Department of Animal and Range Sciences

CLAYTON LIVESTOCK RESEARCH CENTER

PROGRESS REPORT

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Effects of slick vs non-slick bunk management on intake, performance, and carcass merit responses by finishing beef steers[1]

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Introduction

Slick bunk management (**SB**) offers feedyards the potential to simplify daily feed allocation decisions; however, the effects of SB on performance and carcass quality are not well established. Therefore, our objective was to evaluate SB and non-slick bunk management (**NSB**) in a finishing trial to determine if bunks could be diligently managed to achieve slick status without adversely affecting performance or carcass merit.

Experimental Procedures

Cattle. One hundred ninety Angus steers (initial BW = 864 lb) were used in a randomized complete block design to evaluate the effects of slick vs non-slick bunk management on finishing performance and carcass characteristics. The steers used in this experiment were received at the Clayton Livestock Research Center (CLRC) on 7/30/02 after being grown on native grass. Upon arrival at the CLRC, steers were offered 5 lb of wheat hay per head and 12 lb of a common 65% concentrate diet. Cattle were allowed to rest overnight and on the following day were dewormed, (Ivomec pour on; Merial) given 7-way clostridial (Ultrabac 7; Pfizer) and Bovine respiratory disease (Reliant-plus; Merial) booster vaccinations, and tagged with an individually numbered ear tag. The steers were stepped up to a 90% concentrate diet over the next 3 weeks.

Experimental Design. All cattle were weighed on 8/29/02 to obtain a sorting BW. All body weight (BW) data were ranked from lightest to heaviest in an Excel spreadsheet, and a random number was assigned to each animal. Because there were two treatments, each steer in a sequential set of two steers was assigned a treatment number (1=slick, 2=non-slick) corresponding to the numerical rank of their random number. This process was repeated for the lightest weight block until 12 steers were assigned to each of the two treatments, resulting in 24 steers assigned to the lightest weight block. This method was repeated for each of eight weight blocks. Because there was an odd number of steers per treatment, the two pens in the heaviest weight block were assigned 11 instead of 12 steers per pen. Each of the treatments within each of the eight weight blocks was assigned a random number and based on the numerical rank of that random number each of the treatments within a block was assigned a pen number corresponding to one of two adjacent pens. Thus, 16 pens with 8 pens per treatment were used to evaluate the two treatments. To ensure that all cattle were equally filled prior to obtaining d-0 weights, the trial was not started until 5 d after obtaining the sorting BW. On 9/3/02 (d 0) cattle were weighed individually, implanted with Ralgro (Shering Plough), and sorted into their respective pens to begin the trial. Upon placement into their home pen, cattle were fed a common 91% concentrate diet (Table 1).

Management, Feeding, and Weighing Procedures. Feedbunks were read twice daily at approximately 7:00 A.M. and 10:30 P.M., and cattle were fed once daily at approximately 8:00 A.M. Bunk space was limited to approximately 11 inches per head to allow only 2/3 of the cattle to eat at once. The objective of the SB treatment was for bunks to contain at least 0.5 lb per head at 10:30 P.M. and 0.0 lb at 7:00 A.M., before feeding at approximately 8:00 A.M. If a bunk within the SB treatment became slick before 10:30 P.M., feed allocation was increased by 0.5 lb/head/d (as fed) until the targeted status was achieved. The objective of the NSB treatment was for bunks to contain approximately 0.5 lb per head at 7:00 A.M. before feeding at approximately 8:00 A.M. If a bunk within this treatment was slick at the 10:30

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P.M. or 7:00 A.M. reading, feed allocation was increased by 0.75 or 0.5 lb/head/d (as fed), respectively, until the targeted status was achieved. When accumulated feed (**AF**) in the NSB treatment became compromised by moisture or excessive fines, it was removed, weighed, and analyzed for dry matter (DM). Average DM intake (DMI) for each pen was determined with and without AF removed.

To determine the percent DM of treatment diets, samples of feed were taken weekly from half of the pens within each treatment and dried in a forced-air drying oven at 100^{0}C for 24 h. These bunk sample DM values were used to compute average DMI by the cattle in each pen, and the dried samples were composited by treatment every 28 d, ground through a 1-mm screen in a Wiley mill, and analyzed in duplicate in the laboratory for crude protein (CP), acid detergent fiber (ADF), Ash, Ca, and P (AOAC, 1990). These values for each 28-d interval were averaged at the end of the experiment to compute average CP, ADF, Ash, Ca, and P in the diet (Table 2).

On d 0, 41, and the final day of the experiment (d 122), steers were weighed individually before the morning feeding. On d 41 at the time of the scheduled BW measurement, each steer was re-implanted with Revalor S (Intervet). When it was determined that the majority of steers had reached their optimal physiological end point, they were weighed individually to determine final live wt and shipped to the IBP packing plant in Amarillo, TX (1/03/03) where individual carcass data were collected by personnel of the West Texas A&M University Beef Carcass Research Center. To reduce possible differences in gut fill between the treatments, feed bunks in the SB treatment were managed the same as those in the NSB treatment during the last week of the experiment.

Statistical Analysis. Performance and carcass data were analyzed as a randomized complete block design with pen as the experimental unit and with each treatment represented by one pen within each of eight weight blocks. Statistical analyses were conducted using the General Linear Models procedure of SAS (SAS Inst., Cary, NC) with a model that included effects of block and treatment for the pen-based data. Pen means for average daily gain (ADG) and DMI were included in the SAS data file, and feed:gain (F:G) ratio was calculated by SAS as pen mean DMI/pen mean ADG. When the overall F-value for treatment was significant using the residual mean square as the error term, means were separated using the PDIFF option of SAS. Carcass quality grade data were analyzed by Chi-square with the GENMOD procedure of SAS.

Results and Discussion

Performance data based on final live BW are presented in Table 3. Carcass adjusted performance and carcass merit data are presented in Table 4. Daily DMI averaged 0.44 lb/d less (P = 0.16) for the SB treatment when discarded AF was subtracted from feed delivery data. Leaving discarded AF in the feed log, as would occur in a commercial feedyard, resulted in 0.54 lb/d less (P = 0.09) apparent DMI for the SB than for NSB treatment. Feed efficiency did not differ (P > 0.33) using DMI derived by either method. No difference (P = 0.65) in ADG was observed between the two treatments; however, marbling score was lower (P = 0.04) for SB than for NSB, and Chi-square analyses indicated a greater (P = 0.09) proportion of carcasses with a modest or higher degree of marbling for the NSB treatment. No other differences (P > 0.10) in carcass merit were observed, and no differences (P > 0.10) in carcass adjusted performance were detected when final BW was adjusted using hot carcass weights and a common dressing percent (average dressing percent was used).

Cattle in the SB treatment consumed less total DM and therefore less total NEg. The fact that this lesser NEg intake was not enough to statistically affect performance, but presumably was enough to statistically affect degree of marbling is interesting, but not astonishing. Similar results from an experiment conducted by S. E. Bachman and S. L. Armbruster at a private feedyard were reported by Galyean (1999) in a review of restricted and programmed feeding of beef cattle. Those data suggest that while a 1 lb DMI restriction relative to ad libitum-fed steers was not enough to adversely affect ADG (4.14 vs 4.12 lb/d for ad libitum and restricted, respectively), it seemed to be enough to adversely affect quality grade (47.6% vs 38.4% Choice for ad libitum and restricted, respectively). In his review, Galyean (1999) concluded that one of the keys to successful application of these intake management programs will be a greater understanding of the processes that control marbling so adverse effects on quality grade can be avoided. While the steers in the SB treatment in this study were not limit fed per se, their intake was slightly restricted to accomplish the objectives of the SB treatment. One might hypothesize that cattle in the SB treatment were satiated for a few hours less each day, which might have affected some aspect of fatty acid synthesis within the cell. Acetyl CoA carboxylase is a key enzyme regulating fatty acid metabolism by catalyzing the production of malonyl CoA; the two-carbon donor that when produced is the committed step in fatty acid synthesis. Insulin stimulates fatty acid synthesis by activating Acetyl CoA carboxylase. Likewise, citrate within the cell locally activates the carboxylase for fatty acid synthesis by signaling that building blocks and energy are abundant (Stryer, 1995). Thus, it seems possible that if cattle in the SB treatment were satiated for a few hours less each day (as evidenced by the slightly less DMI required to achieve the SB treatment, and by a noticeably more aggressive behavior at feeding), this might have affected intracellular signaling from citrate and(or) insulin production.

The percentage of mornings that bunks were slick at 7:00 A.M. were 64.4 and 21.7% for SB and NSB, respectively, and the percentage of evenings that bunks were slick at approximately 10:30 P.M. were 15.2 and 3.2% for SB and NSB, respectively. As a practical observation, limiting bunks space so approximately 2/3 of the cattle could eat at once appeared to be of little consequence to cattle in the NSB treatment, but in conjunction with the SB treatment resulted in noticeably more aggression at the feed bunk for approximately 15 minutes after feeding throughout the experiment. It appeared that after approximately 15 minutes the aggression ended and most cattle lost interest in the feedbunk. Using eating rate data (approximately 0.33 lb/head/min) reported by Defoor et al. (2002) to calculate likely consumption by the SB cattle immediately after feeding, it seems that feeding once vs three times per day would have had little effect on the outcome of this study because the cattle likely consumed approximately only 5 lb of DM per head during the initial 15 minutes that most were interested in eating after feed was delivered. Many feedyards that feed three times per day will deliver approximately 6 lb of DM on the first round and in most cases bunks do not become slick between rounds. Because feed is generally always present in both once and three times per day feeding programs, it seems the effects of feeding once vs three times per day on the outcome of this experiment are negligible.

Implications

These data indicate that it is possible to manage bunks to obtain the slick status described herein without adversely affecting performance. However, carcass data indicate the possibility that quality grade might be adversely affected by slick bunk management. Such differences observed with these steers, however, were of little practical significance.

Literature Cited

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Table 1. Formulated composition of the finishing diet fed to steers in both treatments.

Ingredient	%, DM basis
Steam-flaked corn (27 lb/bu)	81.5
Alfalfa hay	9.00
Corn steep blend[a]	3.00
Yellow grease	3.00
Urea	1.00
Supplement[b]	2.50

[a]Corn steep blend = 70% corn steep and 30% molasses as-fed.
[b]Supplement supplied the following in the diet (DM basis): Ca=0.60%, P=0.0%, K=0.10%, Mg=0.08%, S=0.03%, NaCl=0.30%, Ammonium sulfate=0.10%, Co=0.20ppm, Fe=66.47ppm, I=0.50ppm, Mn=40.09ppm, Se=0.05ppm, Zn=75.00ppm, Cu=10.00ppm, Vitamin A=2200IU/kg, Vitamin E=17.5 IU/kg, Monensin=30g/ton, Tylosin=10g/ton, and Crude protein=0.30%

Table 2. Chemical composition of the finishing diet fed to steers in both treatments.

Item	Concentration[a]
Dry matter, %	78.70
Ash, %	4.70
Crude Protein, %	14.11
Acid detergent fiber, %	6.35
Calcium, %	0.83
Phosphorus, %	0.26

[a]All values except Dry matter, % are expressed on a DM basis.

Table 3. Effects of slick vs non-slick bunk management on performance by finishing beef steers.

	Bunk Management Treatments		
Item	Non-slick	Slick	SE[g]
Initial BW, lb	865.3	864.6	1.19
Final BW, lb	1364.2	1358.1	8.29
DMI, lb/steer[a]	21.43	20.99	0.20
DMI, lb/steer[bcd]	21.60[c]	21.06[d]	0.20
Daily gain, lb	4.09	4.05	0.07
Feed:gain[e]	5.24	5.19	0.05
Feed:gain[f]	5.29	5.20	0.05

[a]Dry matter intake with discarded accumulated feed taken out of the feed log.
[b]Dry matter intake with discarded accumulated feed left in the feed log.
[cd]Within a row, means that do not have a common superscript letter differ ($P < 0.10$).
[e]Feed:gain with discarded accumulated feed taken out of the feed log.
[f]Feed:gain with discarded accumulated feed left in the feed log.
[g]Pooled standard error of the treatment means, n = 8 pens per treatment.

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Table 4. Effects of slick vs non-slick bunk management on carcass adjusted performance and carcass merit responses by finishing beef steers.

Item	Bunk Management Treatments		
	Non-slick	Slick	SE[i]
Initial BW, lb	865.3	864.6	1.19
Carcass adjusted final BW, lb	1363.6	1352.5	9.84
Carcass adjusted daily gain, lb	4.10	4.01	0.07
Carcass adjusted feed:gain[a]	5.23	5.23	0.07
Carcass adjusted feed:gain[b]	5.27	5.25	0.07
Hot carcass wt, lb	820.7	813.7	6.02
Dressing percent	60.4	59.9	0.22
Longissimus muscle area, sq. in.	13.66	13.52	0.13
Fat thickness, in.	0.60	0.59	0.01
Kidney, pelvic, and heart fat, %	1.88	1.86	0.03
Yield grade	3.12	3.11	0.05
Marbling score[cde]	451.3[d]	438.6[e]	3.72
Choice- (small marbling) and higher, %[f]	74.20	70.20	-
Choice (modest marbling) and higher, %[gh]	25.81[g]	15.96[h]	-
Select, %[f]	25.80	29.8	-

[a]Carcass adjusted feed:gain with discarded accumulated feed taken out of the feed log.
[b]Carcass adjusted feed:gain with discarded accumulated feed left in the feed log.
[c]300 = Slight^0; 400 = Small^0; 500 = Modest^0
[de]Within a row, means that do not have a common superscript letter differ ($P < 0.05$).
[f]Distribution of carcasses did not differ ($P > 0.10$)
[gh]Distribution of carcasses of Choice (modest marbling) and higher quality grade differs ($P < 0.10$).
[i]Pooled standard error of the treatment means, n = 8 pens per treatment.