Effects of Initial Body Condition, Frame Size and Concentration of Dietary Energy on Performance of Finishing Steers

A.S. Leaflet R1537

Allen Trenkle, professor of animal science

Summary

Steers were sorted into four groups based on hip height and fat cover at the start of the finishing period. Each group of sorted steers was fed a diet containing 0.59 or 0.64 Mcal NEg per pound of diet. Steers with less initial fat cover (.08 in.) gained slightly faster, consumed less feed, and therefore tended to be more efficient than steers with greater finish (.16 in.). Steers fed the lower-energy diet consumed more feed, gained similarly, and were less efficient than steers fed the higher-energy diet. The NRC computer model to evaluate beef cattle diets underpredicted performance of cattle in this experiment, but accurately predicted the differences in gain and feed efficiency observed between the leaner and fatter steers and between the two diets. In this study, the shorter steers (49.4 vs 52.2 in. initial height at the hip) gained faster with slightly greater feed intake and the same feed conversion.

Introduction

It is known that gain and feed efficiency of cattle in the feedlot are negatively related to body condition. As cattle become fatter, gain and feed conversion are depressed. Body condition score is an input to establish nutrient requirements and estimate performance of cattle using the computer program with the Nutrient Requirements of Beef Cattle (NRC, 1996). In most pens of finished cattle the wide range of thickness of subcutaneous fat cover suggests that some cattle have been fed too long while others have not been fed long enough. This difference in fat thickness may result from differences in genetic propensity to deposit subcutaneous fat or differences in body condition when the cattle were started on feed. If more cattle are to be sold in specification markets in the future, producers will have to improve the uniformity of their cattle to optimize economic returns. The objective of this study was to determine if sorting feeder steers based on fat cover as measured by scanning with ultrasound improved performance of the steers in the feedlot and the uniformity of the finished carcasses.

Methods

Eighty crossbred steers weighing 1,000 pounds had been fed a diet containing 0.57 Mcal NEg/lb. for 28 days in a prior study before being allotted to pens for this study. The steers were sorted into two groups based on hip height and each of those groups further divided into two groups based on fat thickness. The steers were predominantly black, red, and white in color. The steers were scanned between the 12th and 13th ribs with a Pie Scanner 210 using a 3.5 MHz 18 cm linear array transducer to measure fat thickness and area of ribeye prior to the initial 28-day study. Steers from each of the four subgroups were then allotted at random to four pens (five steers per pen).

Two pens of cattle in each of the four subgroups were fed the 0.59 or the 0.64 Mcal/lb. corn-based diets shown in Table 1. All steers were implanted with Revalor S at the beginning of the experiment. The steers were housed in an open-front shed with feed bunks under the roof of the shed. The steers were weighed individually in the morning, before feeding, on two days at the start as well as when the cattle were sold and at 28-day intervals throughout. The cattle were scanned for fat thickness, ribeye area, and intramuscular fat at approximately four-week intervals during the study. The cattle were started on the diets shown in Table 1, but intake was limited for the first four weeks while they adjusted to the higher levels of grain. The steers were fed for an additional 70 days following the initial 28-day study.

The observed gain and feed efficiency were compared with those predicted by use of the NRC model (NRC, 1996) by assuming the steers with less fat cover were body condition score of 4.0 and those with more fat were 4.5; the shorter steers would be USDA Choice at 1300 lbs and the taller steers Choice at 1325 lbs. Inputs for starting weight and feed intake were the averages observed in the study.

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Standard error of the means and least significant differences ($P < .05$) between means also were calculated.

Table 1. Composition of diets (dry basis).

	Diet NEg, Mcal/lb.	
Ingredient	0.59	0.64
Cracked corn	69.21	79.00
Pelleted alfalfa	25.00	12.00
Cane molasses	2.00	2.00
Soybean meal	2.50	5.00
Urea	0.60	0.57
Dicalcium phosphate		0.23
Ground limestone	.025	0.76
NaCl	0.30	0.30
KCl		0.23
Trace mineral premix	0.024	0.024
Vitamin A premix	0.08	0.08
Rumesin premix[a]	0.0195	0.0195
Elemental sulfur[b]	0.0192	0.0182
Crude protein, %	12.6	12.6
Metabolizable protein, g/lb.	37.4	38.9
NEg, Mcal/lb	0.59	0.64

[a]Provided 1,400 IU of vitamin A per pound of dry matter.
[b]Provided 15.6 mg sodium monensin per pound of dry matter or 28 g per ton of complete feed (905 dry matter).

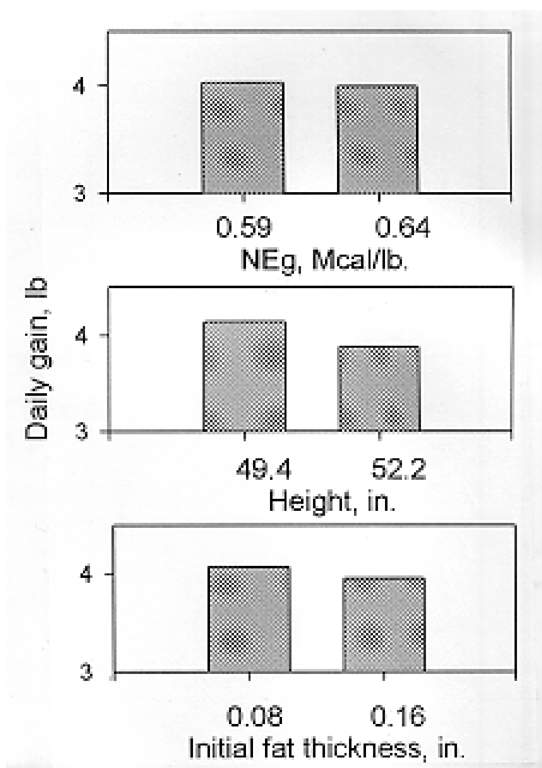
Results and Discussion

The results of this study are summarized in Table 2 and in Figures 1, 2, and 3. Steers fed the lower energy diet consumed 2.2 lbs. more feed dry matter per day, gained similarly, and were about 9% less efficient. The shorter steers consumed about 1 lb. more feed dry matter per day, gained 7% faster, and converted feed to gain similar to the taller steers. Steers with less initial fat cover consumed 0.7 lb. less feed per day, had similar gain, and were 5% more efficient.

The observed daily gain and feed efficiency were compared with those predicted by use of the NRC model in Table 3. The NRC model tended to underpredict gain 2% to 7% and feed conversion 3% to 5%. The model greatly underpredicted feed intake of the steers in this study. Observed intake, however, was used in the model to obtain the projections listed in Table 3. The observed difference in feed conversion between diets was 9% compared with a difference of 7% predicted by the NRC model. The difference in feed conversion between the cattle with less and more fat cover was 6%, which was also predicted by the NRC model.

Steers fed the lower-energy diet consumed enough more feed to compensate for the lower-energy concentration in the diet. However, they were less efficient. If roughage cost per unit of NEg was equal to or greater than corn cost,

Figure 1. Daily gain of steers in relation to concentration of dietary energy, hip height, and initial fat thickness.



which it often is, there would be economic advantage to feeding the high-energy diet. One purpose for comparing the two diets was to obtain information about the effect of dietary energy on predicting performance of cattle at some point in time before slaughter. The results of this study indicate that the difference in level of energy of the two diets used in this study did not affect gain, but did affect efficiency of feed utilization.

These results indicate that cattle with less condition at the start of the finishing period are more efficient than those with more finish. The data in Figure 2 indicate that steers with more initial fat consumed more feed. This may have been because they were heavier, but often as steers become fatter they tend to consume less feed. We do not know why some steers had more fat cover at the start of the experiment, but it might be because they had consumed more feed. A different experiment will have to be conducted to answer this question.

The NRC model predicted that cattle with more body condition would be less efficient. We assumed that the difference in initial fat cover was equivalent to one-half of a condition score. More studies will have to be done to establish the relationship between fat thickness and body condition score. A more precise measure of body condition may be a useful input to estimate performance of cattle with the NRC model.

Table 2. Feedlot performance (fed 70 days).

	--------Shorter[a]--------				---------Taller[a]---------				SE[d]	LSD[e]
	Less[b]		More[b]		Less		More			
	0.59[c]	0.64[c]	0.59	0.64	0.59	0.64	0.59	0.64		
Initial hip height, in.	49.4	49.7	49.5	49.1	52.1	51.8	52.6	52.3	.28	.86
Initial fat thickness, in.	.08	.06	.14	.16	.08	.08	.17	.16	.03	.08
Initial ribeye area, in.^{2}	8.8	8.9	9.3	9.2	9.1	9.5	9.6	9.5	.13	.40
Initial weight, lb.	955	957	1027	1005	953	1006	1071	1034	17.4	54.2
End weight, lb.	1250	1259	1318	1276	1230	1272	1338	1312	18.6	57.8
Daily gain, lb.	4.21	4.33	4.16	3.87	3.96	3.80	3.80	3.97	.09	.28
Feed, lb. DM/d	24.5	23.8	25.9	23.0	23.7	21.5	25.2	22.4	.84	2.62
Feed/gain	5.94	5.51	6.23	5.94	6.00	5.68	6.64	5.64	.22	.69

[a]Hip height, in.
[b]Initial fat thickness, in.
[c]Diet NEg, Mcal/lb.
[d]Standard error of mean.
[e]Least significant difference.

Table 3. Observed differences in gain and feed efficiency due to dietary energy and initial fat cover compared with estimates obtained with the NRC model.

	--------Daily gain, lb.--------		--------Feed/gain--------	
	Observed	NRC	Observed	NRC
Diet, Mcal/lb.				
0.59	4.03	3.89	6.20	6.39
0.64	3.99	3.79	5.69	5.99
Initial fat, in.				
0.08	4.08	3.89	5.78	6.02
0.16	3.95	3.79	6.11	6.36

Implications

The difference predicted by the NRC model in performance of cattle with different initial body condition scores was substantiated in a growth trial involving cattle sorted into groups based on thickness of fat measured with ultrasound.

Acknowledgments

Materials were supplied as follows: Rumensin®, Elanco Products, Indianapolis, Ind.; trace mineral premix, Calcium Carbonate Division of J.M. Huber Corporation, Quincy, Ill.; and vitamin A, Hoffmann-LaRoche, Inc., Nutley, N.J. The assistance of Rod Berryman, research farm superintendent; Deborah Bleile, laboratory technician; Julie Roberts, secretary; and the animal caretakers at the ISU Beef Nutrition Research Farm is appreciated.

Figure 2. Feed intake of steers in relation to concentration of dietary energy, hip height, and initial fat thickness.

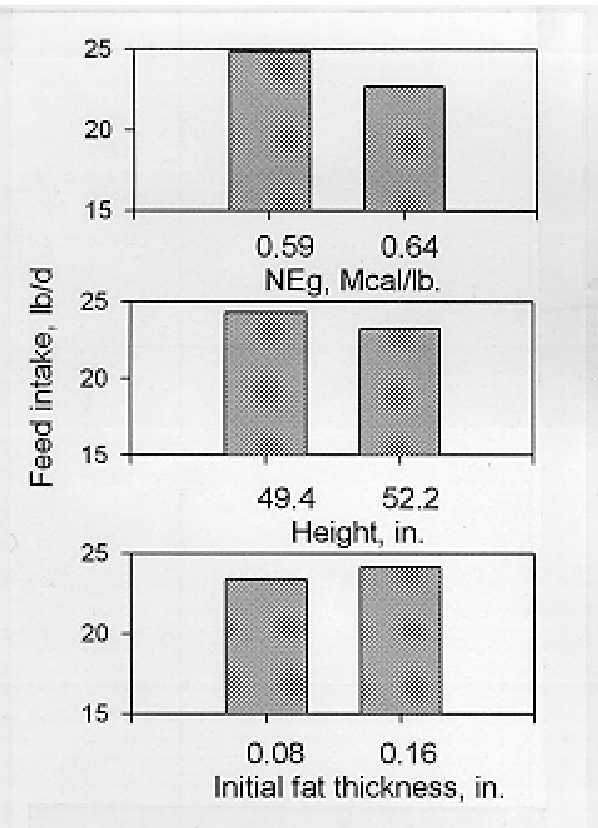


Figure 3. Feed efficiency of steers in relation to concentration of dietary energy, hip height, and initial fat thickness.