Western Beef
Development Centre

WINTER FEEDING BEEF COWS - MANAGING MANURE NUTRIENTS

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Introduction

Beef cattle producers in Western Canada compete at an economic disadvantage relative to other regions in North America due to high winter feeding costs. Producers are seeking ways to effectively reduce these costs by managing manure nutrients more efficiently yet still maintain acceptable levels of beef cattle production. In the past few years, producers have been moving from confined drylot winter feeding systems where cattle are housed in pens and manure is hauled out, to systems where cattle are wintered on field feeding sites and the manure nutrients are distributed over the site. Beef cattle typically do not retain the majority of feed nutrients. Erickson and Klopfenstein (2001) reported that feedlot steers only retained 10 % of the nitrogen (N), excreting the remaining 90% in the urine and feces. In addition, most of the nitrogen excreted in the urine was then lost to volatilization. There is the potential to more efficiently utilize N, if some of these losses can be reduced. This study compared drylot versus field wintering systems, primarily evaluating changes in soil nutrients from winter feeding sites.

Winter Feeding Systems

Ninety-six (96) crossbred pregnant beef cows were randomly allocated to 1 of 3 replicated (n=2) winter feeding systems. Feeding systems included (1) field bale grazing (BG), round straw + grass-legume hay bales fed *ad libitum* every 3 days; (2) field bale process feeding (BP), round straw + grass-legume hay bales processed and windrow fed *ad libitum* every 3 days; and (3) drylot feeding (DF), round straw + barley greenfeed bales processed bunk fed in drylot daily. In the BG system, straw and hay bales were set out on the site in fall, in 18 rows of 8 bales each. Access to feed was controlled with electric fence allowing 1 hay and straw bale every three days. The BP system utilized a Highline 6800 bale processor to feed 1 hay and straw bale every 3 days, with feeding areas rotated throughout the paddock over the course of the trial. In the DF system, cows were fed daily with a feed wagon and tractor. In all systems, the amount of feed was varied according to weather conditions. All feeds were sampled and analyzed for moisture, protein, and energy to determine rations for each feeding system. Daily rations were based on 3% of body weight, consisting of 16 lbs of oat straw and 24 lbs grass/legume hay or greenfeed, calculated at 40 lbs per head per day. Salt and trace mineral was supplied free choice.

Site Description and Management

The study was conducted at the Termuende Research Farm, Lanigan, SK, over two consecutive winters, 2003-2004 and 2004-2005. The winter field-feeding site was a long established Russian wild ryegrass (*Psathyrostachys juncea*) pasture situated on an Orthic Black soil (Saskatchewan Soil Survey, 1992). The site was divided into four 2.5-acre replicate areas located opposite each other with a centralized winter watering system. BG and BP feeding systems were studied at this site. No fertilizer was applied to the study area during the previous 2 years. However, in 2000 and 2001, the site received 30 ton/acre of cattle manure and 50 lb N/acre (46-0-0), respectively.

Soil Measurements

Soil samples (n=36) were collected from the site in the fall of 2003 to provide background levels of soil nutrients. Feeding areas were again sampled (n=45) in the spring of 2004 following winter feeding. All samples were taken to a 6-inch depth and analyzed for nitrate N, ammonia N, phosphorous (P), and potassium (K). For comparative purposes, manure treatments from the drylot system were also mechanically applied to the research site.

In the fall of 2003, cattle manure and compost from the DF system was mechanically applied to the study site in a replicated complete block design with 4 replicates per treatment. Treatment rates, manure at 30 ton/acre and compost at 10 ton/acre, were based on the amount of manure deposited by cows over the feeding period. Treatments were laid out in 100 ft X 16 ft strips and consisted of control, raw manure, and composted manure.

Results

Composite samples were taken for nutrient analysis from the manure and compost, and are presented in **Table 1**. Samples were analyzed for total N and phosphorous (P), and available N and phosphorous.

Table 1. Nutrient analysis of raw manure and compost applied to the pasture study site.

	Available N	Total N	Available P	Total P
	---------------------------------- lb/ton			--
Manure	.026	5.1	.042	1.7
Compost	.094	12.4	.048	3.5

Soil Nutrients

Soil sample levels of nitrogen and potassium are shown in **Table 2**. In fall 2003, soil N levels were equivalent in all treatment areas prior to manure application or cattle wintering. Variation was small, showing an even distribution pattern of nutrients at the research site. However, following winter feeding of beef cows, soil nutrients on research plots were highly variable. Nutrient levels from feed sites showed inorganic soil N levels varying from 44 to 161 lb/acre and K levels from 1150 to 2332 lb/acre (**Table 2**). Nitrogen levels were 2.5 to 3.0 X greater on bale graze and bale process feeding sites compared to control. Levels were also significantly greater where cattle were wintered compared to treatment areas, which received manure or compost applied with equipment. This would suggest that the increased N levels from cattle wintering sites appeared to be due to capture of urine nutrients that had been lost when the cows were fed in the corral.

Table 2. Soil nutrients in the 6-inch depth (lb/acre).

	Inorganic nitrogen (NO_3-N + NH_4-N)		Potassium (K)	
	Fall 2003	*Spring 2004*	*Fall 2003*	*Spring 2004*
Bale Processing	31.4	161.6*a*	1442.4	2332.9*a*
Bale Grazing	30.3	113.4*a*	1381.7	2126.1*a*
Manure	32.5	40.1*b*	1334.3	1293.5*b*
Compost	42.3	53.4*b*	1249.7	1216.9*b*
Control	36.6	44.4*b*	1137.4	1150.0*b*

Within a column, means having the same letter do not differ significantly.

Costs

Costs associated with the project include labour, equipment, feed, and custom work. All costs were calculated in total then reported as cost per cow per day. Feed costs included trucking and were: hay at $68.95 per bale, oat straw at $23.00 per bale, and greenfeed at $37.70 per bale. Labour for feeding was charged at $15.00 per hour. Equipment costs were calculated using a guide to machinery rates (Saskatchewan Agriculture & Food, 2004). Therefore, in 2003-04 system costs of DF, BP, and BG were $1.42, $1.04 and $1.06 per cow, respectively. In 2004-05, costs for DF, BP, and BG were $1.53, $0.96 and $0.95 per cow, respectively.

Conclusions

Crossbred pregnant beef cows (n = 96) were allocated to one of three replicate (n = 2) wintering systems. Significant benefits can result from winter feeding beef cows on preselected sites due to increased capture and utilization of manure nutrients. Deposition of nutrients with cows versus machinery indicates more efficient cycling of nitrogen for subsequent pasture growth.

In this study, economic calculations favored infield feeding. Cow cost per day was lower for field feeding than wintering cows in drylot pens. Feed costs were similar between the systems, but field feeding had savings in machinery use and manure handling costs. Results also indicate that benefits from wintering cows on feeding sites can be managed to reduce daily costs with minimal impacts on cow performance.

**n stands for the number of samples taken; e.g. n=36 indicates that 36 samples were taken.*

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