at the beginning and conclusion of the grazing period 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) were used in the first year of a planned two year early-weaning study. The experimental design was a Randomized Complete Block and was approved by the Institutional Animal Care and Use Committee at Oregon State University. The first year of the experiment began August 2, 2004 (EW date) and concluded February 15, 2005 (approximately 1 month prior to calving). 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 a common pasture as a single group until the date of EW. Early weaned calves (39 steers; 39 heifers) were 130 ± 2 d of age (on August 2) and traditional-weaned calves (**TW**; 39 steers; 39 heifers) were 209 ± 2 d of age (on October 20). All cows were weighed and evaluated for BCS following an overnight shrink (16 h) at EW and TW. Also, all calves were weighed at EW and TW following a 16-h shrink (overnight).

Early-weaned calves were allotted to one of three pens (17 x 21 m), in a manner consistent with their dams blocking allocation, and provided meadow hay daily at approximately 2.5% of BW from EW to TW (79 d). The TW calves grazed along side their dams during this time. In addition, EW calves were provided 1.0 $kg \cdot hd^{-1} \cdot d^{-1}$ (DM basis) of a supplement consisting of 63.5% ground beet pulp, 33% soybean meal, and 3.5% 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). The supplement was formulated to contain 26% CP (DM basis). The quantity of meadow hay provided to each pen was noted daily.

Early weaned cows and TW cows and calves were returned to their respective pastures at the Northern Great Basin Experimental Range approximately 1 week after EW. 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 the experiment. The mineral/salt mix described above was available free choice.

Six cows from each treatment (2 $cows \cdot pasture^{-1} \cdot treatment^{-1}$) were fitted with global positioning system (**GPS**) collars (Lotek GPS_2000 Collars; Lotek, 115 Pony Drive, Newmarket, Ontario, Canada, L3Y7B5) to obtain data related to grazing behavior. Collars are equipped with head forward/backward and left/right movement 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 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 $occupied \cdot pasture^{-1} \cdot wk^{-1}$). 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 forward/backward and left/right movement sensor counts, sum of forward/backward and left/right movement counts, 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 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 by February 15, approximately 1 mo prior to calving.

The production costs associated with each weaning treatment were compared for economic analysis. The economic components of the study included winter feed costs and the overall net return for EW and TW cows. Actual feed costs were used whenever possible.

Before study initiation, calves were vaccinated with Vira Shield® 5 and Clostri Shield® 7 (Novartis Animal Health US, Inc.) at approximately 30 d of age. Four weeks later calves were revaccinated with Clostri Shield® 7. 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 month 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. The model included treatments (EW and TW) and pasture (n = 3). 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 three replications (pastures) and two factors: treatments (EW and TW) and sampling periods (n = 3). Data were analyzed as a split-plot with treatments as whole plots and periods as subplots (Petersen, 1985). A Fisher's protected LSD was used as previously to separate treatment means.

Results and Discussion

Standing Forage

Initial and final standing forage at the Northern Great Basin Experimental Range was not affected by pasture ($P > 0.46$) and averaged 297 and 181 kg/ha, respectively. Initial standing forage was greater than final standing forage ($P = 0.04$). Precipitation for the crop year was 82% (229 mm) of the 67-year average (279 mm; WRCC, 2005); however, it is of interest to note that precipitation during the grazing period of the study (August through October) was 144% of average.

Behavior

Weaning treatment did not influence time spent grazing, resting, or walking ($P > 0.34$; Table 1). In addition, distance traveled (m/d) and average distance to water (m/d) were similar for EW and TW cows ($P > 0.16$). The number of visits to water each week and the percentage of ha occupied per pasture each week by EW and TW cows were not different ($P > 0.15$). We are aware of no other research evaluating the effects of weaning on grazing behavior of beef cows.

Cow Performance

During the 79 d between EW and TW, BCS of EW cows increased 0.4 while TW cows lost 0.5 ($P < 0.01$; Table 2). Similarly, weight change during the same period was 12 and -44 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 32 kg compared with EW cows ($P < 0.03$). Consequently, overall total cow BCS change was not affected by weaning treatment ($P = 0.38$). Nevertheless, overall weight change for EW cows was 24 kg greater than what was observed for TW cows ($P = 0.01$). Total feed costs for EW cows during the winter feed period were $149.49 compared with $177.42 for TW cows ($P = 0.07$; data not shown). The greater cost associated with TW cows is because of the alfalfa (and related costs) required to obtain a similar BCS to EW cows by 1 mo prior to calving.

Calf Performance

Calves of EW and TW cows weighed 175 ± 3 kg at EW (8/02/2004) and 229 ± 4 kg at TW (10/20/2004) with no difference because of weaning treatment ($P > 0.91$; data not presented). As a result, calf ADG from EW to TW was approximately 0.69 kg for both groups of calves ($P = 0.68$). This was expected of the EW calves because of the meadow hay and supplement provided; however, we did not anticipate TW calves to perform at this level. This erroneous assumption was based on long-term calf performance data from the Northern Great Basin Experimental Range where calf ADG from August to October is approximately 0.23 kg (Wallace and Raleigh, 1961; Turner and DelCurto, 1991). This may partially be explained by a combination of the low total precipitation in the 2003-2004 crop year and timely precipitation during the grazing portion of the study. Ganskopp and Bohnert (2001) demonstrated that forage nutritional quality is greater in those years with below average compared with above average precipitation. Also, the above average precipitation from August through October allowed for fall green up which should have improved the nutritional quality of the diet selected by calves, thereby improving ADG. The quantity of meadow hay offered to EW calves averaged 4.3 $kg \cdot hd^{-1} \cdot d^{-1}$ (DM basis). The total cost of feeding the EW calves from EW to TW was $47.95/hd, resulting in a cost of gain of $0.88/kg. No calf morbidity (temperature > 40.5°C) was observed in EW or TW calves.

The unexpected gain of TW calves from EW to TW, a calf market that didn't have much of a spread between 175 and 230 kg calves, and the current practice that a spring-calved cow/calf pair is 1.0 animal unit (NRCS, 2003), resulted in TW returning more income to the cow/calf producer than EW given the conditions of the current study ($32/cow if EW and TW calves were each sold at weaning; $18/cow if TW calves sold at TW and EW calves sold at TW after 79 d in feedlot; data not shown).

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, calf prices, and costs associated with winter feeding (feedstuffs, labor, and fuel).

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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	9.7	9.6	0.34	0.77
Resting Time, h/d	13.4	13.7	0.33	0.66
Walking Time, h/d	0.81	0.74	0.049	0.35
Distance Traveled, m/d	5916	5405	233.9	0.17
Avg. Distance to water, m/d	1221	1131	62.1	0.35
Weekly visits to water	5.8	5.7	0.26	0.77
Distribution, %[b]	21	20	0.6	0.16

[a] Early and traditional weaned cow's calves were weaned at 130 ± 2 d and 209 ± 2 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]				
8/2/04 BCS	4.9	4.9	0.01	0.10
10/20/04 BCS	5.3	4.5	0.04	0.01
BCS Change	0.4	-0.5	0.04	0.004
8/2/04 Wt., Kg	500	500	2.9	0.94
10/20/04 Wt., Kg	511	456	4.4	0.01
Wt. Change, Kg	12	-44	1.5	0.001
Hay Feeding Period[c]				
11/23/04 BCS	5.5	4.9	0.04	0.01
12/21/04 BCS	5.7	5.2	0.47	0.02
1/18/05 BCS	5.4	5.2	0.05	0.06
2/15/05 BCS	5.6	5.6	0.56	0.59
BCS Change	0.3	1.1	0.08	0.02
11/23/04 Wt., Kg	554	514	0.5	0.0003
12/21/04 Wt., Kg	561	527	0.4	0.0003
1/18/05 Wt., Kg	574	542	6.7	0.08
2/15/05 Wt., Kg	591	567	4.9	0.07
Wt. Change, Kg	79	111	1.0	0.002
Total BCS Change	0.7	0.6	0.05	0.38
Total Wt. Change, Kg	91	67	0.02	0.01

[a] Early and traditional weaned cow's calves were weaned at 130 ± 2 d and 209 ± 2 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] Early weaning occurred on 8/2/04 and traditional weaning occurred on 10/20/04.
[c] Hay feeding began on 10/20/04 and concluded on 2/15/05. The early weaned cows received only meadow hay (15.1 kg/hd daily; DM basis) while the traditional weaned cows received meadow hay (14.7 kg/hd daily; DM basis) plus alfalfa (3.34 kg/hd three days a week; DM basis).