



## Performance of Beef Cattle Overwintered on Bale-grazed Pasture or in a Dry Lot in South-central North Dakota

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*Allowing beef cattle to harvest their own forage potentially can decrease production costs by reducing reliance on inputs such as labor and machinery required for forage harvest. This study assesses the performance of beef cattle kept on pasture to bale graze or in dry-lot pens during the winter in North Dakota. Results show that bale grazing may be a viable alternative to keeping cattle in dry lots in the winter. Further, environmental conditions such as blizzards will not necessarily hinder bale grazing when proper precautions are taken to ensure that animals have access to water, feed and shelter.*

### Summary

The performance of beef cows managed in two overwintering environments (pasture or dry-lot pens) was assessed in a study conducted during three winters, from 2016 to 2018, at the Central Grasslands Research Extension Center, Streeter, N.D. Starting in the fall of each year, nonlactating pregnant Angus cows were divided into four groups of similar body weight (BW) and kept on pasture to bale graze or in dry-lot pens in the winter.

Keeping cows on pasture or in dry-lot pens in the winter did not influence ( $P > 0.05$ ) their final BW and final body condition score (BCS). However, daily gains were greater ( $P < 0.05$ ) in bale-grazing cows relative to cows kept in a dry lot. Although both groups lost BCS, the loss was greater ( $P < 0.05$ ) in cows kept in a dry lot.

Results show that bale grazing is a viable alternative to keeping cattle in dry lots in the winter. Further, environmental conditions such as blizzards will not necessarily hinder bale grazing when proper precautions are taken to ensure that animals have access to water, feed and shelter.

### Introduction

Winters in the northern Plains are characterized by cold temperatures, low wind chills, freezing rain and snow. A large portion of winter (40 to 70 days) averages minus 18 C, although extreme minimum temperatures of minus 51 C have been recorded (Enz, 2003).

The majority of beef cows in the Northern Plains is housed in open dry-lot pens during the winter (Asem-Hiablíe *et al.*, 2016) and is exposed to these extreme winter conditions. In typical dry lots, cattle are fed mechanically harvested feeds such as hay and silage.

Winter feed costs, resulting from labor, machinery and energy required to provide feed, water and bedding to cattle kept in dry lots, make up more than 60 percent of total feed costs for most beef cow-calf operations (Taylor and Field, 1995). Thus, beef producers are interested in reducing winter feed costs by extending the grazing season.

Extending the grazing season by keeping cattle on pasture for a significant period of time during the winter allows animals to harvest their own food and decreases reliance on inputs such as machinery and energy required to harvest forage (D'Souza *et al.*, 1990). By maximizing the use of grazed grass, the cheapest feed resource for ruminants (Hennessy and Kennedy, 2009), extending the grazing season can decrease production costs and enhance profitability of livestock production (D'Souza *et al.*, 1990; Hennessy and Kennedy, 2009).

Strategies for extending the grazing season such as swath grazing, bale grazing and stockpiling have been evaluated (D'Souza *et al.*, 1990; Willms *et al.*, 1993; Volesky *et al.*, 2002; McCartney *et al.*, 2004; Jungnitsch *et al.*, 2011; Kelln *et al.*, 2011; Baron *et al.*, 2014). The economic benefits from these strategies accrue mainly from cost reductions of feeds and feeding, labor, fuel, machinery maintenance and repair, and manure removal.

Environmentally, keeping cattle on pasture returns nutrients directly onto the land and allows for optimal nutrient capture by growing plants (Jungnitsch *et al.*, 2011; Kelln *et al.*, 2011). Depositing manure directly on pastures avoids nutrient accumulation in one place, minimizing nutrient loss to the environment through runoff or leaching (Kelln *et al.*, 2012; Bernier *et al.*, 2014).

Extending the grazing season must be assessed against benefits to the animal as well as to the producer. Local information on animal performance in extended grazing systems, especially bale grazing, as well as data on the economics of extended grazing under North Dakota winter conditions, is limited. Therefore, this study was conducted to assess the performance of pregnant beef cows managed in two overwintering environments (pasture or dry lot) under south-central North Dakota winter conditions.

### Procedures

This study extended for three years, from 2016 to 2018. Starting in the fall of each year, nonlactating pregnant Angus cows (2016,  $n = 32$ , body weight [BW] =  $599 \pm 68$  kg; 2017,  $n = 40$ , BW =  $620 \pm 59$  kg; 2018,  $n = 40$ , BW =  $643 \pm 47$ ) were divided into four

groups of similar BW and kept on pasture to bale graze or kept in dry-lot pens in the winter.

Pastured cows were kept in paddocks separated by three-strand, high-tensile wire electric fencing. Dry-lot pens contained a hay feeder and a water tank. Cows in both housing scenarios were offered the same Conservation Reserve Program (CRP) hay (Table 1), free choice.

<b>Table 1.</b> Nutrient composition of grass hay offered to cows bale grazing on pasture or kept in a dry lot.	
<b>Nutrient</b>	<b>%DM</b>
Dry matter	94.3
Crude protein	7.5
Total digestible nutrients	51.7
Neutral detergent fiber	66.3
Acid detergent fiber	47.8
Calcium	0.56
Phosphorus	0.10
Potassium	0.77
Magnesium	0.18

Two-day body weights were taken at the start and end of the study. Two independent observers assigned body condition scores (BCS) using a 9-point system (1 = emaciated, 9 = obese; Wagner et al., 1988; Rasby et al., 2014) at the start and end of the study. Animal handling and care procedures were approved by the NDSU Animal Care and Use Committee.

### Bale Grazing

Historically, the bale-grazing site was cropland in a corn and small-grain rotation. In the two years prior to the start of this study, the site was planted with cool-season cover crops, mainly rye and brassicas.

In 2016, the site was burned down with 2,4-D and Round-up in late April, after which meadow brome was planted in early May. Three-acre paddocks were separated using three-strand, high-tensile wire electric fencing. One water tank was placed between two paddocks. Wind breaks were placed in each paddock.

In early fall, round CRP hay bales (7.5 percent crude protein [CP]; 51.7 percent total digestible nutrients [TDN]) were placed in each paddock in two rows approximately 15 meters apart. Cows were allotted four bales in one grazing session; access to new bales was controlled using a single portable electric wire.

Cows were moved to a new set of four bales when the depth of waste feed remaining across the diameter of each bale was less than 10 centimeters (cm). Cows had *ad libitum* access to fresh water, mineral supplement and salt blocks.

### Dry Lot

Two groups of cows were kept in dry-lot pens. Each pen contained a two-bale hay feeder and a Richie water tank. Dry-lot cows were fed the same CRP hay as the bale-grazed cows. Like the bale grazed cows, dry-lot cows had *ad libitum* access to fresh water, mineral supplement and salt blocks.

## Results

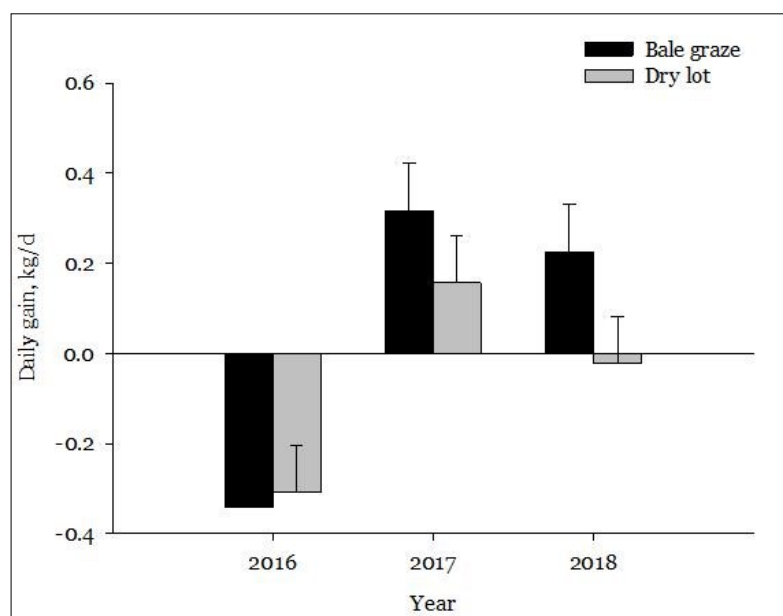
### Animal Performance

Initial cow BW and BCS were similar ( $P > 0.05$ ) between housing treatments in both years (Table 2). Keeping cows on pasture or in dry-lot pens in the winter did not influence ( $P > 0.05$ ) final BW and final body condition score (BCS). However, daily gains were greater ( $P < 0.05$ ) in bale-grazing cows relative to cows kept in a dry lot.

Although both groups lost BCS, the loss was greater ( $P < 0.05$ ) in cows kept in a dry lot (Table 2). Whether on pasture or in dry-lot pens, cows lost body weight and condition in the first year but maintained or gained weight and BCS in the second year (Figure 1).

## Discussion

The first year of the study was marked by three blizzards, which led to huge snow accumulations. Despite snow depths being greater than 50 cm in selected places, cows were able to bale graze for 70 days before the termination of the study.



**Figure 1.** Average daily gains of cows (2016, n = 32; 2017, n = 40) kept on pasture or in a dry lot in the winter during two winters.

**Table 2.** Performance of cows kept on pasture or in a dry lot in the winter.

	Housing (H)		SE	Year (Y)			SE	P-value		
	Pasture	Dry Lot		2016	2017	2018		H	Y	H x Y
Initial BW, kg	621	623	11.5	600 <sup>b</sup>	618 <sup>b</sup>	647 <sup>a</sup>	9.8	0.883	0.002	0.784
Final BW, kg	623	618	11.7	577 <sup>b</sup>	636 <sup>a</sup>	650 <sup>a</sup>	12.5	0.656	<0.001	0.803
Daily gain, kg/d	0.07	-0.06	0.062	-0.33 <sup>b</sup>	0.24 <sup>a</sup>	0.10 <sup>a</sup>	0.075	0.052	<0.001	0.202
Initial BCS	5.6	5.7	0.053	5.7 <sup>a</sup>	5.4 <sup>b</sup>	5.8 <sup>a</sup>	0.062	0.090	<0.001	0.728
Final BCS	5.4	5.3	0.060	5.4 <sup>a</sup>	5.4 <sup>a</sup>	5.2 <sup>b</sup>	0.071	0.700	0.001	0.144
BCS change	-0.20 <sup>a</sup>	-0.31 <sup>b</sup>	0.051	-0.25 <sup>b</sup>	0.06 <sup>a</sup>	-0.58 <sup>c</sup>	0.060	0.027	<0.001	0.235

The study was terminated after accessing water points became impossible. This shows that strategies for extending the grazing season should be accompanied by a contingency plan for feed and water supplies in case grazing becomes impossible.

Here are some interesting observations from blizzard events of 2016: First, despite windbreaks, not all cows sought shelter during the blizzards. Some simply would stand on the leeward side of the bales, while other cows did not seek shelter at all and continued to graze.

Secondly, when water troughs were cleared of snow after each blizzard and refilled, not all cows visited the water troughs immediately, as anticipated. However, we observed what seemed to be a “catch up” period of several days following blizzards when water intake increased, as noted by more frequent filling of water troughs. Events such as blizzards can prevent or drastically reduce access to water, requiring pastured cows to utilize snow as a source of water. Animals can survive on snow as shown in beef calves (Degen and Young, 1990a) and pregnant beef cows (Degen and Young, 1990b).

Cows in both housing scenarios lost body weight and condition in the first year, which was likely a combination of hay quality and environmental conditions. The hay was low in energy, protein and phosphorus (P) content and did not supply these nutrients to meet the requirements of cows in mid-gestation (National Research Council, 1996), particularly during adverse weather conditions as encountered in 2016. The positive animal performance in the second and third years may be attributed to more favorable environmental conditions.

Overall, daily gains were numerically greater in cows kept on pasture. The smaller-size dry-lot pens would be expected to give dry-lot cows a competitive energy expenditure advantage over cows on pasture. Animals on pasture spend more energy walking in search of food and water or shelter and more time eating and foraging for food than housed animals (Osuji, 1974).

Extra muscular activities, over and above those observed indoors, might increase maintenance energy requirements of animals on range by 25 to 50 percent (Osuji, 1974). However, this might not apply in bale-grazing situations where animals do not travel long distances to feed.

Keeping cattle on pasture or in dry-lot pens in the winter must be assessed against benefits to the animal, as well as financial benefits to the producer. Extending the grazing season reduces feed costs significantly because animals harvest their own food (D’Souza et al., 1990). Several studies (D’Souza et al., 1990; Willms et al., 1993; McCartney et al., 2004; Jungnitsch et al., 2011; Kelln et al., 2011; Baron et al., 2014) have shown economic advantages of extending the grazing season associated with reducing costs of feeds and feeding, labor, fuel, machinery maintenance and repair, and manure removal.

## Conclusions

Results show that bale grazing is a viable alternative to keeping cattle in dry lots in the winter. Further, environmental conditions such as blizzards will not necessarily hinder bale grazing when proper precautions are taken to ensure that animals have access to water, feed and shelter.

## Acknowledgments

Technical assistance provided by Dwight Schmidt, the late Rodney Schmidt, Cody Wieland, Thomas Mittleider and Rick Bohn is gratefully acknowledged.

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