WesternBeef DEVELOPMENT CENTRE

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COMPARISON OF GRAZING OAT AND PEA CROP RESIDUE VS FEEDING HAY ON BEEF COW PERFORMANCE, REPRODUCTIVE EFFICIENCY, AND SYSTEM COST

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Introduction

Winter feeding costs are a major contributor to the overall cost of production for cow-calf producers. Traditionally, these costs are due to feeding cows conserved forages in drylot pens over the winter period, which includes costs for harvesting, handling and transporting feed, and removal of manure. Feed for pregnant cows during the winter months in western Canada is usually hay in round bales. Lately, there has been renewed interest in utilizing annual crop residues (straw+chaff) in beef cow diets because of their potential to reduce winterfeed costs. The objective of this study was to determine the effects of grazing either oat or pea residues in field paddocks or drylot pen feeding grass-legume hay on beef cow performance, calving rate, calf birth weight, and winter feeding system costs.

Crop Management and Weather

A three-year (YR 1, 2009-10; YR 2, 2010-11; YR 3, 2011-12) winter grazing study was conducted at the Western Beef Development Centre's Termuende Research Ranch near Lanigan, Saskatchewan. Each year, two fields of 39 acres each were seeded with pea (60 lb/acre) or oat (64 lb/acre). The oat crop received 20.0 lb/acre of actual nitrogen (N) fertilizer at seeding. Pre-emergence weed control was managed in both crops using glyphosate at 2 L/acre (Roundup). Post-emergence, a mixture of fluroxypyr + 2, 4-D (Attain A), thifensulfuron methyl + tribenuron methyl (Refine®SG), and nonylphenoxy polyethoxyethanol (Ag-Surf) at 0.12 gal/acre was applied to the oat crop and a mixture of imazamox + imazethapyr (Odyssey®WDG) and naphthalene (Merge, BASF Canada Inc., Mississauga) at 0.12 gal/acre was applied to the pea crop.

In YR 1, the oat and pea crops were swathed September 18, 2009 and November 3, 2009, respectively and combined five and two days later, respectively. In YR 2, the crops were swathed and combined October 15, 2010 and October 16, 2010, respectively. In YR 3, both crops were swathed September 28, 2011 and combined three days later. Oat and pea residues (straw+chaff) were collected in piles and deposited in the field using a whole buncher (AJ Manufacturing, Calgary) attached to the combine. Precipitation data were collected from a Termuende Research Ranch benchmark site weather station located at the study site, and from Environment Canada's Climate Data for Esk, Saskatchewan (51º48'N, 104º51'W; www.climate.weatheroffice.ec.gc.ca) (Figure 1).

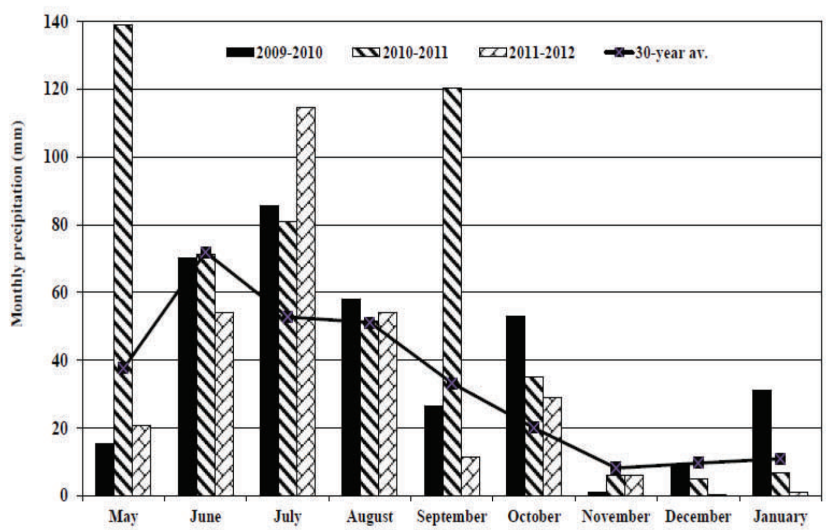

Figure 1. Average monthly precipitation for May through January of 2009/10, 2010/11 and 2011/12 compared to 30-year average temperatures for these months.

Winter Grazing Management

Year to year weather variation affected the length of the winter feeding period. The study was conducted from November 20, 2009 to January 21, 2010 (YR 1: 62 d), November 10, 2010 to November 30, 2010 (YR 2: 20 d), and October 18, 2011 to December 20, 2011 (YR 3: 62 d). Dry, pregnant Black Angus cows (90, 78, and 68 cows for YR 1, YR 2, and YR 3, respectively) averaging 1441 lb were used in the study. Each year, cows were stratified based on body weight, age, and pregnancy status and randomly allocated to one of three replicated (n=3) wintering systems that included; (i) oat residue (chaff+straw) grazing (**OAT**), where the oat crop was allowed to mature, grain was harvested, and oat residues were collected and cows grazed residue piles in field paddocks with supplementation; (ii) pea residue grazing (**PEA**), where the pea crop was allowed to mature, grain was harvested, and pea residues were collected and cows grazed residue piles in field paddocks with supplementation; and (iii) drylot (**DL**) pen feeding, where cows were housed in outdoor pens and fed grass-legume (smooth bromegrass-alfalfa) round-bale hay in bale feeders along with supplementation.

Each field area was further subdivided into three 13-acre paddocks and cows were managed in systems (OAT and PEA) in field paddocks; feed was allocated on a three-day grazing period basis using portable electric fence. Water was supplied in insulated troughs and three portable wind breaks were supplied in each paddock. Cows in the DL system were housed in outdoor pens surrounded by wooden slatted fences, with each pen containing an open-faced shed, watering bowl, and round-bale feeder.

Throughout the study, PEA, OAT, and DL cows received an average of 8.8, 6.8, and 0.88 lb/d of rolled oat grain (12.7% crude protein (CP); 69.8% total digestible nutrients (TDN)), respectively, or 0.7, 0.5 and 0.1% body weight (BW) daily. The amount allocated was intended for maintenance of body condition with no BW gain above that of conceptus growth. Cow BW and body condition (BCS) were monitored during the study. All cows had *ad libitum* access to a commercial 2:1 mineral supplement and cobalt-iodized salt throughout the feeding period. Additional grass-legume hay was supplied to cows on OAT and PEA systems only during inclement weather or when extreme winter conditions affected residue DMI and accessibility to piles. Following each treatment period, cows were group-fed daily with 4.0 lb/hd/d of 16% CP range pellet and grass hay (9% CP) to meet protein and energy requirements until there was adequate pasture growth in the spring, or until calving.

System Costs

Costs associated with each winter feeding system included feed, bedding, labor, equipment, repairs, depreciation, and manure removal (DL only). The cost of the crop residue was determined by dividing the total crop production and harvesting expenses by the total yield (crop and straw/chaff pre-harvest) in each system, as described by Kelln et al (2011). Crop production expenses included seed, herbicide, fertilizer, and field passes for harrowing to spread remaining residue, seeding, land rolling, spraying, swathing, combining, and hauling grain. The actual purchase price of hay was used for the cost of forage in the DL system. Actual costs for oat grain, mineral, salt, and bedding straw were used. Additionally, a land rental rate of $30/acre was included in the crop production costs. Equipment costs to produce the feed and to allocate feed during the study were calculated using custom rates published in the Saskatchewan Ministry of Agriculture's Farm Machinery Custom and Rental Rate Guide (SMA, 2008). Labor for each system was estimated at $15/hr (SMA, 2008) and total costs were reported as $/cow/day.

Results and Discussion

Differences observed in rainfall were large, with YR 2 summer period (May to August) being 200% wetter than the 30-year average (Figure 1). The 20 inches of rain observed in 2010 severely affected crop establishment and maturity, directly affecting study period grazing length in YR 2.

Crop Yield and Nutritive Value

Whole crop (grain+straw+chaff) oat and pea biomass was 4.7 and 3.6 ton/acre, respectively. Oat residue (straw+chaff) biomass (0.96 ton/acre) was greater than pea residue biomass (0.49 ton/acre). Oat residue had lower CP level (6.8%) compared to pea residue (11.1%) and mixed hay (10.4%), while pea residue had the greatest CP of all forages (Table 1). Pea residue was similar in CP and TDN with mixed hay, but had less TDN compared to oat residue. Oat residue had greater energy (TDN) concentration than pea residue vs DL hay. Utilization of crop residue was lower in PEA (33.4%) and OAT (44.9%) systems than hay utilization for cows in DL (90.0%) wintering system (Table 1). Overall, forage nutritive value of oat residue, pea residue and hay met NRC (2000) recommended energy requirements for beef cows with similar weight and gestation stage as cows used in the current study.

Cow dry matter intake (DMI) of crop residue and hay varied among feeding systems, with the lowest DMI (7.5 lb/d) being observed for cows in PEA system and greatest (35.3 lb/d) in DL system. Because crop residues in OAT and PEA systems had substantially lower DMI (Table 1) compared to grass-legume hay, it was necessary to provide additional grain supplement (Table 1) to cows grazing the residues to meet protein and energy requirements. The reduced residue DMI observed in the current study is likely a result of combined effects of extreme cold temperatures, snow depth, residue type and palatability, and native animals. In YR 2, rainfall and snowfall were greater than the 30-year average during the summer, fall, and winter affecting crop establishment, maturity, and feed accessibility during the field grazing trial. The heavy snowfall plus high winds or cold temperature visibly impacted feed accessibility by the livestock, ultimately affecting forage utilization and intake.

Table 1. Effect of winter feeding system on DMI, consumed nutrient quantity^{z}

	System^{y}		
Item	**DL**	**OAT**	**PEA**
Forage nutrients			
CP, %	10.4	6.8	11.1
TDN, %	54.5	58.6	50.9
DMI, lb/d			
Forage utilization, %	90.0	44.9	33.4
Forage intake, lb/d	35.3	12.8	7.5
Oat grain, lb/d	0.22	10.8	9.3
Total intake, lb/d	35.5	23.6	17.2

^{z}Average of three years
^{Y}DL = drylot pen feeding; OAT = grazing oat residue in field paddocks; PEA = grazing pea residue in field paddocks.

Table 2. Effect of winter feeding system on beef cow performance^{z}

	System^{y}		
Item	**DL**	**OAT**	**PEA**
Cow Performance			
Initial body weight, lb	1434	1457	1431
Final body weight, lb	1559	1507	1439
Body weight change, lb	125	50	8
Condition (BSC)			
Initial	2.6	2.8	2.8
Final	2.8	2.7	2.6
Change	0.2	-0.1	-0.2

^{z}Average of three years
^{Y}DL = drylot pen feeding; OAT = grazing oat residue in field paddocks; PEA = grazing pea residue in field paddocks.

Cow and Calf Performance

Initial BW did not differ between the winter feeding systems (Table 2), however, cows in DL and OAT wintering systems gained BW while cows in the PEA system maintained body weight. No differences were observed between wintering systems for cow initial and final body condition score (Table 2). In the current study, cows having less experience in extensive field grazing systems and feed access limitation due to weather conditions may have played a role in residue intake restriction. Previous research (Kelln et al 2011) also has suggested that cattle require an acclimation period prior to winter grazing field crops. In addition, cow performance and increased supplementation in the extensive grazing systems in the current study could also be explained by the increased energy demand for field grazing during winter. However, the differences observed in BW and BCS in the current study between cows in the extensive field systems (OAT and PEA) and cows in DL system should not be considered a negative factor of extensive grazing, since all cows were allocated forage and supplementation for maintenance requirements (no net loss or gain of body tissue beyond conceptus growth). Cows in all systems were in fair to good BCS (2.6 to 2.8) throughout and at the end of the study period. In general, negative effects on cow reproduction occur when BCS falls below 2.5 during the pre-calving period (Selk et al. 1988). Table 3 indicated that calving rate was not different, but calf birth weight was different for cows in OAT system (85.3 lbs) compared to cows in DL system (91.7 lbs). According to NRC (2000), optimal calf birth weight for adult Angus cows is about 79.5 lb, which was exceeded in all three wintering systems in the current study. Additionally, Thompson et al (1983) stated that, even with observed differences in forage energy intake levels during winter feeding, and as long as maintenance requirements were met, varying forage energy levels did not have an effect on either cow or calf performance throughout the subsequent production cycle, as evidenced by cows in this study.

Table 3. Effect of winter feeding system on calving rate and calf birth weight[z]

	System[y]		
Item	DL	OAT	PEA
Calving rate, %	96.8	94.0	97.5
Calf birth weight, lb	91.7	85.3	89.1

[z]Average of three years
[y]DL = drylot pen feeding; OAT = grazing oat residue in field paddocks; PEA = grazing pea residue in field paddocks.

Table 4. Effect of winter feeding system on cost ($/hd/day)[z]

	Wintering Systems[y]		
Item	DL	OAT	PEA
Feed cost, $	1.74	1.01	1.15
Direct cost, $	0.05	0.04	0.06
Yardage cost, $	0.34	0.30	0.32
Total cost, $	2.13	1.36	1.53

[z]Average of three years
[y]DL = drylot pen feeding; OAT = grazing oat residue in field paddocks; PEA = grazing pea residue in field paddocks.

Economics of Winter Feeding Systems

Total cost associated with each winter feeding system is presented in Table 4. The DL ($1.74/cow/d) system had the greatest feed cost compared to OAT ($1.01/cow/d) and PEA ($1.15/cow/d) systems. The OAT system had the lowest cost/cow/day, 12% and 36% lower than the PEA and DL systems, respectively. Thus, the current study suggests that annual crop-residue grazing systems can provide an economic alternative to drylot pen-feeding systems, allowing for reduced costs associated with yardage, feed, and grazing expenses.

Implications

This winter feeding study suggests that grazing annual crop residues may be a viable alternative to decrease winter feeding costs. Winter field conditions (snow depth and cold temperatures) limited the accessibility of residue piles by cows in the field. Therefore, even though some crop residue nutritive values were fairly similar to grass-alfalfa hay, residue intake in the field was lower, making it necessary to provide additional supplement to PEA and OAT cows. System costs were lower when grazing pea and oat residues, however, careful consideration must be given so that cow performance is not negatively affected when animals are managed on crop residue during the winter months. Beef producers with access to oat crop residues should consider using this feed in a chaff/straw-based ration along with adequate supplementation to ensure the cow's nutritional needs are being met.

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References

Kelln, B. M., H. A. Lardner, J. J. McKinnon, J. R. Campbell, K. Larson, and D. Damiran. **2011**. Effect of winter feeding system on beef cow performance, reproductive efficiency, and system cost. Prof. Anim. Sci. 27:410.

National Research Council (NRC). 2000. Nutrient Requirements of Beef Cattle. 7th rev. ed. Natl. Acad. Press, Washington, DC.

Selk, G. E., R. P. Wettemann, K. S. Lusby, J. W. Oltjen, S. L. Mobley, R. J. Rasby, and J. C. Garmendia. 1988. Relationships among weight change, body condition and reproductive performance of range beef cows. J. Anim. Sci. 66:3153.

SMA (Saskatchewan Ministry of Agriculture). 2008. Farm machinery custom and rental rate guide. 2007-2008. Regina, SK Canada.

Thompson, W. R., J. C. Meiske, R. D. Goodrich, J. R. Rust, and F. M. Byers. 1983. Influence of body composition on energy requirements of beef cows during winter. J. Anim. Sci. 56:1241.

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