Effects of an Acclimation Protocol During the Handling Events of the 7-day CO-synch + CIDR Protocol on Temperament and Reproductive Performance of *Bos taurus* Commercial Beef Heifers

S. Tastad, J.V.C. Silva[1], S.P. Hurtado, A.F. Machado[1], V.E.G. Leon, J. Jaeger[2], N. Oosthuizen[3], S. Johnson, and N.W. Dias

Abstract

Cattle temperament can have a significant effect on reproductive performance. Earlier studies reported that enrolling excitable heifers in an estrus synchronization (ES) protocol effectively improved temperament by the day of artificial insemination (AI). The objective of this study was to assess the effects of acclimation, during the handling events of an ES protocol, on temperament and reproductive performance of commercial beef heifers. Heifers were assessed for reproductive tract score (RTS), chute score (CS), and exit velocity (EV) before enrollment in the study (day -10). Those with immature tract scores were excluded. Angus-influenced commercial heifers (n = 361) were stratified by RTS and CS to either the treatment (TRT) or the control (CTRL) group, tagged accordingly, and then pastured together. Before ES protocol handling events (day 0, 7, and 10), TRT heifers were sorted and acclimated by running them through the chute without restraint and commingling them with their CTRL pasture mates. CS and EV were collected to measure temperament during ES days -10, 0, 7, and 10 for all individuals. Estrus detection patches were applied on day 7 and scored on day 10. Pregnancy status was determined approximately 40 days post-AI by rectal ultrasonography. RTS ($P = 0.777$), CS ($P = 0.990$), and EV ($P = 0.9607$) did not differ between groups on day -10. There was no difference in estrus detection patch scores ($P = 0.1906$), or the percent of heifers pregnant to the ES protocol between TRT (56.8%) and CTRL (52.7%) heifers ($P = 0.3563$). On day 7 ($P = 0.001$) and day 10 ($P = 0.0002$), CS was lesser for TRT heifers in comparison to CTRL heifers. Our findings suggest that acclimating heifers to the facility during the handling events of the 7-day CO-synch + CIDR ES protocol effectively improved heifer temperament by the time of artificial insemination, but it did not support better reproductive performance.

[1] Department of Animal Science, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil

[2] Department of Animal Science, South Dakota State University, Brookings, SD

[3] ABS Global, DeForest, WI

Introduction

Commercial beef producers have been hesitant to adopt estrus synchronization (ES) protocols as a production management tool. After a survey of Virginian cattlemen, the greatest concerns were focused on cost, number of handling events, and conception rates to fixed-time artificial insemination (TAI). One factor to have a known negative effect on TAI conception rates is excitable temperament (Dias et al., 2022). Temperament is the behavioral response to human handling (Fordyce et al., 1988). It has previously been shown that acclimation to human handling can decrease excitability and increase reproductive performance of Brahman-influenced cows (Cooke et al., 2011). Earlier studies reported that the human handling of beef heifers that occurs during the events of an ES protocol was effective at improving temperament in Angus-influenced beef heifers by TAI (Dias et al., 2022). The objective of this study was to assess the effects of acclimation, during the handling events of an ES protocol, on temperament and reproductive performance of commercial beef heifers. We hypothesized that acclimating heifers to the facility during the handling events of the ES protocol would effectively decrease temperament excitability by TAI, and thus increase the percent of heifers pregnant to the ES protocol when compared to nonacclimated counterparts.

Experimental Procedures

Temperament Evaluation

Angus-influenced commercial beef heifers (n = 361) from five locations were enrolled in the experiment. Before enrollment (day -10), all heifers were evaluated for reproductive tract score (RTS), chute score (CS), and exit velocity (EV). Reproductive tracts were scored using the five-point scoring system (Holm et al., 2009). Heifers with an RTS of 1, having an immature tract and no palpable structures, were excluded from the study. For measures of temperament, we used the methods described by Cooke and others (Cooke et al., 2011). CS was evaluated on a five-point system upon entering the chute; 1 = calm, no movement; 2 = restless movement; 3 = frequent movement and vocalization; 4 = constant movement, vocalization, shaking of the chute; and 5 = violent, continuous struggling. One infrared beam was set just outside of the head catch of the chute, and another was placed 6.6 ft from the first. Once the heifer was released from the chute and crossed the start beam, the timer started. When she crossed the second beam, the timer stopped and the exit time at chute side was recorded. To compute EV, the distance between the two timers (6.6 ft) was divided by the heifer's exit time. Additionally, on day -10, heifers were stratified by RTS and CS into either the treatment (TRT) or the control (CTRL) group and tagged with a colored ear tag indicating their respective group. Heifers were pastured together.

ES Protocol

The ES protocol used was the 7-day CO-synch + CIDR protocol for beef heifers (Lamb et al., 2006). On day 0 heifers were given an injection of gonadotropin releasing hormone (GnRH) intramuscularly (IM) and an EAZI-BREED CIDR device (Zoetis Animal Health, Parsippany, NJ) was inserted vaginally. On day 7, the CIDR was removed, heifers were given an injection of prostaglandin ($PGF_{2\alpha}$) IM, and an estrus detection patch was applied to the individual's tailhead. After 54 hours ± 2 hours later (day 10), TAI was performed, and an IM injection of GnRH was administered. On all days (0, 7, and 10), TRT heifers were acclimated prior to the ES event of the day by running them through the tub, alley, and chute without being caught. They were then commingled back with their pasture mates, and all heifers (TRT and CTRL) were brought through the facility for the ES event of that day. Additionally, on all days (0, 7, and 10), all heifers were evaluated for CS and EV. On day 10, the estrus detection patches were evaluated and scored based on the percentage of patch surface that was rubbed off. Patches were scored on a 5-point system; 0 = lost patch, 1 = less than 25% activated, 2 = less than 50% activated, 3 = less than 75% activated, and 4 = more than 75% activated. After TAI, heifers were returned to the pasture and exposed to bulls 14 days after TAI (experimental day 24). Pregnancy status was determined via rectal ultrasonography approximately 40 days post-TAI.

Statistical Analysis

All data were analyzed using the SAS 9.4 software. For the percentage of heifers pregnant to the ES protocol parameter, GLIMMIX was used with heifer as the experimental unit. For all repeated measures, EV and CS, the MIXED procedure was used. The level of significance was set at $P < 0.05$ with tendency set at $0.05 \leq P \leq 0.10$.

Results and Discussion

There was no difference in RTS ($P = 0.777$), CS ($P = 0.990$), and EV ($P = 0.9607$) between TRT or CTRL heifers on day -10 before enrollment in the ES protocol and acclimation. When looking at measurements of temperament, on day 7 ($P = 0.001$) and day 10 ($P = 0.0002$), CS was lesser for TRT heifers in comparison to CTRL heifers (Table 1). For EV, there were no between-group differences but there was an effect of day ($P < 0.05$). All heifers had slower ($P > 0.05$) velocities for days 7 and 10 compared to days -10 and 0. We concluded that it is likely that acclimation during the ES protocol was effective at improving temperament due to the difference in CS between TRT and CTRL heifers. To support this claim, blood samples were collected on a subset of heifers, and these will be analyzed for plasma cortisol concentrations. Circulating levels of cortisol are a biomarker of stress (Sapolsky et al., 2000). This analysis is a work in progress and will help discern the physiological effect of acclimation. There was no difference in estrus detection patch scores between groups ($P = 0.1906$). While there was a 4-percentage point difference in the percent of heifers that became pregnant to the ES protocol between TRT (56.8%) and CTRL (52.7%) heifers, this was not a statistically significant difference (Table 1). This was attributed to the lack of significance with a small sample size. In the future, more heifers will be enrolled in the study to increase the power of the test.

Implications

Acclimation during an ES protocol is cost-conscious and effective at improving temperament of beef heifers, and more research is needed to discern the effects on reproductive performance.

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Table 1. Average chute score, exit velocity, estrus detection patch score, and percent of heifers pregnant to the protocol by treatment group

	Average chute score		Average exit velocity (m/second)		Average estrus detection patch score		TAI conception rate (%)	
Heifer group	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**	**CTRL**	**TRT**
Day -10	2.3	2.3	2.0	1.9				
Day 0	2.3	2.1	2.1	2.0				
Day 7	2.1[b]	1.7[a]	1.7	1.6				
Day 10 (TAI)	2.2[b]	1.8[a]	1.6	1.6	2.1	2.3		
Day 40							52.7	56.8
P-value	TRT = 0.0003 Day < .0001 TRT × Day = 0.0011		TRT = 0.3848 Day < .0001 TRT × Day = 0.8934		TRT = 0.1906 Location < .0001 TRT × Location = 0.4629		TRT = 0.3563 Location = 0.5405 TRT × Location = 0.9801	

[ab]Means within rows with unlike superscripts differ ($P < 0.05$).