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Summary

The impact of morning (0730), evening (1600), and twice daily (0730/1600) feeding on feedlot performance was evaluated in yearling steers fed high grain diets. Exp. 1 was conducted from July 20 to October 12, 1993. The 92% concentrate diets were based on dry whole shelled corn. There were four pen replicates per treatment. Exp. 2 was conducted from January 6 to May 10, 1994. The 93% concentrate diets were based on a 50/50 blend of dry whole shelled corn and high moisture corn. There were six pen replicates per treatment. In Exp. 1 evening feeding increased ($P<.06$) average daily gain and improved ($P<.06$) feed/gain over morning feeding. The most pronounced effects were during the initial 28 days of the 84-day experiment. Performance of steers fed twice daily was intermediate to evening and morning treatments. Twice daily feeding improved performance over morning feeding (average daily gain, $P<.10$; feed/gain $P<.01$). Most of this response occurred during the final 28 days of the experiment. During Exp. 2 there were treatment effects on interim period performance but no responses ($P>.10$) occurred for cumulative performance variables.

Key Words: Feedlot, Feeding Frequency, Feeding Schedule

Introduction

In the midwest, cattle feeders frequently feed high grain diets once daily, in the early morning. Larger feedlots commonly feed cattle two or three times daily. Published production responses to feeding more than once daily are variable. In most cases, the constraints of limited linear bunk space, bunk feed volume, and feed stability probably dictate how frequently cattle should be fed. There are, however, other variables to consider.

In the summer, cattle must contend with heat loads created by radiant energy and ambient temperature. The heat produced during fermentation and metabolism adds to the heat load. If by altering animal behavior we could cause more of the heat produced by the animal to be shifted to evening when solar energy is diminished, this may allow cattle to be more efficient. In the winter, shifting proportionally more heat production to nighttime hours may also be beneficial since cold stress is more likely to occur or be more acute at night.

If evening eating is advantageous from a thermodynamic perspective, then feeding cattle in the early morning may be counterproductive. We conducted two experiments to evaluate how time of day and frequency of feeding affected performance of steers in summer-autumn or winter-spring seasons.

Materials and Methods

The three treatment schemes involved feeding steers a common diet (Table 1) either at 0730 (AM), 1600 (PM), or twice daily (0730 and 1600, AP). These treatments were applied to finishing cattle experiments. In Exp. 1 steers (83 head) were assembled at the SDSU Research Feedlot between July 15 and July 20. Upon arrival, steers were vaccinated against IBR, BVD, BRSV, Haemophilus s., and PI_3 and were dewormed. During the assembly and subsequent receiving period, steers were limit

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Table 1. Diet formulations[a,b]

	Exp. 1	Exp. 2
Hay, %	8.0	7.00
Whole shelled corn, %	85.18	41.60
High moisture corn, %	--	41.60
Liquid supplement, %	3.60	3.60
Ground corn, %	1.34	--
Soybean meal, 44%	--	5.90
Corn gluten meal, %	.74	--
Blood meal, %	.54	--
Urea, %	.55	.20
$CaCO_3$, %	.05	.10
Crude protein, %	12.61	11.8
NE_m, Mcal/cwt	91.6	94.7
NE_g, Mcal/cwt	61.3	64.7

[a]Provided additional vitamins and minerals to meet or exceed NRC nutrient recommendations.
[b]Diet contained 27 g monensin/ton.

fed high moisture ear corn and a protein-vitamin-mineral supplement.

Steers were sorted based on body weight into two blocks. The allotment weights were 753 and 882 lb for light and heavy blocks, respectively. Each steer was individually identified and implanted with Revalor-S on day 1 of the experiment. Allotment included stratifying weight within the blocks across each treatment and then into two replicate pens of seven steers within each treatment. (One replicate pen consisted of only six steers.) The test pens began receiving experimental diets on July 20, 1993, and continued through October 12, 1993.

Exp. 2 was conducted from January 6 to May 10, 1994. The steers had been on a backgrounding experiment since weaning in October. Two blocks representing two ranch sources were equally represented in each treatment. The 18 pens of eight steers provided six replicates per treatment. There were 9 pens of steers in each ranch block. Steers were implanted with Synovex-S on day 1 and day 56 of the experiment.

Adaptation to finishing diets was accomplished by restricted feeding. Initial feed deliveries were set at 1.5% body weight and then gradually increased to achieve ad libitum intake by 21 to 30 days on feed. Diet ingredients were sampled weekly to determine dry matter, crude protein, acid detergent fiber, neutral detergent fiber and ash content. Feed bunk conditions were scored and noted daily. Feed calls were made at 0700 for steers fed in AM and AP. The AP feed call was fed in two equal portions. Bunk conditions for cattle fed in PM were scored and feed calls were made at 1530.

Individual body weights were determined at 0700 on 28-day intervals (Table 2). Feed summaries corresponded with weigh days. In Exp. 2, all steers were fed twice daily for 3 days prior to determining final body weight. Feedlot performance of the steers was evaluated by considering experimental units to be represented by pen mean data.

Results and Discussion

In Exp. 1 during the initial 28-day period, average daily gains were greater ($P<.05$) when the cattle were fed at 1600 versus 0730. Feed/gain was lower ($P<.05$) for the PM treatment, reflecting average daily gain differences since dry matter intakes were similar. This response also occurred in the 57- to 84-day period. Cumulative feed efficiency was improved ($P<.01$) by feeding steers in the evening. Performance of steers fed twice daily was intermediate and not different ($P>.10$) from the AM and PM treatments. Weather was moderate throughout this experiment and there was little obvious evidence of heat stress. Average daily high and low temperatures were 71° and 49°, respectively.

In Exp. 2, interim steer performance varied in an inconsistent fashion (Table 3). As in Exp. 1, PM feeding increased ($P<.01$) average daily gain in the early feeding (1 to 28 days) and later (57 to 84 days) periods. Cumulative 84-day average daily gains were higher for the PM treatment (2.95, 3.31, and 3.05 lb for treatments AM, PM, and AP, respectively). Climatic condition changes during this January through May feeding period were dramatic.

Table 2. Exp. 1 interim and cumulative feedlot performance of steers fed at different times and frequencies (summer-fall)

	Treatment			P[a]		
Item	AM	PM	AP	AM vs PM	AM vs AP	PM vs AP
Initial wt	822	816	820	NS	NS	NS
1-28 days						
Body wt (28)	950	972	959	NS	NS	NS
Avg daily gain	4.52	5.59	4.98	.0119	NS	NS
Dry matter intake	18.43	19.54	18.08	NS	NS	.0817
Feed/gain	4.12	3.49	3.63	.0253	.0638	NS
29-56 days						
Body wt (56)	1073	1099	1079	.0905	NS	NS
Avg daily gain	4.39	4.52	4.29	NS	NS	NS
Dry matter intake	23.68	23.31	22.95	NS	NS	NS
Feed/gain	5.38	5.19	5.37	NS	NS	NS
57-84 days						
Body wt (84)	1182	1221	1203	.0154	NS	NS
Avg daily gain	3.89	4.37	4.41	.0849	.0637	NS
Dry matter intake	26.71	25.68	25.75	NS	NS	NS
Feed/gain	6.90	5.88	5.87	.0235	.0224	NS
Cumulative (84 days)						
Avg daily gain	4.27	4.82	4.56	.0048	.0774	NS
Dry matter intake	22.94	22.84	22.26	NS	NS	NS
Feed/gain	5.36	4.73	4.89	.0009	.0052	NS

[a]NS = P>.10.

Table 3. Exp. 2 interim and cumulative feedlot performance of steers fed at different times and frequencies (winter-spring)[a]

	Treatment			P<[a]		
Item	AM	PM	AP	AM vs PM	AM vs AP	PM vs AP
Initial wt	734	734	730	NS	NS	NS
<u>1-28 days</u>						
Body wt (28)	793	815	792	.01	NS	.01
Avg daily gain	2.02	2.86	2.21	.01	NS	.01
Dry matter intake	16.04	16.50	15.74	.03	.14	.01
Feed/gain	8.19	5.81	7.74	.01	NS	.01
<u>29-56 days</u>						
Body wt (56)	916	932	914	.06	NS	.04
Avg daily gain	4.40	4.18	4.38	NS	NS	NS
Dry matter intake	21.52	22.02	21.15	.06	.13	.01
Feed/gain	4.90	5.30	4.86	.10	NS	.08
<u>57-84 days</u>						
Body wt (84)	984	1013	986	.01	NS	.02
Avg daily gain	2.42	2.89	2.57	.02	NS	.10
Dry matter intake	19.48	19.66	19.24	NS	NS	NS
Feed/gain	8.17	6.82	7.63	.02	NS	.12
<u>85-112 days</u>						
Body wt (112)	1080	1106	1077	.03	NS	.02
Avg daily gain	3.43	3.35	3.24	NS	NS	NS
Dry matter intake	21.32	21.58	20.61	NS	NS	.10
Feed/gain	6.28	6.51	6.45	NS	NS	NS
<u>1-124 days</u>						
Final body wt	1107	1105	1103	NS	NS	NS
Avg daily gain	2.99	2.99	3.01	NS	NS	NS
Dry matter intake	19.85	20.06	19.42	NS	.14	.04
Feed/gain	6.64	6.72	6.48	NS	NS	.15

[a]NS = P>.15.

If eating behavior was altered by treatment, fill differences could be affecting "apparent" performance of steers. When fill was "normalized" by twice daily feeding of all groups to determine final body weight, no differences in 124-day average daily gains were evident.

During the period 112 to 124 days, average daily gains were 2.28, -.10, and 2.15 for treatments AM, PM, and AP, respectively. To normalize fill, the PM steers received 50% of their daily dry matter intake on the evening of day 121 rather than 100% as had been done previously. The AM treatment was handled similarly the morning of day 122. Both groups were thereafter fed at the same time as the AP steers.

The average daily gain of 2.15 lb for the AP treatment during the 112- to 124-day period should not be biased by fill because feeding and weighing conditions were unchanged. If the difference in average daily gain between the AP and PM treatments was due to fill, the PM cattle were carrying 27 lb more fill than the AP treatment on day 112. This represents 2.4% body weight and seems unrealistic since both groups of cattle were on full feed and elapsed time between the last feeding and body weight measurements was similar for AP and AM treatments. The normalized feeding schedule may have adversely affected the PM steers, biasing the estimate of fill. Unfortunately, carcass weight data were not available for either experiment.

These steers were weighed at 0700 and 1430 on days 56, 84, and 112. Differences in body weight within the day are shown in Table 4. On each date at 0700, fill was greater for the PM steers than the AM or AP steers or increased less prior to the 1430 body weight. Less increase in fill seems logical since the AM and AP treatments were fed between the 0700 and 1430 body weight determinations. These body weight differences within a day and changes with time on feed suggest eating and/or drinking patterns are altered dramatically by feeding schedules.

Lacking carcass data, it is unclear how treatments have affected gains by steers in either experiment. In each experiment PM feeding was affecting apparent average daily gain through 84 days on feed. Although other work is necessary to determine the potential advantages of evening feeding, it is apparent from this work that there are no detrimental effects associated with evening feeding.

Table 4. Within day changes in body weight (Exp. 2)[a]

	Treatment			P		
Item	AM	PM	AP	AM vs PM	AM vs AP	PM vs AP
Day 56	-12.0	.8	-7.2	.01	.11	.01
Day 84	-24.2	12.8	-7.8	.01	.01	.01
Day 112	-9.5	15.5	3.3	.01	.01	.01

[a](Body weight at 0700) - (body weight at 1430).