Western Beef Development Centre
Division of PAMI

EFFECT OF WINTER FEEDING SYSTEMS ON COW PERFORMANCE & CROP YIELD

**By: Breeanna Kelln, Dept. Animal & Poultry Science;
Dr. Bart Lardner, WBDC; Dr. Jeff Schoenau, Dept. Soil Science;
& Tom King, Dept. Soil Science**

Introduction

Managing the pregnant beef cow during the winter feeding season represents a large cost for Western Canadian producers, upwards of 60-65% of the total cost of production (Kaliel and Kotowich 2002). Harvested forage, such as hay, costs between $0.03 and $0.07 per pound of dry matter, which is double the cost for the same amount of nutrients from pasture (Kallenbach 2000). In addition, the cost of feeding bales can be equal to 3% of the cost of harvesting the hay (Volesky et al. 2002). These costs can lead to a substantial increase in wintering beef cattle and, consequently, many producers are looking to decrease production costs with feeding systems that utilize annual crops, such as swath grazing, bale grazing, and grazing crop residue. However, the impact of these alternative winter feeding systems on cow performance is a significant concern for many cow/calf producers. This study compared three field feeding systems to traditional pen feeding, evaluating system effects on cow performance and the following year's crop production.

Study Site Description

A two-year study was conducted at the Western Beef Development Centre's Termuende Research Ranch, located at Lanigan, SK, over the 2005/06 and 2006/07 winter periods. The feeding systems included swath grazing (SG), bale grazing (BG), and straw/chaff grazing (ST/CH) compared to a traditional drylot system (DL). In June of each year 100 acres of forage barley (cv. Ranger) was seeded at two bushels per acre, along with 50 lbs per acre actual nitrogen (N). The field was then sub-divided into ten, 10-acre paddocks using electric fence. The barley crop was swathed at mid-dough stage for either greenfeed or swath grazing. Straw/chaff paddocks were left to mature and the grain was combined each year in late September. A whole-buncher (AJ Manufacturing, Calgary AB) was attached to the combine to collect the piles of straw/chaff residue.

Trial Management

Each year 180 cows were randomly allocated to one of four winter systems with three replicate groups per system. Each replicate group of cows (n=15) was confined in the 10 acre paddock and managed using electric fence to control access to feed. Drylot cows were housed in pens at the Termuende Research Ranch facilities. In each system feed was allocated according to maintenance requirements. All cows were fed on a three-day feeding schedule along with free choice salt and mineral. Water was supplied in troughs and portable windbreaks were placed in each paddock and moved with the cows throughout the trial. The 2005/06 trial period lasted 76 days due to available straw/chaff feed. Cows on the swath graze and bale graze systems were able to graze an extra 19 days. This allowed for an average of 142.5 cow-days/acre for the swath graze and bale graze systems, and 114 cow-days/acre for the straw/chaff system. The 2006-07 trial period lasted only 21 days due to heavy freezing rains and winter storms limiting accessibility of the feed. However, cows were allowed back on the fields in early spring for another 21 day period until all feed was consumed.

Crop Yield and Quality

Yield samples of the standing crop were taken in the fall of each year prior to grazing. In both years of the study, the barley crop yielded extremely high, averaging 3.57 tons/acre (Table 1). In addition to pre-grazing yield, post-grazing crop yield was estimated the following growing season in August to determine effects of feeding systems on subsequent crop production. The highest yield was observed on the bale grazing areas at 3.21 tons/acre compared to 2.81 tons/acre on the straw/chaff areas (Table 1). This 13% decrease in yield may be attributed to an immobilization of plant-available nitrogen due to the high amount of carbon associated with the residue straw left after feeding. However, the nitrogen in these areas will be converted to a plant available form over the next couple of years. The study site where the crop was grown had a history of manure application and, therefore, nutrients were not limiting which is reflected in the overall high yields observed.

Table 1. Forage barley yield (dry matter basis)

		Lbs/acre	Tons/acre
Pre-Grazing	2005/06	6519	3.23
	2006/07	7824	3.91
Post-Grazing[z]	Swath Graze	5956	2.98
	Straw/Chaff Graze	5612	2.81
	Bale Graze	6424	3.21

[z]Crop yield 2006-07

Feed samples were taken from each treatment area throughout the grazing season to monitor feed quality as the winter progressed (Table 2). The average energy (TDN) levels prior to grazing for SG, ST/CH, BG and DL were 64, 48, 66 and 66%, respectively. Crude protein (CP) levels were 14, 10, 13 and 13% for SG, ST/CH, BG and DL, respectively. Quality of the feed decreased marginally throughout the winter, with an average decrease of 4% TDN and 1% crude protein. Due to the lower quality of the straw/chaff piles, cows on the straw/chaff system were supplemented with a range pellet (14% CP) and 78% TDN at 6 lb/day/head.

Table 2. Feed quality in wintering systems[z]

Treatment	CP[y] *(%)*	TDN (%)	DE (Mcal/kg)
Swath Graze	13.9	64.0	2.8
Straw/Chaff Graze	9.7	47.6	2.1
Bale Graze	13.3	66.1	2.9
Drylot	13.3	66.1	2.9

[z]average of 2005/06 and 2006/07
[y]CP=crude protein; TDN=total digestible nutrients; DE=digestible energy

Cow Performance

Measurements of live body weight, body condition, rib and rump fats were taken at the start of the trial and end of the trial, and every 21 days throughout. Apparent dry matter intake was also estimated in each system after the feeding period. Over the two years of the study, cows in drylot system gained more than cows in the extensive field feeding systems (Table 3). All the cows on trial were in the second trimester of gestation and were allocated feed to meet maintenance requirements, therefore, the greater daily gain observed in the drylot treatment may not be economically beneficial compared to the other systems. Cows on the straw/chaff system had slightly reduced gains when compared to the other treatments, which may be attributed to the lower quality of the crop residue. The range pellet supplemented in the straw/chaff system allowed for nutritional requirements of the cattle to be met, and animals gained nearly 0.5 lb per day. Body condition score, rib and rump fat measurements were minimally affected with little differences observed between treatments. No effects on reproductive performance were seen in any feeding system over the two years. Apparent dry matter intake (DMI) was similar between swath graze and straw/chaff groups while bale graze and drylot cows had slightly higher intakes (Table 3). The drylot treatment cows consumed 8% less feed compared to bale graze cows, however, drylot cows had greater daily gains suggesting perhaps increased nutrient requirements when cows are managed in field feeding systems.

Table 3. Effect of wintering feeding system on cow performance and estimated apparent intake (dry matter basis)

Treatment	Initial Body weight *(lb)*	ADG[z] *(lb)*	DMI[y] *(lb)*
Swath Graze	1349	0.89	26.3
Straw/Chaff Graze	1355	0.47	26.2
Bale Graze	1352	0.88	30.5
Drylot	1349	1.98	28.1

[z]ADG=average daily gain; average of 2005/06 and 2006/07 trial periods; weights have been adjusted to account for conceptus growth
[y]DMI = estimated apparent dry matter intake from 2005/06 and 2006/07 trial periods

Conclusions

Beef cows are allocated to one of four replicate (n = 3) winter feeding systems to investigate system impact on animal performance. Cow body weight over the two-year trial was not affected by feeding systems. Feed quality during the study was more than adequate to meet maintenance requirements of the animals. Barley crop yield was increased in areas where cows were bale grazed the previous year, suggesting increased capture of manure nutrients in these areas (Kelln et al. 2007).

Figure 1. Cows bale grazing November 2006

Acknowledgements

Appreciation is given to the Saskatchewan Beef Development Fund and the Saskatchewan Agriculture Development Fund for monetary support for this project. Acknowledgment is also given to Leah Froehlich at the Western Beef Development Centre for collection of data during this study.

References

Kaliel D and Kotowich J. 2002. Economic evaluation of cow wintering systems. Provincial swath grazing survey analysis. Alberta Production Economics Branch, Alberta Agriculture Food and Rural Development, Edmonton, AB.

Kallenbach, Robert. 2000. Reducing losses when feeding hay to beef cattle. University of Missouri Extension. Accessible: http//muextension.missouri.edu/explore/agguides/crops/g4570.htm

Kelln B, Lardner, HA, Schoneanu, J and King T. 2007. Effect of winter feeding systems on soil nutrients, soil distribution and soil compaction. Western Beef Development Centre Fact Sheet. #2007-01. 4pp.

Volesky, J.D., Adams, D.C. and Clark, R.T. 2002. Windrow grazing and baled-hay feeding strategies for wintering calves. J. Range. Manage. 55:23-32.

For more information contact:
Western Beef Development Centre
Box 1150
Humboldt SK S0K 2A0
Phone (306) 682-3139 Fax (306) 682-5080
www.wbdc.sk.ca

AGRI-FOOD INNOVATION FUND
Canada Saskatchewan