Effects of bale feeder type, monensin supplementation, and limit feeding on hay waste, intake, and performance of beef cattle

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STORY IN BREIF

This experiment was conducted to evaluate the effects of limit feeding, monensin supplementation, and bale feeder type on cow performance, hay waste, net disappearance, and apparent digestibility. Angus and Angus X Hereford cows were allotted by body weight and assigned to one of two treatments. Treatment 1 (control) included 24 hour access to an open bottom steel ring feeder and 1.0 lb/day of a 38% CP cottonseed meal based supplement. Treatment 2 (limited) included 7 hour access to a modified cone feeder with low quality prairie hay and 1.0 lb/day of a 38% CP cottonseed meal based supplement with 200 mg/head inclusion of monensin. Cows were allotted to one of four previously grazed 3 acre paddocks with a 40 x 25 m^2 concrete pad. There was no difference between day 0 and off test body weight change for cattle receiving the control or limited treatment. Hay waste was reduced by the limited treatment. Total waste was 346 and 165 lb for the control and limited treatments, respectively. The limited treatment wasted 11.9% of bale weight, compared to 24.9% in the control treatment. Net disappearance of hay for each cow was reduced from 26.55 to 21.96 lb per day for the control and limited treatments, respectively. Improved hay efficiency resulted in a decrease in cost of hay and supplement/cow of $0.32/d. The combination of modified cone feeder, limit feeding, and monensin supplementation resulted in a decrease in feeding cost while not sacrificing cow performance.

Key Words: ionophore, round bale, hay feeding, efficiency

INTRODUCTION

Feeding hay to beef cattle in the Great Plains is a very common management practice. There have been several technologies or management strategies developed to increase efficiency of harvested forage utilization. These include, but are not limited to, hay feeder design, limiting access to hay, and monensin supplementation. Pasture and feed for cattle can account for over 60% of the costs of a cow-calf operation (Miller et al., 2001). For 101 northern plains beef herds, hay cost averaged $152 per cow exposed (Hughes, 2013). As input costs continue to rise, the ability to reduce feed costs by increasing hay feeding efficiency has the potential to greatly affect cow-calf profitability in the Great Plains. The purpose of this study was to determine hay disappearance, hay waste, and animal performance of a winter feeding system integrating these three underutilized technologies compared to a more conventional winter feeding system.

MATERIALS AND METHODS

This experiment was conducted at the Range Cow Research Center, North Range Unit, located approximately 28 mi west of Stillwater, OK. Seventy two gestating Angus and Angus x Hereford cows (1,172 ± 130 lb) were allotted by 12 h shrunk BW and assigned to one of two treatments. Treatment 1 (CONT; control) included 24 h access to an open bottom steel ring feeder containing low quality prairie hay (6.2% CP, 54% TDN) and 1.0 lb/d of a 38% CP cottonseed

meal-based supplement. Treatment 2 (LIMIT; limited) included limited access to a modified cone feeder containing the same low quality prairie hay. A similar protein supplement (38% CP) containing monensin (MON, Rumensin 90®; Elanco Animal Health; Greenfield, IN) was fed at the rate of 1.0 lb/d to deliver 200 mg of monensin daily. Wire panels were placed around the concrete pads to allow access to hay for 7 h daily; starting at 0800 h. Cattle were assigned to one of six pens measuring three acres each with three replications (pens) per treatment and twelve cows per pen. Each pen was previously grazed to remove standing forage and four pens included a 40 x 25 ft^2 concrete pad with a feeder on each pad. Three waste collection periods were completed during the experiment. Prior to collection, the concrete pads were cleared of hay and debris, and all hay remaining within the feeders was removed, weighed, and sampled. After the pads and feeders were cleaned, a new bale was placed in the feeders and the collection period began. All hay outside of the feeders at the time of collection was considered waste. Waste was separated into wet and dry subgroups to account for differences in dry matter due to fecal and urine contamination. Hay waste was measured at 1400 h daily until 85% of the hay within each feeder was consumed. Cattle weights were taken at 0800 each weigh day. Cattle were removed from pens containing open feeders at daylight to reduce differences in fill between treatments. Cattle were removed from treatments for 7 d and reweighed to obtain a common fill off test weight.

RESULTS AND DISCUSSION

Diets were designed to meet protein requirements of gestating beef cattle, and therefore, minimal weight loss occurred during late gestation. There was no difference between treatments for d 0-84 BW change ($P = 0.33$; Table 1), d 0-84 body condition score (BCS) ($P = 0.28$; Table 2) and off test BW ($P = 0.86$). These results suggest that both feeding systems provided nutrients adequate for the cows' requirements.

Cattle receiving the CONT treatment had a larger ($P < 0.01$; Table 3) amount of wet waste, dry waste, and total waste than cattle receiving the LIMIT treatment. Total hay waste was reduced by the LIMIT treatment by 181 lb per bale fed. Difference in percent of bale weight wasted was significant ($P \leq 0.01$) between treatments.

Table 1. The effect bale feeder type, monensin supplementation, and limit feeding on cow performance

	Treatment[1]			
Item, lb	Control	Limit	SEM	*P*-value
BW;				
Allotment	1,172	1,174	31.13	0.93
d0	1,208	1,203	31.35	0.87
d84	1,223	1,226	31.71	0.94
off test[2]	1,183	1,189	30.61	0.86
BW change;				
d0-d84	10.0	22.9	13.03	0.33
d0-off test	-23.9	-14.1	11.81	0.41

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h to prairie hay, open bottom steel ring feeder; Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder.
[2] Off Test = Weight taken 7 days after completion of feeding to adjust for gut fill

Table 2. The effect of bale feeder type, monensin supplementation, and limit feeding on cow BCS

	Treatment[1]			
Item	Control	Limit	SEM	*P*-value
BCS;				
d0	4.38	4.45	0.19	0.71
d84	4.84	4.82	0.19	0.92
BCS change;				
d0-d28	0.19	-0.08	0.15	0.08
d0-d84	0.47	0.29	0.17	0.28

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h access to prairie hay, open bottom steel ring feeder; Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder.

Cattle receiving the CONT treatment wasted 24.9% of the original bale weight, while cattle receiving the LIMIT treatment wasted only 11.9% of bale weight. The combination of technologies in the LIMIT treatment is an effective method in reducing hay waste, resulting in a decrease in total waste of 52%.

Table 3. The effect of bale feeder type, monensin supplementation, and limit feeding on hay waste

	Treatment[1]			
Item, lb	Control	Limit	SEM	*P*-value
Hay fed	1,389	1,394	32.33	0.89
Orts	175	240	40.88	0.14
Wet waste	155	102	8.99	0.01
Dry waste	191	63	18.23	0.01
Total waste	346	165	15.86	0.01
Bale weight wasted, %	24.9	11.9	1.32	0.01

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h access to prairie hay, open bottom steel ring feeder; Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder.

Net disappearance per cow was 4.6 lb/d (Table 4) less for cattle receiving the LIMIT treatment. Total hay savings due to the combination of technologies in the LIMIT treatment for the entire experiment (84 d) per pen (n = 12) was 4,624 lb. Net disappearance is a function of both cow intake and hay waste, which makes it an effective indicator of hay feeding efficiency. The combination of modified cone feeder, limit feeding, and MON supplementation in the LIMIT

treatment was an effective method to reduce net disappearance, resulting in improved hay feeding efficiency.

Table 4. The Effect of bale feeder type, monensin supplementation and limit feeding on net disappearance

	Treatment[1]			
Item, lb	Control	Limit	SEM[3]	*P*-value
Hay fed	28,131	24,527	1,971.85	0.14
Orts	1,371	2,391	709.20	0.22
Net disappearance[2];				
Per pen	26,760	22,136	1,369	0.03
Per cow	2,230	1,845	114.08	0.03
Per cow/d	26.6	22.0	1.36	0.03

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h access to prairie hay, open bottom steel ring feeder; Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder.
[2] Net disappearance is calculated by subtracting orts from hay fed.

Costs associated with each treatment are different due to differences in overhead cost and daily costs (Table 5). Overhead costs for this study are referred to as bale feeder and fence costs. These costs are depreciated for five years for the bale feeder and three years for the fencing materials. Overhead costs were higher for the LIMIT treatment due to fence and feeder costs. The LIMIT treatment resulted in a decrease in net disappearance, which resulted in a decreased hay cost of $0.21/d.

Table 5. Economics of bale feeder type, limit feeding, and monensin supplementation

	Treatment[1]	
Item, $	CONT	LIMIT
Overhead cost;		
Bale feeder	$ 91.00	$ 115.00
Fence	$ 0.00	$ 45.33
Daily cost;		
Supplement	$ 0.20	$ 0.20
Hay	$ 1.33	$ 1.10
Additive (MON)	$ 0.00	$ 0.02
Total cost per cow;		
Per feeding period[2]	$ 135.99	$ 124.19
Per d	$ 1.56	$ 1.43

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h access to prairie hay, open bottom steel ring feeder; Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder.
[2] 84 days

The economic sensitivity to hay price and length of feeding period is in table 6. Total cost for the 84 d feeding period was $135.99 and $124.19 for the CONT and LIMIT treatments, respectively. Reduced hay prices combined with a short feeding period result in no benefit of the combination of technologies in the LIMIT treatment. The LIMIT treatment has substantial economic benefit as hay price increases up to $200/ton and length of feeding approaches 120 d.

Table 6. Sensitivity of hay price and days fed on economics

	Cost of Hay, $ / Ton			
Item;	$ 50	$ 100	$ 150	$ 200
60 d feeding length				
CONT[1]	59	99	139	179
LIMIT[2]	60	93	125	158
80 d feeding length				
CONT	77	130	183	236
LIMIT	75	119	163	207
100 d feeding length				
CONT	94	160	227	293
LIMIT	90	145	200	255
120 d feeding length				
CONT	111	191	271	350
LIMIT	106	172	238	303

[1]Control = 38% CP cottonseed meal based pellet with 0 mg/hd monensin, 24 h access to prairie hay, open bottom steel ring feeder.
[2]Limit = 38% cottonseed meal based pellet with 200 mg/head of monensin, 7 hours access to prairie hay, modified cone feeder

This experiment resulted in a savings of $11.80 per cow over an 84 d feeding period. As hay prices and days in the feeding period increase this feeding system becomes more economically valuable. Potential savings per cow in the sensitivity in this experiment can be as high as $33.09 per feeding period. This feeding system has the potential to be an effective and economically viable alternative feeding system for cow-calf producers in the Great Plains.

LITERATURE CITED

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