

Effects of Pen Cleaning on Feedlot Performance and Carcass Characteristics of Beef Steers Fed during the Winter in the Northern Great Plains

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The objective of this study was to determine the effects of winter pen cleaning methods on feedlot performance and carcass characteristics of steers. Pen cleaning treatments did not influence animal performance within the conditions of this study. However, marbling score and quality grade of carcasses tended to be greater with increasing amounts of pen cleaning. The relationship between pen space and pen cleaning requires further research to determine their combined influences on animal performance.

Summary

Our hypothesis was that pen cleaning during the winter would improve animal performance and carcass characteristics of steers fed in the northern Great Plains. This study utilized 156 steer calves. Calves were assigned randomly to one of 12 pens, with pen randomly assigned to treatment. Treatments consisted of 1) Control - no cleaning, 2) Full - entirety of the pen cleaned twice throughout the study and 3) Apron - bunk aprons (approximately 10 feet) behind the bunk cleaned twice throughout the study. Calf weights were collected twice, prior to the start of study and prior to slaughter. Calves were fed for 195 days prior to reaching market readiness. Following slaughter, carcass data were collected. Our results are contrary to our hypothesis because pen cleaning resulted in no differences ($P \geq 0.48$) in body weight, average daily gain (ADG), dry-matter intake (DMI) or feed efficiency in the current study. Hot carcass weight, ribeye area, back fat and yield grade of carcass also were not affected ($P \geq 0.44$; Table 2) by pen cleaning treatment. We observed a tendency ($P = 0.09$) for greater marbling score and quality grade in carcasses resulting from steers managed with more thorough pen cleaning strategies. That pen cleaning did not improve animal performance was unexpected. It is possible that the light stocking density of pens or the ample bedding supplied negated the anticipated differences.

Introduction

The purpose of this study was to evaluate the efficacy of pen cleaning as a method to improve livestock performance of beef cattle fed to finish during the winter months in the northern Great Plains. Previous research with bedding frequency (Anderson et al., 2007) has demonstrated factors related to environment can improve animal performance.

Observing greater performance with pen cleaning as a result of reduced energy expenditure to maintain body temperature or by decreasing the energy expenditure associated with movement is logical. Secondary benefits to removing manure, mud and snow across the entirety of a drylot pen would be captured through decreased maintenance of pen surfaces.

The removal of manure buildup directly behind the bunk line, allowing cattle easier access to feed, is a less labor-intensive cleaning method. Both pen cleaning methods have positive attributes, but no research has directly compared the extent of pen cleaning (cleaning bunk apron only vs. cleaning full pens) on animal performance. The objective of this project was to evaluate pen cleaning method on feedlot performance and carcass characteristics of steers fed in a drylot during the winter in the northern Great Plains.

Experimental Procedures

This study was approved by the North Dakota State University Institutional Animal Care and Use Committee prior to initiation of study procedures. To accomplish our research objective, 156 beef steers (626.2 ± 30.28 pounds) were assigned to one of 12 pens ($n =$ four per treatment).

Thirteen steers initially were placed into each pen. Pens were stocked at a similar density with approximately 290 square feet of pen space per animal. Treatment was assigned randomly to pen and

consisted of: 1) Control - no cleaning, 2) Full - entirety of the pen cleaned twice throughout the study and 3) Apron - bunk aprons (approximately 10 feet) behind the bunk cleaned twice throughout the study.

Pens or aprons were cleaned on approximately 56-day intervals from the start of the study. Throughout the study, cattle were provided fresh bedding weekly, with an estimated 5.5 pounds/head/day of straw used during the course of the study.

Upon arrival, cattle were acclimated to pens. Weights were collected on two consecutive days and calves were sorted into pens. All calves received a growth promotant implant (Synovex S, Zoetis Inc., Parsippany-Troy Hills, N.J.) at the initiation of the study and were re-implanted 56 days later with Synovex Plus (Zoetis Inc., Parsippany-Troy Hills, N.J.).

Rations were developed to adapt cattle from a moderate-roughage diet to a high-concentrate diet. The final finishing ration consisted of 57.7% corn, 23.5% modified distillers grains with solubles (mDGS), 5% straw, 11% silage, 1.3% calcium carbonate and 1.5% supplement (dry-matter basis). Steers were fed for a total of 195 days. Feed was provided to target clean bunks the following morning prior to feeding.

At the conclusion of the feeding period, cattle were weighed on two consecutive days and shipped to a commercial abattoir for slaughter and subsequent carcass data collection. Data were analyzed with the mixed procedures of SAS (SAS Ins. Inc., Cary, N.C.). All data were analyzed, with pen serving as the experimental unit. Significance was declared at $P \leq 0.05$.

Results and Discussion

We found no influence ($P \geq 0.48$; Table 1) of pen cleaning on initial body weight (BW), final BW or ADG. Likewise, dry-matter intake and feed efficiency were similar ($P \geq 0.55$) across treatment. Hot carcass weight, ribeye area, back fat and yield grade of carcass also were not affected ($P \geq 0.44$; Table 2) by pen cleaning treatment. We observed a tendency ($P = 0.09$) for greater marbling score and quality grade in carcasses resulting from steers managed with more thorough pen cleaning strategies.

Table 1. Impacts of pen cleaning on feedlot performance of steers fed during the winter in the northern Great Plains.

	Treatment ¹			SEM	P-value
	Control	Apron	Full		
Initial BW, lb.	627.8	625.2	625.6	30.28	0.99
Final BW, lb.	1,392.7	1,370.7	1,391.7	26.59	0.81
ADG, lb/day	3.93	3.83	3.93	0.065	0.48
DMI, lb/day	23.2	23.4	23.3	0.53	0.94
G:F	0.170	0.163	0.169	0.004	0.55

¹ Treatments: Control = Pens that were not cleaned, Apron = bunk aprons cleaned twice throughout the study, Full = entire pen cleaned twice throughout the study.

Table 2. Impacts of pen cleaning on carcass characteristics of steers fed during the winter in the northern Great Plains.

	Treatment ¹			SEM	P-value
	Control	Apron	Full		
HCW, lb.	838.4	830.2	844.7	15.48	0.81
Ribeye area, inch ²	13.2	13.1	13.1	0.28	0.97
Back fat, inch	0.50	0.46	0.50	0.025	0.44
Marbling score ²	444	463	484	11.1	0.09
Quality grade ³	9.9	10.2	10.4	0.13	0.09
Yield grade	3.1	3.0	3.1	0.10	0.46

¹ Treatments: Control = Pens that were not cleaned, Apron = bunk aprons cleaned twice throughout the study, Full = entire pen cleaned twice throughout the study.

² Marbling score based on 400 = Small⁰⁰.

³ Quality grade based on Low Choice (Ch) = 10, High Prime (Pr⁺) = 15.

The data presented in the current study are largely contrary to our hypothesis. The reason for the lack of feedlot performance differences in steers could be attributed to lack of separation of pen conditions, to the relatively light stocking density of pens, or to the adequate bedding provided to all pens. Any of these factors could have resulted in pen conditions that negated the possible impacts of the treatments imposed.

Previous research at the Carrington Research Extension Center has demonstrated that pen management can influence animal performance. Average daily gains of steers were improved by 0.86 pound/day by providing bedding, when compared with cattle not provided bedding (Anderson et al., 2007). This improvement is likely due to reduced energy expenditure to maintain body temperature. Previous research evaluating mud depth, bedding and temperature has demonstrated significant effects to livestock performance and economic returns (Mader, 2011). Cleaning frequency has been evaluated (Wilson et al., 2004); unfortunately this research was not able to determine effects on animal performance. Pen maintenance, especially pen cleaning, may decrease the energy expenditures associated with movement, reduce environmental stress, and subsequently improve overall gain and performance.

Future research evaluating stocking density of pens and cleaning regimens may lead to better understanding of the benefits of pen cleaning. Specifically, research evaluating at what point animal space dictates that producers place greater attention on pen cleaning to avoid decreases in performance would be helpful for livestock producers. Additionally, continued research through time would prove beneficial because the differences in weather within a given year can influence cattle performance strongly.

Literature Cited

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