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Finishing Steers in a Deep-bedded Hoop Barn and a Conventional Feedlot: Effects on Behavior and Temperament during Winter in Iowa

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Summary and Implications

As the Iowa beef industry invests in environmental management, there has been increasing interest in systems that minimize runoff. A possible housing option used previously for pigs and sheep to help mitigate some of these environmental concerns are hoops. The objective of this study was to compare steer behavior and temperament between two housing treatments; hoop building (HP n=3; 4.65m^2/steer) vs. conventional feedlot (FD n=3; 14.7m^2/steer) during winter months. A total of 240 crossbred *Bos taurus* steers were used. Steers were ear tagged, implanted, and weighed (400 ± 23.38 kg) on arrival and allotted to balance weight and breed. Behavioral data were collected using a 10 min scan sampling technique using live observation by two experienced observers from 0800 h to 1600 h on days 39, 75 and 118 of the trial. Two behaviors (head in bunk and head in waterer) and three postures (lying, walking and standing) were recorded. The day post-behavior collection, steers were moved through a squeeze chute for subjective temperament scoring. Scores ranged from 1 (exits chute calmly) to 6 (very aggressive, charges handlers). HP steers spent more time at the feedbunk ($P = 0.04$) than FD steers between treatments, however there was no difference ($P = 0.66$) for time spent at the waterer. Lying was higher ($P = 0.008$) for HP steers compared to their FD counterparts. HP steers exhibited a lower ($P = 0.003$) incidence of walking and standing ($P = 0.008$) compared to their FD counterparts. Temperament scores were lower $P = 0.03$) for HP steers compared to FD steers and day ($P < 0.001$) was a source of variation. Day by treatment interactions were not different ($P = 0.47$). In conclusion, overall time budget differences were observed with HP steers being less active than FD steers overall, but spending more at the feed bunk. Temperament scores increased over the first two observation days of the trial, and declined on the third observational day. Therefore, housing steers in a hoop does not result in detrimental alterations in either behavior or temperament when compared to steers in a conventional feedlot.

Introduction

As the Iowa beef industry invests in environmental management, there has been increasing interest in systems that minimize runoff. One example of such a facility is the deep-bedded hoop barn. To date there is limited information comparing animals raised for beef production in regards to their behavior between the deep-bedded hoop barns and other housing systems for beef cattle. Identifying potential alterations in cattle behavior and overall temperament between different housing systems can help producers when redesigning facilities and in the creation of educational management tools to maximize beneficial, impacts for animal well-being and economical return. The objective of this study was to compare steer behavior and temperament between two housing treatments; hoop building (HP) vs. conventional feedlot (FD) during the winter months (January to April 2007).

Materials and Methods

Animals and timeline. Two hundred and forty crossbred *Bos taurus* steers were used. Steers were ear tagged, implanted, and weighed (400 ± 23.38 kg) on arrival and allotted to balance weight and breed. All steers were fed a diet of 74.2% dry whole shelled corn, 15% ground hay, 3.3% protein pelleted supplement, 300 mg/hd/d monensin, and 7.5% added water. Steers had libitum water access from one waterer/pen. Corn stalks were provided to HP steers for bedding. The trial was conducted from January through April 2007 (defined as “winter months”) and was approved by the Iowa State University IACUC.

Treatments. Two housing treatments were compared. Treatment one; ***Hoop building*** (HP; n = 3 pens). Pen dimensions were 12.2 m wide by 15.2 m long. The hoop barn was oriented lengthwise in a north / south direction. The roof material was composed of a polyvinyl tarp stretched over arched supports in a Quonset® design. The roof was set on 3.05 m tall wood posts, which provided a total height of 7.92 m. The north and south ends were left open and the west wall was covered in tongue-in-groove planking for wind and sun protection. The east wall was left open with a 0.5 m tall by 12.2 m long by 0.91 m wide concrete feedbunk along its length. A concrete pad extended 4.3 m from the bunk. A driveway along the east exterior provided access for a feed wagon. Waterers were located next to the bunk along the pen dividers. Space of 4.65m^2/steer was provided (Figure 1).

Figure 1. Hoop building.

Treatment two; **C*onventional feedlot*** (FD; n = 3 pens) was an open air feedlot. Pen dimensions were of 12.2 m wide by 48.2 m long. A 0.5 m high by 11.9 m long by 0.91 m wide feedbunk was located at the north end of the pens, with a concrete pad extending 10 m from the bunk. Waterers were located in the pen 7 m from the feedbunk. A metal open-front building covered 7.6 m of the north end of all the pens, with a drive-through alley for feed wagon access. The north wall of the building was equipped with adjustable polyvinyl curtains to allow air flow regulation, and the south wall was open. Space of 14.7 m^2/steer was provided (Figure 2).

Figure 2. Conventional feedlot.

Animal handling facility. The tub, chute and squeeze chute were located in the West end of the conventional feedlot. The squeeze chute was a Silencer® (Moly Mfg, Lorraine, KS) Rancher model (Interior dimensions: 0.66 m wide by 2.3 m long). Sand was placed at the exit of the squeeze chute for a distance of 3 m at a depth of 6 cm for traction. Exiting steers then proceeded to a holding pen until all steers from a pen were weighed, and then were returned to their original pen. Steers from the feedlot walked 79.2 m on average to the chute, and from hoop barn walked 223 m on average to the chute.

Behaviors and postures. Behavioral data were collected using a 10 min live scan sampling technique by two experienced observers from 0700 h to 1600 h on days 39, 75 and 118 of the trial. Two behaviors (***head in bunk*** defined as the steer within 1 m of bunk, with head in or immediately over the bunk and ***head in waterer*** defined as head in water bowl, actively drinking) were noted. Three postures (***lying***, defined as the steer's main body in contact with the ground, lying laterally or sternally, ***walking*** defined as the steer on all 4 legs while changing position the pen, and ***standing*** defined as not moving, with all four legs in contact with ground and no main body contact) were recorded.

Temperament scoring. One day post-behavioral collection steers were moved through a squeeze chute for subjective temperament scoring. Scores ranged from 1 (exits chute calmly) to 6 (very aggressive; charges handlers). The scoring system was adapted from the Beef Improvement Federation (2006; Table 1).

Table 1. Temperament scoring for steers exiting the squeeze chute. Temperament scoring adapted from the Beef Improvement Federation (2006).

Score	Definition
1	Exits chute calmly (walk)
2	Restless, exits promptly (trot)
3	Nervous, constant movement, exits at fast trot
4	Jumps, shakes chute, exits briskly (canter)
5	Aggressive, jump, bellow in chute. Exits at gallop
6	Very aggressive. Charges handlers

Statistical analysis. Behavioral data was averaged over each hour of the observation and then transformed using the arcsine of the measure to normalize the distribution. Behavioral data was analyzed using the PROC MIXED procedure of SAS® (SAS Inst. Inc., Cary, NC) software for parametric data. The experimental unit was the pen (n = 3; containing 40 steers with two treatments: hoop barn (HP) versus conventional feedlot (FD) were compared. The experimental design was repeated measures and the statistical model main plot included time (24 h), day (three days of observation), treatment (HP versus FD), time by treatment interaction. Pen nested within treatment was used as the error term. Temperament scores were analyzed using PROC GLIMMIX (SAS) for non-parametrical data. The experimental unit was the individual steer. The experimental design was repeated measures and the statistical model main plot included treatment, day and the interaction with individual steer was used as the error term.

Results and Discussion

Behaviors and postures. HP steers spent more time at the feedbunk (P = 0.04) than FD steers between treatments, however there was no difference (P = 0.66) for time spent at the waterer. Lying behavioral incidence was higher (P = 0.008) for HP steers compared to their FD counterparts. HP steers exhibited a lower (P = 0.003) incidence of walking and standing (P = 0.008) compared to their FD counterparts (Table 2).

Temperament scores. Temperament scores were lower (P = 0.03) for HP steers compared to FD steers (Figure 3). Day was a source of variation (P < 0.001) with HP steers exhibiting lower scores that FD steers, and overall increasing on the first two observation days and decreasing on the third (Figure 4). Day by treatment interactions were not different (*P* = 0.47; Figure 5). In conclusion overall time behavioral incidence were observed with HP steers being less active, but spending more time at the feedbunk. Steer temperament at exit increased over the first two days of observation, before dropping on the third day of the trial. Therefore, housing steers in a hoop does not result in adverse behavior or temperament alterations.

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Table 2. LSmeans and standard errors for main effects on behavior and postures of housing facility (hoop [HP] versus feedlot [FD]) for beef steers from January to April 2007.

	Treatment		
	Hoop (HP)	Feedlot (FD)	*P*-values
Behavior, %			
Head in bunk	20.8 ± 0.008	17.7 ± 0.008	0.04
Head in waterer	0.70 ± 0.001	0.009 ± 0.001	0.66
Postures, %			
Lying	46.9 ± 0.02	37.1 ± 0.02	0.008
Walking	1.70 ± 0.002	4.0 ± 0.002	0.003
Standing	30.0 ± 0.01	40.3 ± 0.01	0.008

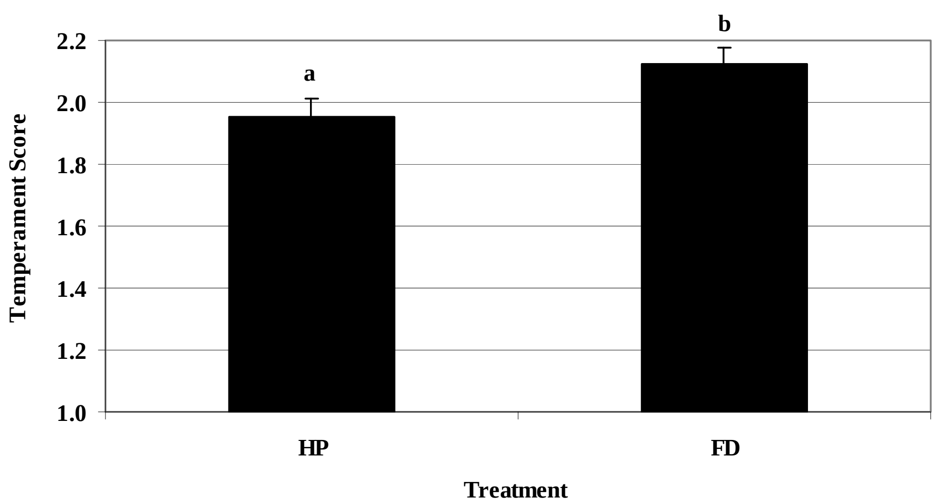

Figure 3. LSMeans for temperament scores for beef steers (n = 120) by housing treatment, hoop (HP) versus conventional feedlot (FD) when exiting the squeeze chute over three observational days from January to April 2007 (*P* = 0.03).

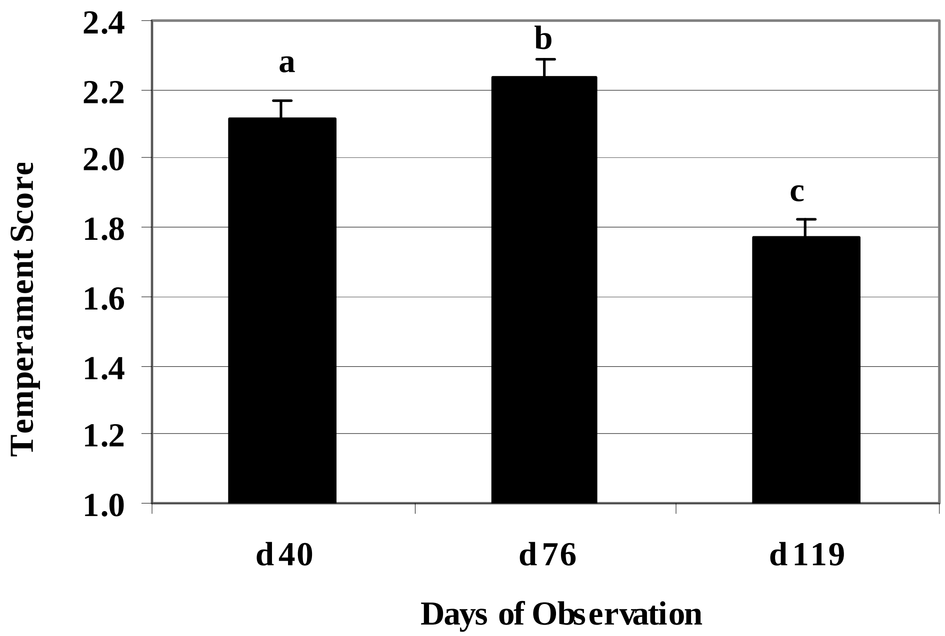

Figure 4. LSMeans for temperament scores for beef steers (n = 120) over three observational days when exiting the squeeze chute from January to April 2007 (*P* < 0.001).

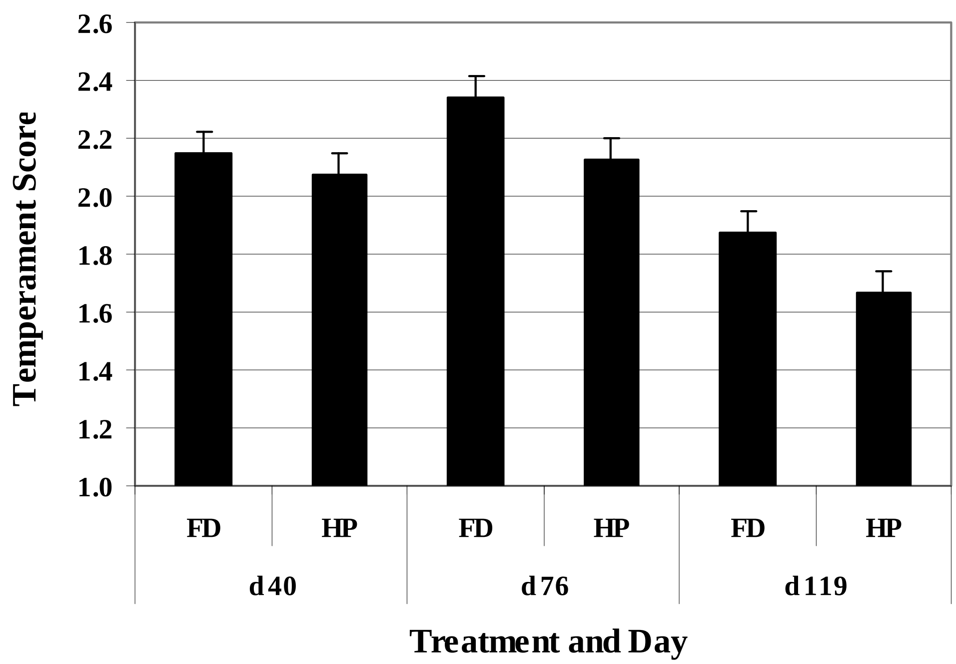

Figure 5. Least squares means for beef steer (n = 240) temperament scores by over three observational days by treatment (hoop (HP) versus conventional feedlot (FD) when exiting the squeeze chute January to April 2007 (*P* = 0.47).