WesternBeef DEVELOPMENT CENTRE

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EFFECT OF PERENNIAL FORAGE SYSTEM ON FORAGE CHARACTERISTICS, COW PERFORMANCE AND SYSTEM ECONOMICS

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Introduction

Winter feeding costs are 60 to 68% of the total production cost of a cow-calf operation system in western Canada (Kelln et al., 2011; Lardner et al., 2014). These costs are due to feeding cows in drylot pens over the winter period, and include costs for harvesting, transporting feed and manure removal. Providing forages to pregnant beef cows during the winter months in western Canada is usually managed as round hay bales placed in bale feeders in pens (Krause et al., 2013). However, forages stockpiled in the field and grazed as dormant fall/winter pasture can be an excellent alternative to the more costly feeding in drylot pens. Winter in-field feeding directly on pasture is a potentially more efficient system in terms of nutrient recycling compared with drylot feeding in a yard (Jungnitsch et al., 2011). The objective of this study was to determine the effects of (i) grazing stockpiled perennial grass-legume forage in field paddocks (**SPF**) (ii) or drylot pen feeding similar quality forage as hay (**HAY**) on beef cow performance and winter feeding system costs.

Crop Management and Weather

A 3-year winter grazing study was conducted at the Western Beef Development Centre's Termuende Research Ranch near Lanigan, Saskatchewan. Each year, a 60-acre meadow bromegrass-alfalfa (grass legume ratio 4:1) pasture (average yield = 1.8 ton/acre) was stockpiled until early September, swathed and windrowed for either grazing or baling. Consequently, 30 acres of the forage crop was baled as large round bales (~1500 lb), transported to the yard site (1 mile from field site) and fed in drylot pens and the remaining crop was swathed in the field for stockpile grazing.

Temperature and precipitation data were obtained 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).

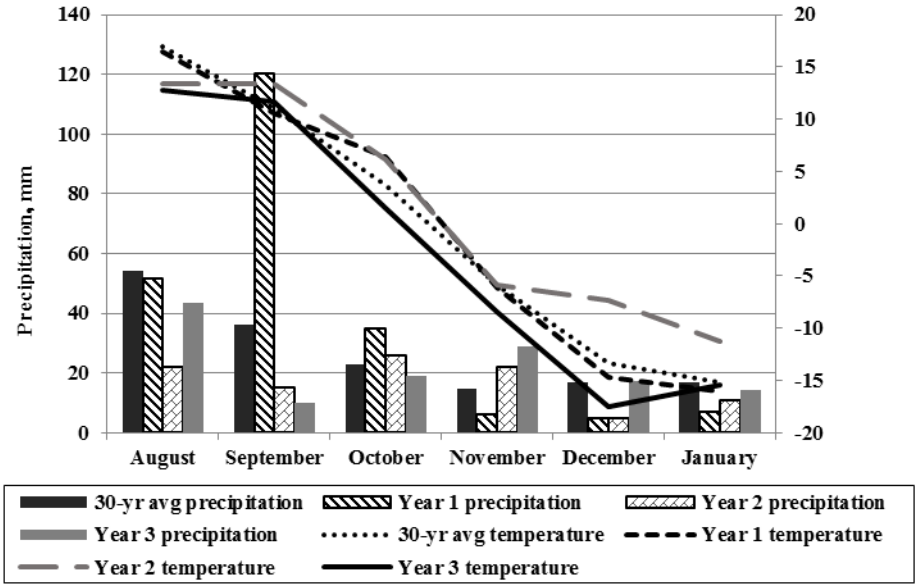

Figure 1. Average monthly precipitation and temperatures from August to January of yr 1, yr 2 and yr 3 compared to 30-year average.

Differences were observed between years for precipitation (rain+snowfall) and temperature, with yr 2 feeding period (November to December) being warmer compared to either the 30-year average (Figure 1) or yr 1 and 3.

Grazing Management

Year to year weather variation affected the length of the fall/winter grazing period. The study was conducted from October 20 to December 7 2010 (yr 1: 48 d); October 11 to December 22 2011 (yr 2: 72 d) and October 11 to December 5 2012 (yr 3; 55 d). Dry, pregnant Black Angus cows (60, 60, and 48 cows for yr 1, 2, and 3, respectively) averaging 1413 lb were used in the study. Each year, cows were stratified based on body weight (BW), age, and pregnancy status and randomly allocated to 1 of 2 replicated (n = 3) forage systems either; (i) stockpiled forage grazing (**SPF**), where perennial grass-legume forage was stockpiled, then swathed and windrow grazed; or (ii) drylot (**HAY**) pen feeding, where cows were housed in outdoor pens and fed similar quality grass-legume round-bale hay.

The SPF field was further subdivided into 3, 10-acre paddocks for grazing and cows were managed in field paddocks where forage was allocated on a 3-day grazing period basis using portable electric fencing. Water was supplied in insulated troughs and 3 portable wind breaks were supplied in each paddock. Cows allocated to the HAY system were housed in 3 separate outdoor pens surrounded by wooden slatted fences, with each pen containing an open-faced shed, watering bowl, and round-bale feeder. The goal was to have cows maintain body condition and have no weight gain above that required for pregnancy. However, the amount of stockpiled forage and hay allotted varied depending on forage utilization and environmental conditions. Throughout the study, cows in SPF and HAY systems received an average of 2.4, and 0.2 lb/d of rolled barley grain (12.2% CP; 86% TDN), respectively, or 0.2 and 0.01% BW daily. Supplement levels differed between SPF and HAY systems, as SPF cows in field paddocks were more exposed to wind chill factor and energy loss due to cold temperature (NRC 2000).

Cow BW and body condition (BCS), feed intake (DMI) and subsequent reproductive performance were monitored during the study. The same cows were used for the entire 3 yr study unless culled for injury or failure to conceive. All cows had *ad libitum* access to a commercial 2:1 mineral supplement and cobalt-iodized salt throughout the feeding period. Following each treatment period, cows were group-fed 4 lb/d of a 16% CP range pellet and mixed grass:legume hay (16% CP, 36% ADF, 58% NDF) to meet protein and energy requirements until there was adequate pasture growth in the spring or until calving.

System Cost

Costs associated with each forage system included feed, bedding, labor, equipment, repairs, Costs associated with each system included feed, salt/mineral, bedding, and yardage - labor, equipment use, infrastructure and manure removal (HAY only). Feed included both forage and rolled barley grain. The rolled barley was purchased at an average price of $0.10/lb. The cost of the forage was determined by dividing the total DM yield (average 1.8 ton/acre) by the costs of swathing, baling and hauling bales to the yard site in the HAY system ($0.023/lb). A land rental rate of $30/acre was also included in the forage cost calculation. For the SPF system, $0.25/cow/day was used to represent the cost of the forage plus a depreciation cost for the infrastructure (fence, portable windbreaks, water trough, feed trough). The feeding process was timed; the times were used to determine equipment and labor costs for feed allocation in each system. Other direct costs included bedding. Depreciation cost for HAY was calculated using an estimated cost for drylot pen infrastructure (fence, gate, pole shed, water bowls, feed trough, bale feeder) less estimated salvage value, divided by expected years of use. Labor was valued at $15.00 per hour and rates for equipment (truck, tractor, bale processor) were obtained from SMA's *Farm Machinery Custom and Rental Rate Guide*.

Results and Discussion

Differences were observed in snowfall and temperature between years, with yr 2 feeding period (November to December) being warmer compared to the 30-year average (Figure 1) or yr 1 and yr 3; which allowed for a longer winter grazing period in the second year.

Forage Nutritive Value, Dry Matter Intake and Soil Nutrients

Forage nutritive value (9.5% CP, 51% TDN) was similar between the two systems (**Table 1**), and met NRC (2000) recommended energy requirements for beef cows with similar weight and gestation stage as cows used in the current study. Animal accessibility to swathed forage in the field can be affected by snow depth and drifting, freezing rain, wind and lower temperatures, all of which can reduce utilization (Kelln et al., 2011). However, this was not the case in the current study. Estimated forage dry matter intake (DMI) varied between the two systems with the greatest DMI (15% greater) being observed for cows in SPF system. Increased consumption of both forage and supplementation in the SPF systems in the current study could also be explained by the increased energy demand for field grazing during winter (NRC, 2000; Kelln et al., 2011; Krause et al., 2013). The maintenance energy requirements increase by 10 to 20% for grazing animals compared to cattle housed in drylot pens (NRC, 2000; Kumar et al., 2012). Soil nitrate levels were slightly higher in the SPF system while other soil nutrients were not significantly different between the two treatments.

Cow and Calf Performance

Initial BW did not much differ between the winter feeding systems (**Table 2**), however, cows in HAY wintering systems had greater BW change (71 lb) than cows managed in the SPF system (52 lb). No differences were observed between wintering systems for cow initial BW and final body condition score (**Table 2**). Cows in both systems were in good body condition (BCS = 2.6 to 2.8) throughout

the study and at the end of the study period. **Table 3** indicates that calf birth BW (94 lb) and calving interval (364 d) were not different between cows managed in the two systems. According to NRC (2000), optimal calf birth BW for mature Angus cows is 79.5 lb., which was exceeded in both systems in the current study. Overall, SPF and HAY systems were similar in beef cow performance and reproductive efficiency.

Economics of Winter Feeding Systems

Total cost associated with each system is presented in **Table 4**. Feed costs were 45% lower for cows managed in SPF ($0.64 cow/d) system compared to cows in the HAY ($1.17 cow/d) system. The SPF system had 12% lower total cost ($1.50 cow/d) than the DL system ($1.72 cow/d). Thus, the current study suggests that perennial stockpiled forage grazing systems can provide an economic alternative to drylot pen feeding systems allowing for reduced costs of $0.21/ cow per day associated with winter feeding expenses.

Implications

This study evaluating two different forage systems indicates that stockpiled perennial forage grazing in field paddocks can be an alternative management system for extending the grazing season during the fall and winter months in western Canada. Nevertheless, climatic conditions can affect the outcome of an extensive system, therefore when managing cows in SPF systems, producers need to be prepared to supplement animals according to winter conditions.

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Table 1. Effect of forage system on nutrient and dry matter intake y[1]		
	Forage system[2]	
Item	**SPF**	**HAY**
Crude protein, %	9.9	9.0
Total digestible nutrients, %	50.9	51.3
DMI, lb/d		
Forage, lb/d	31.1	26.7
Barley grain, lb/d	2.4	0.2
Total diet intake, lb/d	33.5	26.9

[1]Average of 3 years.
[2]SPF = stockpiled perennial forage grazing HAY = round bale hay fed in drylot pens.

Table 2. Effect of forage system on beef cow performance[1]		
	System[y]	
Item	**SPF**	**HAY**
Cow Performance		
Initial body weight, lb	1437	1423
Final body weight, lb	1489	1493
Body weight change, lb	52	71
Body condition		
Initial	2.6	2.6
Final	2.7	2.7
Change	0.1	0.1

[1]Average of 3 years.
[2]SPF = stockpiled perennial forage grazing; HAY = round bale hay fed in drylot pens.

Table 3. Effect of forage system on calf birth weight and calving span[1]		
	System[2]	
Item	**SPF**	**HAY**
Calf birth body weight, lb	95	93
Length of calving span, d	32	44
Calving interval, d	364	363

[1]Average of 3 years.
[2]SPF = stockpiled perennial forage grazing; HAY = round bale hay fed in drylot pens.

Table 4. Economic analysis of forage systems ($/hd/day)[1]		
	Forage system[2]	
Item	**SPF**	**HAY**
Feed cost	0.64	1.17
Direct cost	0.03	0.03
Yardage cost	0.83	0.52
Total cost	1.50	1.72

[1]Average of 3 years.
[2]SPF = stockpiled perennial forage grazing; HAY = round bale hay fed in drylot pens.

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