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Effects of an Alleyway Brush on the Behavior of Commercial Beef Heifers and Cows During a 7-day CO-Synch + CIDR Protocol and Pregnancy Outcomes

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Abstract

Temperament is one factor that can influence the success of estrus synchronization (ES) protocols. This study explored whether exposure to a cattle brush device during ES handling events could improve temperament and pregnancy outcomes in beef cows and heifers. A total of 71 heifers and 162 cows from the Agricultural Research Center in Hays, KS, were stratified by reproductive or physiological status and randomly assigned to the treatment (TRT) or control (CTRL) groups. On days 0, 7, and 10 of the ES protocol, TRT animals encountered a spring-mounted brush in the alleyway before entering the chute. The brush was removed for CTRL animals. Chute score (CS) and exit velocity (EV) were recorded on days –10, 0, 7, and 10. Estrotect indicators were applied on day 7 and evaluated on day 10 to measure estrus response. Pregnancy was diagnosed via transrectal ultrasonography 33 days post-timed artificial insemination (TAI) for heifers and 68 days for cows. No treatment differences in CS were observed on days -10, 0, or 7 ($P > 0.10$). However, on the day of TAI, TRT heifers had lower CS ($P < 0.01$) and box scores ($P < 0.01$) than CTRL heifers, while TRT cows tended to have lower CS values ($P < 0.10$). Exit velocity did not differ between groups, but both cows and heifers showed a day effect ($P < 0.01$). Estrotect scores were unaffected by treatment ($P > 0.10$). Pregnancy rates were similar between the TRT and CTRL groups for heifers and cows ($P > 0.10$). However, estrus expression positively influenced pregnancy outcomes in heifers ($P < 0.01$) and cows ($P < 0.05$). Days postpartum also tended to affect cow pregnancy rates ($P < 0.10$). Additional research is needed to determine the effects of positive reinforcement with a brush on reproductive production measures.

Introduction

Beef producers in the United States have been slow to adopt advanced reproductive technologies, with only 11.6% of operations using artificial insemination and 7.3% implementing an estrus synchronization (ES) protocol (USDA, 2020). However, the use of an ES protocol can help increase the number of females calving at the beginning of the season. This results in greater days postpartum for cows in their subsequent breeding season, allowing more postpartum recovery days and a more uniform calf. Many factors affect the success of an ES protocol, including pubertal status, nutrition,

genetics, environmental factors, and temperament of the cattle. Temperament refers to an animal's behavioral response to handling by humans (Fordyce et al., 1988). It has previously been reported that cattle with excitable temperaments can have lower pregnancy rates than their calmer contemporaries (Cooke et al., 2011; Dias et al., 2022). A recent study at Kansas State University found that acclimating commercial beef heifers to the working facility and human interaction prior to the handling events of an ES protocol led to potential improvements in heifer temperament and increased pregnancy rates, compared to heifers that were not acclimated (Tastad, 2025). This suggests that interventions aimed at reducing stress and improving welfare during handling could mitigate negative effects on reproductive outcomes. Building on this idea, strategies that provide positive reinforcement during handling may offer an additional approach to improving reproductive success. Therefore, the objective of this study was to explore the effects of using a cattle brush device as positive reinforcement during the handling events of the ES protocol on temperament and pregnancy rates of beef cows and heifers to fixed-timed artificial insemination (TAI). The hypothesis is that beef females exposed to the cattle brush during the handling events of the ES would have improved temperament by completion of the estrus synchronization protocol and improved conception rates to TAI.

Experimental Procedures

Commercial beef heifers (n = 71) and cows (n = 162) from the Agricultural Research Center in Hays, KS, were enrolled in the experiment. On the day of enrollment (day -10), heifers were given a reproductive tract score (RTS) and chute score (CS). Reproductive tract scores were based on the five-point scoring system described by Anderson et al. (1991). Upon entering the chute, heifers were evaluated for their behavior and given a CS based on a five-point scale, where 1 = calm and motionless; 2 = restless movements; 3 = frequent movement and vocalization; 4 = constant movement, vocalization, shaking, and struggling; 5 = violent and continuous struggling (Cooke et al., 2011). The same scoring system was used for the artificial insemination breeding box score measurement on the day of TAI. Heifers were then stratified by RTS and CS. For the cow experiment, females were stratified by days postpartum, body condition score, age, and CS. All animals were assigned to either the treatment (TRT) or control (CTRL) group, represented by a different-colored ear tag placed in their left ear.

After being assigned to a group, animals were released from the chute, and their exit velocity (EV) was recorded using infrared timing beams. The timer started as the animal exited the chute and passed the first beam and stopped when the second beam was crossed. For heifers, beams were spaced 138 in. apart; for cows, 103 in. Spacing varied by facility, but EV was consistently calculated as distance (in.) divided by time (seconds). Although cows and heifers were housed at separate locations, animals within each location were co-mingled and grazed together.

All females were enrolled in a 7-day CO-Synch + controlled internal drug release (CIDR) TAI protocol (Lamb et al., 2006). On day 0, each animal received an intramuscular injection of Fractel (gonadorelin injection; Zoetis Animal Health, Parsippany, NJ) and had an EAZI-BREED CIDR (Zoetis Animal Health, Parsippany, NJ) inserted into their vagina. On day 7, females were given a 5 mL Lutalyse injection (prostaglandin F2 alpha; Zoetis Animal Health, Parsippany, NJ), the CIDR was removed, and an Estrotect breeding indicator (Rockway, Inc. Spring Valley, WI) was placed just in front of the female's tailhead. The TIA was performed 54 ± 2 hours later (day 10) for the

heifers and 63 ± 3 hours for the cows. All females received a second injection of Factrel at TAI, and Estrotect patches were scored based on the percentage rubbed off before going under the alleyway brush. Pregnancy status was measured via transrectal ultrasonography approximately 33 days post-TAI for the heifers and 68 days after breeding for the cows.

On days 0, 7, and 10 of the experiment, cattle in the TRT group were exposed to a brush positioned in the alleyway of the chute. The brush was mounted on a spring, allowing flexible movement as animals walked beneath or interacted with it. This spring-loaded brush was attached to an adjustable steel arm clamped to the alleyway, enabling both height adjustments and easy removal when needed. For each session, the brush was set to approximate the shoulder height of heifers and cows in the TRT groups. During CTRL sessions, the brush was removed from the alleyway. Cattle were processed through the chute in groups of 10, alternating between the TRT and CTRL groups to prevent any one group from consistently being worked at the end of the day.

All data were analyzed using SAS software v. 9.4 (SAS Institute Inc., Cary, NC, USA). Two sample t-tests were used to analyze differences between the two treatment groups for individual traits on each day. Pregnancy rates to the ES protocol were analyzed with the GLIMMIX procedure, with the heifer as the experimental unit. Repeated measures of CS and EV were analyzed using the MIXED procedure. Statistical significance was declared at $P < 0.05$, and tendencies were considered when $0.05 \leq P \leq 0.10$.

Results and Discussion

The results of the heifer portion of the experiment are reported in Table 1, while the cow results are shown in Table 2. No differences in CS were observed between TRT and CTRL animals on days -10, 0, and 7 ($P > 0.10$). However, on the day of TAI, the TRT heifers exhibited lower CS ($P < 0.01$) and box score ($P < 0.01$) measurements compared to their CRTL counterparts. The TRT cows tended to have lower CS values ($P < 0.10$) than the cows in the CTRL on day 10. Chute scores decreased throughout the trial period for both the cows and heifers, aligning with previous studies (Dias et al., 2022; Tastad, 2025) and potentially indicating that the females may have acclimated to the working facilities. Nevertheless, the females in this study exhibited adequate temperament, with average CS ranging from 1.07 to 1.97. There may have been more significant improvements in behavior if females had displayed more excitable temperaments.

For EV, no differences were observed between treatments of cows or heifers. However, there was an effect of day ($P < 0.01$) for both. Heifers exhibited similar average EV on days -10, 0, and 7, but they were slower ($P < 0.01$) on day 10. For the cows, EV became faster during the first three days of the ES protocol, but they also showed slower EV on the day of TAI (day 10; $P < 0.01$). The slower EV on day 10 might be attributed to the animals exiting the breeding box instead of the regular chute.

There were no treatment differences ($P > 0.10$) for Estrotech score in the cows or heifers. The average pregnancy rate between groups was not affected by treatment for the cows ($P > 0.10$) or heifers ($P > 0.10$). But, whether the cows ($P < 0.05$) or heifers ($P < 0.01$) showed signs of estrus had a significant effect on pregnancy outcome. The number of days postpartum ($P > 0.10$) recovery that a cow had also tended to impact the average pregnancy rate. These results were not surprising, as previous research indicated that estrus expression is a strong predictor of conception rates in synchro-

nized breeding programs, and adequate postpartum recovery is critical for successful rebreeding (Bucher, 2009).

Implications

Bovine temperament can be improved by sequential handling events, but additional research is needed to determine the effects of positive reinforcement with a brush in the chute alley on reproductive production measures.

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Table 1. Average chute score, box score, exit velocity, estrus detection patch score, and percentage of heifers found pregnant to an estrus synchronization protocol by group

	Average chute score		Average box score		Average exit velocity (in./second)		Average estrus detection patch score		TAI[1] pregnancy rate (%)	
Heifer group	**CTRL[2]**	**TRT[3]**	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**
Day -10	1.97	1.97			69.69	73.62				
Day 0	1.92	1.77			68.90	65.75				
Day 7	1.92	1.94			69.69	70.08				
Day 10 (TAI)	1.50[b]	1.23[a]	2.33[b]	1.69[a]	110.24	116.14	3.11	3.06		
Day 43									44.0	40.0
P-value	TRT = 0.2185 Day < 0.0001 TRT × Day = 0.3526		TRT = 0.0115		TRT = 0.7422 Day < 0.0001 TRT × Day = 0.8283		TRT = 0.7360		TRT = 0.6254 Estrus = 0.0055	

[ab]Means within a row with uncommon superscripts differ ($P < 0.05$).
[1] TIA = Fixed-time artificial insemination.
[2] CRTL = Control.
[3] TRT = Treatment.

Table 2. Average chute score, box score, exit velocity, estrus detection patch score, and percentage of cows found pregnant to an estrus synchronization protocol by group

	Average chute score		Average box score		Average exit velocity (in./ second)		Average estrus detection patch score		TAI[1] pregnancy rate (%)	
Cow group	**CTRL[2]**	**TRT[3]**	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**
Day -10	1.93	1.94			94.88	100.79				
Day 0	1.47	1.51			81.89	84.25				
Day 7	1.43	1.39			72.83	77.95				
Day 10 (TAI)	1.07[x]	1.19[y]	1.37	1.35	215.35	245.28	3.10	2.86		
Day 78									48.1	46.8
P-value	TRT = 0.3152 Day <0.0001 TRT × Day = 0.4319		TRT = 0.8274		TRT = 0.2439 Day <0.0001 TRT × Day = 0.3237		TRT = 0.2972		TRT = 0.9046 DPP[4] = 0.0782 Estrus = 0.0390	

[xy] Means within a row with uncommon superscripts differ ($0.05 \leq P \leq 0.10$).
[1] TIA = Fixed-time artificial insemination.
[2] CRTL = Control.
[3] TRT = Treatment.
[4] DPP = Days postpartum.