FACT SHEET
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EFFECT OF WINTER GRAZING SYSTEM ON BEEF COW PERFORMANCE AND SYSTEM COSTS

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Introduction

Winter feeding costs alone account for more than two-thirds of the total annual feeding and management expenses in beef cow-calf production in western Canada (Larson, 2013; Damiran et al., 2016). The increased costs associated with traditional drylot pen feeding in winter have subsequently resulted in the evaluation of alternative extensive grazing systems (McCartney et al., 2004) that may reduce feed costs. Apart from better economic returns, extensive grazing strategies also tend to reduce fuel, equipment and labour costs associated with harvesting and hauling feed, as well as manure removal from pens (Kelln et al., 2011; Damiran et al., 2016). Moreover, beef cows grazed on extensive grazing systems were reported to have similar or improved cow performance without negative effects on reproductive performance compared to cows fed barley hay bales in drylot pens (Kelln et al., 2011). Cool season annual forages such as barley are well suited to Western Canadian growing conditions and provide acceptable forage yield and quality for winter grazing (McCartney et al., 2004; Kelln et al., 2011). Recently, with the introduction of low heat unit corn varieties suited to western Canadian weather, there is an increased interest in the use of warm season annuals in extensive grazing systems (Lardner et al., 2017). However, there are concerns among beef producers with regard to the sorting of energy rich plant parts (Launchbaugh and Dougherty, 2007), forage utilization (DeVries et al., 2014), and weather adaptation (SMA, 2010) of grazing cows in extensive winter management systems. The objectives of this 3-year study was to compare three wintering systems: (i) whole plant, low heat unit hybrid standing corn grazing, (ii) whole plant swathed barley grazing, and (iii) drylot pen feeding barley greenfeed hay during winter on forage characteristics, cow performance, subsequent calf performance, and system costs.

Study Site and Crop Management

The 3 year study was conducted at the Western Beef Development Centre's (**WBDC**) Termuende Research Ranch located east of Lanigan, Saskatchewan. The soil at the site is classified as Chernozemic Black Oxbow soil. In spring each year (late May to early June), a 15 acre field was seeded to corn (cv. DKC 26-25) at the rate of 30,000 seeds/acre and 120 lb/acre of nitrogen (46-0-0) fertilizer was applied by harrowing pre-seeding. Also, in spring each year (early to mid-June), a 15 acre field was seeded to barley (cv. AC Ranger; 2 bu/acre) along with 50 lb/acre of N fertilizer (as 46-0-0). Weed control in the corn crop was managed with pre- and post-seeding applications of 1 L/acre of Roundup each year. The barley crop received an application (0.5 L/acre) tank mix of Refine/Perimeter/Axial BIA each year (late-June to early-July).

Whole plant barley was swathed in late August at the soft dough stage, while whole plant corn continued to grow until the first killing frost in September. The barley greenfeed for feeding in drylot pens was grown in an adjacent field with similar agronomics to the barley in the swath grazing. The barley crop was cut with a haybine, allowed to cure in the swath and then baled into large round hay bales (~1500 lb)which were transported to the yard site and fed in drylot pens.

Grazing Management

Each year 60 dry, pregnant multiparous Black Angus cows stratified by BW (~1500 lb) were randomly allocated to 1 of 3 replicated (n = 2) winter feeding systems: (1) grazing standing whole plant corn (**GWPC**); (2) grazing swathed whole plant barley (**GSB**) in field paddocks or (3) feeding barley greenfeed bales in drylot pens (**DL**). Cows were allocated forage based on forage nutrient density and environmental conditions in accordance with the NRC (2000) beef model for maintenance of body condition. Cows were managed on winter systems for 77 d (9 November 2012 to 25 January 2013) in yr 1, 78 d (24 October 2013 to 9 January 2014) in yr 2, and 45 d (21 October 2014 to 3 December 2015) in yr 3. The cows were allocated 3 to 4 days of standing corn and swathed barley using portable electric fences. Water was provided in insulated portable troughs to each GWPC and GSB paddock (10 cow/paddock) and two portable wind breaks and bedding straw were provided in each replicate paddock. Cows in the DL system were housed in two adjacent outdoor drylot pens (50 × 120 m) surrounded by wooden slatted fences. Each pen contained an open-faced shed and a heated water bowl. Each pen was also provided with a round bale feeder, which was replenished with a new greenfeed bale every 3 to 4 days. All cows were supplied with free choice loose mineral (Right Now® Bronze, Cargill Nutrition) and a cobalt iodized salt block. Following each trial period, the cows were group fed a range pellet at 4.4 lb/cow/d (13% CP) and barley greenfeed hay to meet nutrient requirements until adequate pasture growth was available in the spring. Cows were managed together on summer pasture and during the breeding season until the following winter period. Cow BW, body condition (**BCS**), feed intake (**DMI**) and reproductive performance were monitored during the study.

Weather

Temperatures (°C) and monthly precipitation (mm) data were obtained from WBDC's benchmark site meteorological station. Long term (1981-2010) monthly temperature (°C), precipitation and snow (cm) data were obtained from Environment Canada's Climate data for Watrous, Saskatchewan, which is the closest weather station to the research study site (www.climate.weatheroffice.gc.ca). **Figure 1** suggests that the warmest temperatures during the 3-yr study period were observed in the third year. The grazing periods in yrs 1 and 2 were colder than the 30 yr average (1981-2010), with yr 2 being the coldest. Environmental factors such as extreme cold conditions, snow depth and wind can have a negative impact on animal productivity in extensive grazing programs (Kelln et al., 2011). Increased snow depth and reduced visibility resulting from heavy snowfall can make it difficult for the cows to find and consume forages buried under the snow (Kelln et al., 2011). The average snow on the ground at the end of the months from November to February were 12, 3, and 3.3 cm in yr 1, yr 2, and yr 3 respectively, which also indicates that cows had the least favorable grazing conditions in yr 1 of the study (**Figure 2**). The cows managed in the DL system were fed using a bale feeder so there were no access issues.

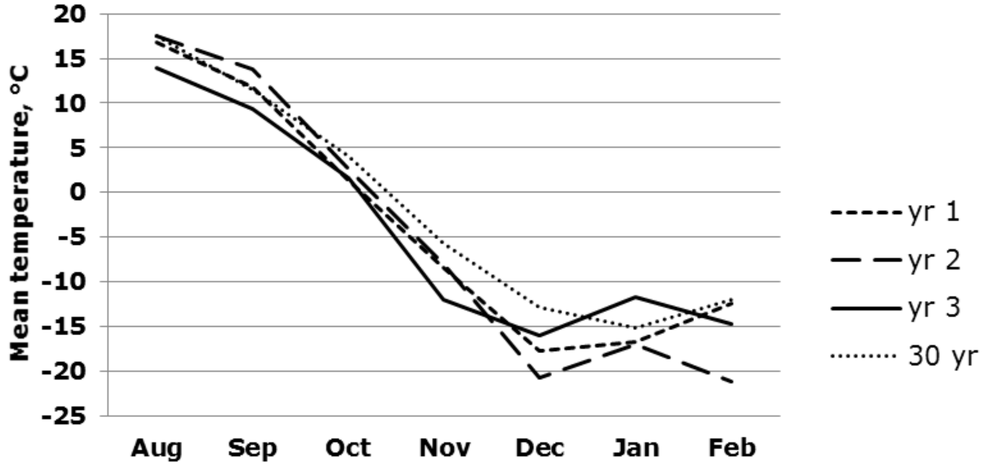

Figure 1. Average monthly temperatures from August to January of 3 yr study period compared to 30-year average

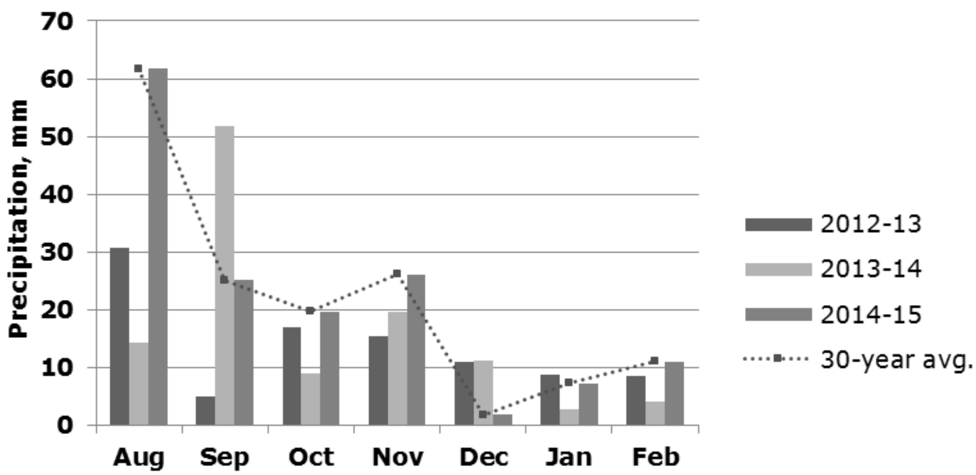

Figure 2. Average monthly precipitation from August to January of 3 yr study period compared to 30-year average

System Costs

Total production costs ($/head/d) were calculated from the crop production costs (divided by yield to determine value for feed), yardage and labour to feed, and other direct costs (bedding, medicine, and veterinary services). Crop production costs were calculated using actual costs incurred, suggested retail prices and published custom rates from the Saskatchewan Ministry of Agriculture's *Farm Machinery Custom and Rental Rate Guide* (SMA, 2010). An opportunity cost of $40/acre was included in the crop production costs; this represents rent that could have generated had the land not been used for feed production. Dry matter yields were determined for each feed and divided by the crop production costs. In the GWPC and GSB systems, feed cost per cow per day is based on the cost per lb of DM, the number of feet allocated to the cows and the lbs of DM per foot of row (GWPC) or swath (GSB). Labour was valued at $18/h, and used the actual number of times cows were fed, bedded, watered and checked with approximate times to complete each activity. Yardage costs were determined based on the calculated rates from cow-calf cost of production analysis as described by Larson (2013). Depreciation costs for each system were based on the starting and ending values of the infrastructure required in each system and the useful life (assumed 15 years).

Results and Discussion

Forage Yield, Composition, Cow Utilization and Dry Matter Intake

A minimum yield of 1790 lb/acre is required to support efficient grazing and forage apprehension through snow during winter months (Coleman, 1992). In the current study, whole plant standing corn and swathed barley produced more than adequate biomass required to support grazing by beef cows (9500 vs. 6960 lb/acre; GWPC and GSB, respectively)(**Table 1**). A 1500 lb beef cow in second trimester of pregnancy requires 50% TDN and 7.8% CP in the diet (NRC, 2000). **Table 1** suggests that these forages were sufficient in meeting all the nutrient requirements of beef cows during the second trimester of pregnancy. Utilization of the 3 forages was different between the winter feeding systems. Limitations to feed accessibility resulting from snow, wind, precipitation, and low temperatures can be more pronounced in field paddocks compared to drylot pens, which can negatively affect feed utilization (Kulathunga et al., 2016).The preferential refusal for consuming corn stalks by cows was observed in the GWPC, which might have resulted in the reduced utilization of the whole corn plant. Cows grazing barley swath had the maximum dry matter intake (35 lb/d), followed by cows in drylot treatment (28 lb/d) and those grazing whole plant corn (22 lb/d).

Table 1. Effect of winter feeding system on beef forage utilization and dry matter intake (%) over 3 yr)

	System[1]		
Item	**GWPC**	**GSB**	**DL**
Forage composition			
CP, %	10.0	11.5	10.3
TDN, %	68.0	61.0	54.0
Forage utilization, %	49.7	67.7	84.0
DMI lb/d	22	35	28

[1]GWPC = grazing standing whole plant corn; GSB = grazing standing whole plant barley; DL = round bale barley hay fed in drylot pens.

Table 2. Effect of winter feeding system on beef cow performance over 3 yr

	System[1]		
Item	**GWPC**	**GSB**	**DL**
Cow BW, lb			
Initial	1459	1465	1470
Final	1516	1486	1470
Change	56.9	19.0	0.1
Body condition (BCS)			
Initial	2.6	2.7	2.7
Final	2.7	2.7	2.7
Change	0.1	-	-

[1]GWPC = grazing standing whole plant corn; GSB = grazing standing whole plant barley; DL = round bale barley hay fed in drylot pens.

Cow Performance

Cow performance data are presented in **Table 2**. The cows did not differ from each other in final body weight. Cows in all 3 systems were in good body condition (BCS = 2.6 to 2.7) and only minor changes were observed throughout the study. In general, any negative effects on cow reproduction (i.e.; pregnancy rate) occur only when BCS drops below 2.5 during the pre-calving and pre-breeding periods.

Calf Performance

Table 3 shows no difference in calf birth BW (average 91 lb) or calving interval (average 379 d). The cows managed in these three systems, GWPC, GSB and DL did not differ from each other in calf birth weight. Moreover it exceeded the current NRC (2000) recommendations for optimal calf birth BW for mature Angus cows, which is 79.5 lb. Pregnancy rates averaged 95% for cows in the year following winter grazing.

Table 4. Economic analysis of winter feeding systems ($/hd/d)[1]

	System[2]		
Item	**GWPC**	**GSB**	**DL**
Feed	1.61	1.43	1.74
Salt & Mineral	0.08	0.09	0.09
Bedding	0.05	0.04	0.06
Labour	0.35	0.35	0.28
Equipment	0.35	0.35	0.73
Yardage (incl. Deprec. & Manure Removal)	0.09	0.09	0.31
Total costs	2.54	2.35	3.21

[1]Average of 3 years.
[2]GWPC = grazing standing whole plant corn; GSB = grazing standing whole plant barley; DL = round bale barley hay fed in drylot pens.

System Costs

Total costs per cow per day associated with each winter feeding strategy are presented in **Table 4**. The feed costs averaged $1.61, 1.43 and 1.74 /cow/d and total costs averaged $2.54, $2.35 and $3.21 /cow/d for GWPC, GSB, and DL, respectively. The feed, labour, equipment and yardage costs were all lower for the extensive systems (GWPC and GSB) compared to cows being fed barley greenfeed hay in drylot pens. Total system costs were 21 and 27% lower for GWPC and GSB, respectively.

Table 3. Effect of winter feeding system on beef cow-calf performance over 3 yr

	System[1]		
Item	**GWPC**	**GSB**	**DL**
Calf birth weight, lb	93	90	89
Length of calving span[2], d	40	49	44
Calving interval[3], d	374	384	378
Calving distribution[3], % of total			
1-21 d	45.5	29.3	38.1
22-42 d	27.7	34.3	47.6
43-63 d	19.6	26.4	14.3
64-84	7.1	10.0	-
Pregnancy rate[3], %	93	93	98

[1]GWPC = grazing standing whole plant corn; GSB = grazing standing whole plant barley; DL = round bale barley hay fed in drylot pens.
[2]Avaiable only for cows in yr 2 of the study.
[3]Available for cows in yr 2 and 3 of the study

Implications

Extensive winter grazing systems such as grazing whole plant standing corn or swathed whole plant barley are effective alternatives to traditional drylot management systems for reducing feed and production costs during the winter feeding period. However, the unpredictability of temperatures and windchills during winter in western Canada may pose risks to beef producers adopting extensive winter grazing. Utilization of portable windbreaks and bedding are recommended practices to help reduce the adverse effects of weather, without negatively affecting cow performance or reproductive efficiency.

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