

Finishing Steers in a Deep-bedded Hoop Barn and a Conventional Feedlot: Effects on Behavior and Temperament during Summer 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 where runoff is minimized. 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 treatments; hoop building (HP; $n=3$; 4.65m^2 / steer) vs. conventional feedlot (FD; $n=3$; 14.7m^2 / steer) during the summer months. A total of 240 crossbred *Bos taurus* steers were used. Steers were ear tagged, implanted, and weighed (445 ± 31.7 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 0700 h to 1600 h on d 34, 56 and 91 of the trial. Two behaviors (head in bunk and head in waterer) and three postures (lying, walking and standing) were recorded. One 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). There were no ($P = 0.22$) differences for head in bunk behavior between treatments, however there was a difference ($P = 0.02$) for drinking, with HP steers spending more time at the waterer than FD steers. Lying incidence was greater ($P = 0.004$) for HP vs. FD steers. Fewer ($P < 0.05$) HP steers exhibited walking or standing behavior compared to their FD counterparts. Temperament scores were not different between treatments ($P = 0.13$) but day and day*treatment ($P < 0.001$) were sources of variation for temperament measures. In conclusion, overall time budget differences were observed with HP steers being less active but spending more time engaged in drinking related behaviors. Temperament scores increased during the trial but did not differ between the two housing treatments. Therefore, housing steers in a hoop barn 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 summer months (August to November 2006).

Materials and Methods

Animals and timeline. Two hundred and forty crossbred *Bos taurus* steers were used. Steers were ear tagged, implanted, and weighed (445 ± 31.7 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 August to November 2006 (defined as “summer 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 high 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; the *Conventional feedlot* (FD; $n = 3$ pens) was an open air feedlot. Pen dimensions were 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 next to the pen divider 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 to sun. Space of 14.7m² / 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 the 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 d 34, 56 and 91 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-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). 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 a repeated measures and the statistical model main plot included time (24 h), day (three days of observation), treatment (HP versus FD) and 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 a 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. There were no ($P = 0.22$) differences for head in bunk behavioral incidence between housing treatments, however there was a difference ($P = 0.02$) for drinking behavior incidence, with HP steers spending more time at the waterer than FD steers. Lying behavioral incidence was greater ($P = 0.004$) for HP steers vs. FD steers. Fewer ($P < 0.05$) steers exhibited walking or standing behavior in the HP compared to their FD counterparts (Table 2).

Temperament scores. Temperament scores were not ($P = 0.13$) different between housing treatments (Figure 3), but day ($P < 0.0001$; Figure 4) and day by treatment ($P < 0.001$;

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Figure 5) were sources of variation for temperament measures.

In conclusion overall behavioral incidence differences were observed with HP steers being less active but with more time spent engaged in drinking related behaviors, and steer temperament at exit increased over the trial, however the final score of two still indicates a calm animal. Therefore, housing steers in a hoop does not result in adverse behavior or temperament alterations.

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Table 2. Incidence of behavior and postures by housing facility (hoop [HP] versus feedlot [FD]) for beef steers from August to November 2006.

	Treatment		<i>P</i> -values
	Hoop (HP)	Feedlot (FD)	
<i>Behaviors, %</i>			
Head in bunk	22.6 ± 0.01	24.9 ± 0.01	0.22
Head in waterer	1.95 ± 0.001	1.4 ± 0.001	0.02
<i>Postures, %</i>			
Lying	33.9 ± 0.02	20.6 ± 0.02	0.004
Walking	2.10 ± 0.003	3.90 ± 0.003	0.008
Standing	39.6 ± 0.02	48.4 ± 0.02	0.02

LSMeans ± Standard Error.

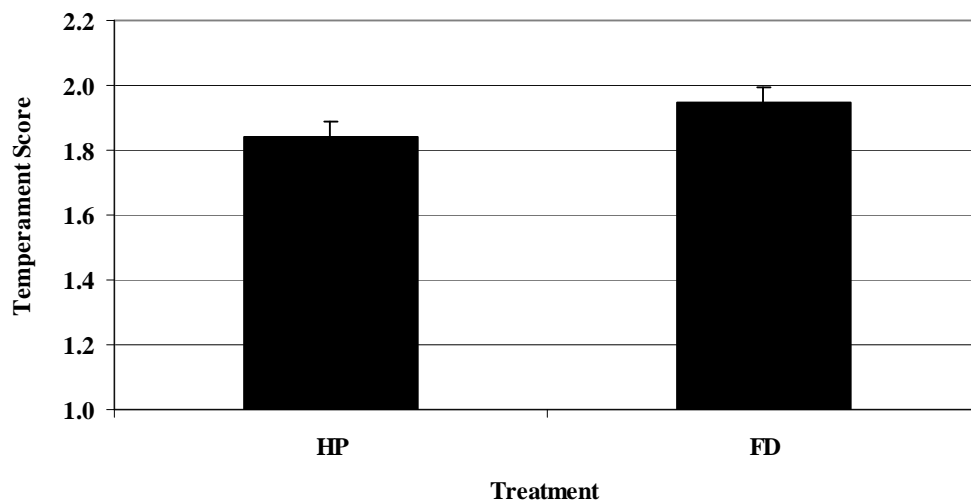


Figure 3. LS Means for temperament scores for beef steers ($n = 120$) by housing treatment, hoop (HP) versus conventional feedlot (FD) when exiting the squeeze chute over three observational days from August to November 2006 ($P = 0.13$).

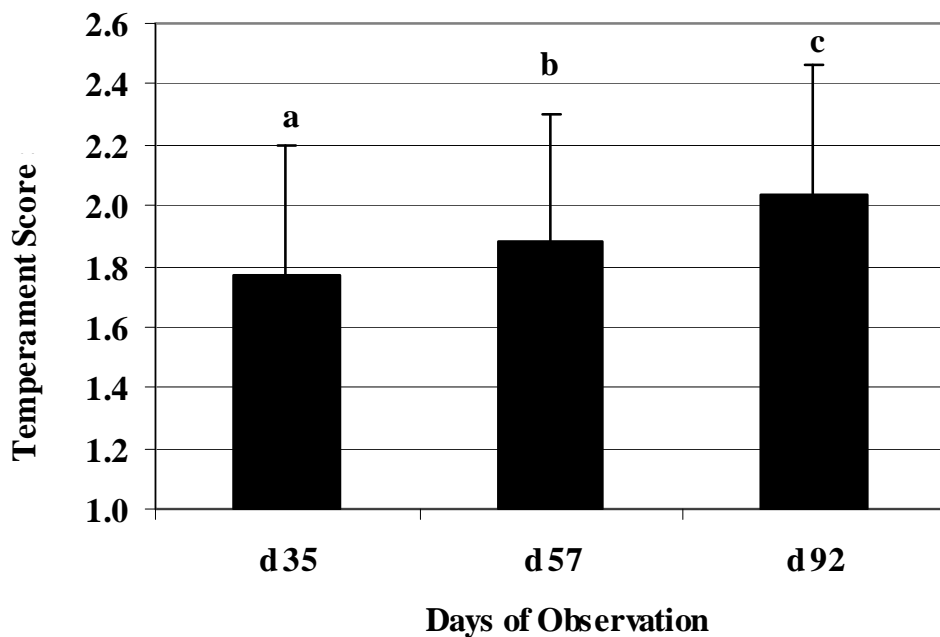


Figure 4. LS Means for temperament scores for beef steers ($n = 120$) over three observational days when exiting the squeeze chute from August to November 2006 ($P < 0.0001$).

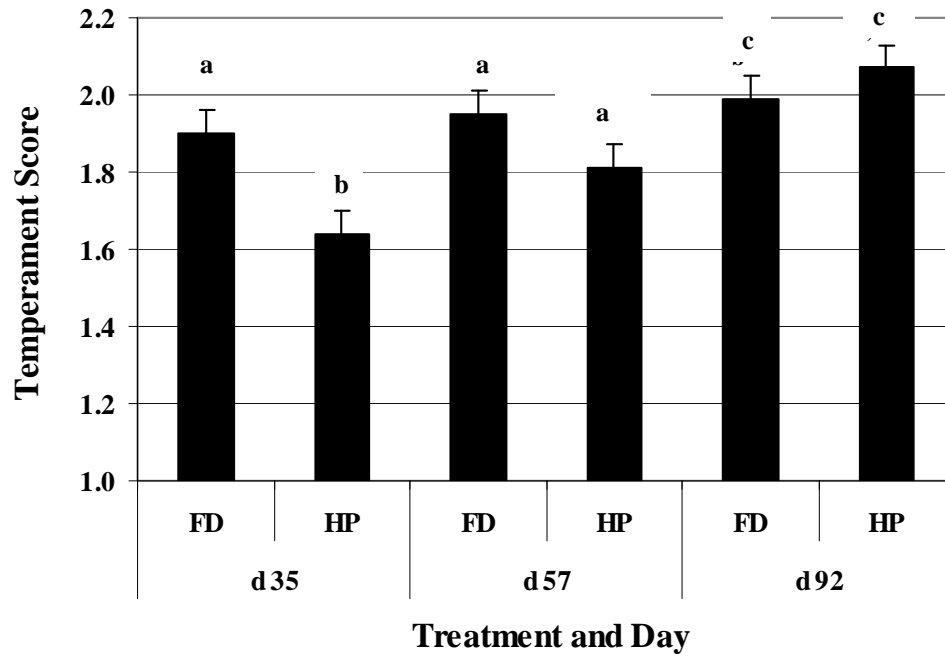


Figure 5. LS Means for temperament scores for beef steers for three observational days by housing treatment (hoop [HP] versus conventional feedlot [FD]) when exiting the squeeze chute from August to November 2006 ($P < 0.001$).