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EFFECTS OF SUPPLEMENTING WINTERING BEEF COWS GRAZING BARLEY CROP RESIDUE ON PERFORMANCE AND SYSTEM COST

By: Dr. Daalkhaijav Damiran, Dr. Bart Lardner, Kathy Larson MSc, and Dr. John J. McKinnon

Introduction

Winter feed, both what is fed and how it is fed, accounts for one of the largest costs for cow-calf producers. Costs can reach as high as 60 to 70% of the total annual production cost of a cow-calf operation in western Canada (Kelln et al., 2011). Drylot pen feeding is the highest cost method for feeding cows over the winter feed due to the costs to harvest and transport the feed and costs associated with manure removal. Grazing pregnant beef cows on cereal crop residues through the winter months is an option to potentially reduce the costs of wintering beef cows (Kelln et al., 2011; Krause et al., 2013). When crop residues are the main forage in beef cow rations during the winter months, additional energy and protein must be provided to meet the animal's requirements for these nutrients (Van De Kerckhove et al., 2011; Damiran et al., 2015). The objective of this study was to compare canola meal (**CM**) with wheat-based dried distillers' grains with solubles (**wDDGS**) as a supplement when wintering beef cows on barley crop residues.

Site and Crop Management

A 2-year winter grazing study was conducted at the Western Beef Development Centre's (**WBDC**) Termuende Research Ranch near Lanigan, Saskatchewan. Each year in June, a 60 acre field of barley was seeded at 96 lb/acre, along with 124 lb/ha of actual nitrogen. The barley crop was swathed in early September and then combined shortly after with crop residues (straw+chaff; **STCH**) collected and dropped in ~50 lb piles using a whole-buncher (AJ Manufacturing, Calgary, Alberta) unit attached to the combine. Prior to grazing the residue, the 60-ac field was further subdivided into six 10-ac paddocks using high-tensile electric fencing to facilitate grazing and control animal access to crop residue.

Animal and Feeding Management

The 2-yr grazing study was conducted from October 26 to December 14, 2012 (yr 1; 49 d) and from October 28 to December 7, 2013 (yr 2: 39 d). Weather variation affected the length of the winter grazing period between study years. The study was conducted in an environment with colder average temperatures (0, -10 and -20°C, October, November, December, respectively) and more precipitation (snowfall) compared to the 30-yr average (+5, -5 and -10°C, October, November, December, respectively) weather condition for the area.

Sixty dry, pregnant Black Angus cows weighing an average of 1460 lb were used in the study. Each year, cows were randomly assigned to 1 of 6 barley **STCH** paddocks (10 cows/paddock), and then paddocks were randomly assigned to 1 of 3 replicated (n=2) supplementation treatments (1) 100% wDDGS (39.2% CP, 78.8% TDN, DM basis); (2) 50% wDDGS and 50% CM (**50:50**); or (3) 100% CM (42.6% CP, 71.5% TDN, DM basis). The amount of feed (STCH + supplementation) allocated was intended for maintenance of body condition (**BCS**), with no significant body weight (**BW**) change other than that of conceptus growth. Cow access to STCH piles (5.7% CP; 51% TDN) was controlled using temporary electric fence on a 3-d basis. The average supplementation rate was 0.41% BW or 6 lb/d. Cow BW and body condition, feed intake (**DMI**) and subsequent reproductive performance were monitored during the study. In addition, each cow was supplied with Right Now Emerald (Cargill Animal Nutrition, Winnipeg, Manitoba) mineral at 70 g/d and limestone at 40 g/cow/d (15 g Ca/cow/d). All cows had ad libitum access to a commercial 2:1 mineral supplement and cobalt-iodized salt throughout the feeding period. Additional rolled barley grain (12.3% CP; 84.0% TDN; processing index = ~76%) was supplied (0.9 lb/hd/d) to cows only during inclement weather or when extreme winter conditions affected residue DMI and accessibility to piles.

Following each treatment period in late December, cows were managed as a single group and fed 4 lb/hd/d of range pellet (16% CP) and grass: alfalfa hay (16% CP, 58% NDF) to meet protein and energy requirements. In January the diet switched to 50% hay (13.2% CP, 58.8% TDN) and 50% barley greenfeed (13.9% CP, 58.2% TDN). In February and March, all cows received a pre-calving pellet at 4 lb/hd/d (containing 49 mg/lb Rumensin; 13.0% CP, 58.2% TDN; FeedRite Ltd., Humboldt, Saskatchewan) and *ad libitum* grass-legume hay (13.2% CP; 58.9% TDN).

System Costs

Costs associated with each supplementation strategy included those related to feed, labor, and equipment according to Krause et al. (2013). Costs that did not vary between systems (i.e. vaccination) were not included in the analysis. Crop production expenses including seed, herbicide, fertilizer, and field passes for harrowing, seeding and spraying were used to generate a value for the crop residue along the costs for combining and hauling grain and piling crop residue in the field. Based on feed and ingredient prices at that time of the study an economic analysis focusing on the feed cost was carried out. The price of canola meal ($222/tonne), wDDGS ($210/tonne), and barley ($260/tonne) were October 2012 market prices. Additionally, a land rental rate of $30/acre was built into the cost of the feed. Equipment costs to produce the feed and to allocate feed during the trial were calculated using custom rates published in the Saskatchewan Ministry of Agriculture's Farm Machinery Custom and Rental Rate Guide (SMA, 2008). The feeding process was timed and used to allocate feeding equipment and labour costs. Labour was valued at $18/h and reported as $ cow/d. Depreciation (buildings and infrastructure) and building and fence repair costs were an average from previous research studies conducted at the WBDC (Krause et al., 2013).

Results and Discussion

Dry Matter and Nutrient Intake

Effect of winter feed supplementation strategy on dry matter feed intake and consumed nutrient quantity over the 2-yr study is presented in **Table 1**. STCH utilization was similar between groups averaging 75.8 percent. Average STCH intake was 27.1, 21.8, and 28.0 lb/d (averaged 25.6 lb/d), or 1.9, 1.5, and 1.9% of BW per day for wDDGS, 50:50, and CM supplemented cows, respectively. These results indicate that wDDGS and CM have comparable effects on beef cow forage intake. The results also indicate that wDDGS, CM or both can be used to meet both energy and protein requirements without negatively affecting STCH consumption.

In a review by Moore et al. (1999) on the effects of supplementation of cattle consuming forages ad libitum, it was summarized that forage DMI was decreased when supplemental energy intake was greater than 0.7% of BW. The level of supplementation in the current study was 0.41% BW (including barley supplementation = 0.45% BW), which is well below the critical value of Moore et al. (1999). No major differences were observed among the winter supplementation strategies in total DM (STCH + supplement) or nutrient intake of the cows. Total DMI was 33.7, 28.4, and 34.2 lb/d or 2.3, 1.9, and 2.4% of BW per day (averaged 2.2% of BW) for wDDGS, 50:50, and CM supplemented cows, respectively.

Table 1. Effects of supplement strategy on beef cow dry matter and nutrient intake

	Supplement[1]		
Item	**wDDGS**	**50:50**	**CM**
Straw-chaff utilization, %	77.9	74.9	74.6
Feed Intake			
Straw-chaff, lb/d	27.1	21.8	27.6
DDGS, lb/d	5.7	2.9	-
Canola meal, lb/d	-	2.9	5.7
Barley, lb/d	0.9	0.9	0.9
Total diet, lb/d	33.7	28.4	34.2
Nutrient intake			
CP, lb/d	4.0	3.8	4.2
TDN, lb/d	19.4	16.3	18.7

[1]wDDGS = cows supplemented with 100% wheat-based dried distillers grains with solubles; 50:50 = cows supplemented with 50% wDDGS and 50% CM; CM = cows supplemented with 100% canola meal.

Cows in the 50:50 system consumed similar to NRC (2000) predictions, but cows in wDDGS and CM treatments consumed 15-20% greater energy than predicted. Likewise, CP consumption for all cows regardless of treatment was greater (~2.2-2.5 fold greater) than NRC (2000) recommended levels for beef cows with similar weight and gestation stage to the animals used in the current study. Thus, in the current study, both wDDGS and CM were serving as protein and energy sources for cows consuming STCH forage.

Cow and Calf Performance

Cow performance data are presented in **Table 2**. Cows in 50:50 supplementation strategy had a positive BW change, while cows in the wDDGS and CM supplementation strategies lost BW during the winter grazing. Cows in all 3 systems were in good body condition (BCS = 2.5 to 2.8) and only minor changes were observed throughout the study (Table 2). In general, as Selk et al. (1988) pointed out, 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.

Table 2. Effects of supplement strategy on beef cow performance[1]

	Supplement[1]		
Item	**wDDGS**	**50:50**	**CM**
BW, lb			
Initial	1460	1451	1460
Final	1443	1454	1455
Change	-17	3	-5
Body condition (BCS)			
Initial	2.8	2.8	2.8
Final	2.6	2.5	2.6
Change	-0.2	-0.3	-0.2

[1]wDDGS = cows supplemented with 100% wheat-based dried distillers grains with soluble; 50:50 = cows supplemented with 50% wDDGS and 50% CM; CM = cows supplemented with 100% canola meal.

Table 3 shows that calf birth BW (average 91 lb) and calving interval (average 381 d) were not different between cows managed in the 3 supplementation strategies. Pregnancy rates (93%) for cows in the year following crop residue grazing did not differ between supplementation strategies.

Table 3. Effects of supplement strategy on calf birth weight, calving interval and cow pregnancy rate

	Supplement[1]		
Item	**wDDGS**	**50:50**	**CM**
Calf birth weight, lb	93	92	88
Calving interval, d	383	385	375
Cow 2nd yr pregnancy rate, %	85	97	92

[1]wDDGS = cows supplemented with 100% wheat-based dried distillers grains with solubles; 50:50 = cows supplemented with 50% wDDGS and 50% CM; CM = cows supplemented with 100% canola meal.

System Cost

Total cost associated with winter supplementation strategy is presented in **Table 4**. As expected mineral costs ($0.15 cow/d), labour ($0.18 cow/d) and equipment ($0.29 per cow/d) costs were similar among treatments. The cost of forage (straw+chaff) and supplement combined made up ~72% of the total cost. The cost of the winter supplementation strategies used in this study were ~36% less than the cost of feeding cows barley greenfeed round bale hay in drylot pens (Krause et al., 2013). The typical winter feeding period for beef cows in western

Canada is 160-180 d (Larson, 2013). The current study results suggest that one quarter (24-28%) of the winter feeding period can be managed by grazing crop residues in field paddocks with adequate supplementation. In addition, previous work at the WBDC (Kelln et al., 2011) has indicated that with extensive winter grazing, an increase in soil fertility is observed due to retention of soil nutrients resulting from the manure and urine from cows winter feeding in field. The fertilization value was outside the scope of this experiment, however, production costs could be offset by the nutrient benefits.

Table 4. Economic analysis of supplement strategy ($/hd/d)

	Supplement[1]		
Item	**wDDGS**	**50:50**	**CM**
Feed cost			
Straw-chaff cost	0.24	0.21	0.27
Supplement cost[2]	0.72	0.74	0.74
Mineral cost[3]	0.15	0.15	0.15
Total feed cost	1.11	1.10	1.16
Labor cost[4]	0.18	0.20	0.19
Equipment cost[5]	0.05	0.05	0.05
Total cost	1.34	1.35	1.40

[1]wDDGS = cows supplemented with 100% wheat-based dried distillers grains with solubles; 50:50 = cows supplemented with 50% wDDGS and 50% CM; CM = cows supplemented with 100% canola meal.
[2]Includes wDDGS/CM and rolled barley grain costs.
[3]Includes minerals/limestone and salt costs.
[4]Includes cost of allocating straw-chaff, supplement, and rolled barley grain.
[5]Equipment costs to allocate the feed and management.

Conclusion and Implications

The results of this study support that either wheat-based dried distillers' grains with solubles, canola meal or a 50:50 blend are good sources of supplemental energy and protein for beef cows being wintered on crop residue. When supplemented at recommended levels their use allows beef cows to over winter with minimal to no body weight change and no negative effects on reproductive performance or subsequent calf performance. However, environmental conditions (i.e., snowfall, temperature, and wind) may limit accessibility of feed in field crop residue grazing systems. Therefore careful management must be considered when using these systems during the winter season.

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