Effects of Initial Body Condition, Frame Size and Concentration of Dietary Energy on Carcass Value of Finished Steers

A.S. Leaflet R1536

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Summary

Yearling 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 diets containing 0.59 or 0.64 Mcal NEg per pound of diet. The value of each carcass was determined by use of the Oklahoma State University Boxed Beef Calculator. Sorting to increase hip height decreased the percentage of Choice carcasses and fat cover, increased ribeye area, and had no effect on carcass weight or yield grades 1 and 2. Sorting to decrease initial fat cover decreased carcass weight, carcass fat cover, and percentage of choice carcasses and increased the proportion of yield grades 1 and 2 carcasses. Concentration of energy in the finishing diet had no effect on carcass measurements. Increasing the percentage of yield grades 1 and 2 carcasses did not result in increased economic value of the carcasses when quality grades were lower and when there was a wide spread between Choice and Select carcasses, as occurred in 1996. With less spread between Choice and Select, as in 1997, sorting the cattle to increase yield grades 1 and 2 resulted in increased value, especially for close-trim boxed beef. The results of this study emphasize the importance of knowing how carcasses will grade before selecting a value-based market for selling cattle.

Introduction

As the beef industry evolves towards selling more cattle directly to retailers, producer’s success in these markets will depend upon the uniformity of their cattle in meeting the specifications of the selected markets. Many pens of cattle are too variable for a high proportion of the cattle to sell for a premium. It is possible to sort the cattle prior to slaughter to improve the uniformity of a portion of the cattle for a premium market. The remainder of the cattle, however, may have to be sold for a discount, negating the benefits of those selling for a premium. If cattle that have the potential of meeting the specifications for the premium markets could be identified earlier, maybe the remaining cattle could be fed and/or managed differently to improve their value in another market. Previous research (A.S. Leaflet R1432) has demonstrated the potential of sorting feeder cattle based on measurement of fat cover with ultrasound. The objective of this study was to determine the efficacy of sorting yearling steers prior to finishing based on frame size (height at the hip) and fat thickness over the ribs for a boxed beef market. Boxed beef was selected to represent a genuine value-based market because that is how many retailers purchase beef.

Materials and Methods

Eighty crossbred steers weighing 1,000 (ranged from 794 to 1172) pounds that had been fed a diet containing 0.57 Mcal NEg/lb for 28 days before being allotted to pens based on hip height and fat thickness were used in this study. 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. The cattle were divided into two groups based on height at the hips and each of those groups was divided into two groups based on fat thickness. 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 corn-based diets containing 0.59 or 0.64 Mcal NEg/lb for a total of 70 days. All steers were implanted with Revalor S at the beginning of the experiment. The details of the diets and management of the steers are described in another report (A.S Leaflet 1537).

All steers were sold as one group at a commercial beef-packing plant. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after 24 hours in the cooler. Ribeye area and fat thickness of each carcass were traced on sheets of acetate paper and measured later. Marbling and percentage of kidney, pelvic, and heart (KPH) fat were estimated by the USDA grader. Yield grades from individual carcasses were calculated from measurements on the carcasses using the standard yield grade equation.

The OSU Boxed Beef Calculator (Oklahoma State University) was used to calculate the value of each carcass with respect to commodity- or close-trimmed boxed beef using prices from November 18, 1996 and October 17, 1997. The 1996 price averaged about $125/cwt for Choice yield grade 3 carcasses with $20/cwt discount for Select carcasses. The 1997 price averaged about $109/cwt for Choice yield grade 3 carcasses with $9/cwt discount for

Select carcasses. Two carcasses grading Standard were priced at $95/cwt.

Table 1. Mean and range of measurements.

	Average	Minimum	Maximum
All steers (80 head)			
Initial hip height, in.	50.8	46.8	54.2
Initial fat cover, in.	0.12	0.04	0.36
Starting weight, lb.	1001	794	1172
Final weight, lb.	1282	1054	1498
Carcass weight	778.5	641.3	913.7
Carcass fat cover, in.	0.37	0.16	0.79
Carcass ribeye area, sq. in.	13.5	10.8	16.6
Marbling score[a]	430	270	550
Calculated yield grade	2.41	1.06	4.42
Carcass value, 1996 prices, $/hd			
Commodity trim	966.47	617.60	1247.38
Close trim	1010.88	617.60	1317.74
Carcass value, 1997 prices, $/hd			
Commodity trim	835.80	617.60	1057.33
Close trim	875.20	617.60	1118.79
Shorter steers with less fat cover (20 head)			
Initial hip height, in.	49.6	47.0	52.5
Initial fat cover, in.	.07	.04	.12
Starting weight, lb.	956	855	1105
Final weight, lb.	1254	1112	1254
Carcass weight	756.0	641.3	843.4
Carcass fat cover, in	0.33	0.16	0.59
Carcass ribeye area, sq. in.	13.0	11.6	15.1
Marbling score	432	360	550
Calculated yield grade	2.32	1.23	3.51
Carcass value, 1996 prices, $/hd			
Commodity trim	928.95	734.89	1110.60
Close trim	974.62	761.75	1128.64
Carcass value, 1997 prices, $/hd			
Commodity trim	809.24	685.02	940.54
Close trim	849.47	711.57	1003.66
Taller steers with less fat cover (20 head)			
Initial hip height, in.	51.9	50.8	54.2
Initial fat cover, in.	0.08	0.05	0.10
Starting weight, lb.	979	821	1079
Final weight, lb.	1251	1054	1359
Carcass weight	759.5	650.1	848.8
Carcass fat cover, in	0.24	0.16	0.47
Carcass ribeye area, sq. in.	13.8	12.0	16.1
Marbling score	403	280	470
Carcass value, 1996 prices, $/hd			
Commodity trim	942.86	617.60	1169.73
Close trim	993.04	617.60	1207.24
Carcass value, 1997 prices, $/hd			
Commodity trim	823.40	617.60	989.73
Close trim	882.80	617.20	1057.65

[a]Practically devoid = 100, Small = 400, Slightly abundant = 700.

Results and Discussion

The mean and range of carcass values for the steers used in this study are given in Table 1. Overall this was an

Table 2. Carcass measurements (10 steers per group).

	Short[a]				Tall					
	Less[b]		More		Less		More		SE[c]	LSD[d]
Dietary energy, NEg/lb	0.59	0.64	0.59	0.64	0.59	0.64	0.59	0.64		
Initial ultrasound scans										
Fat thickness, in.	0.08	0.06	0.14	0.16	0.08	0.08	0.17	0.16	.28	.86
REA, sq. in.	8.8	8.9	9.3	9.2	9.1	9.5	9.6	9.5	.03	.08
Starting weight, lbs.	955	957	1027	1005	953	1006	1071	1034	17.4	54.2
Final weight, lbs.	1250	1259	1318	1276	1230	1272	1338	1312	18.6	57.8
Carcass weight, lbs.	750.2	761.7	793.2	793.2	744.4	774.6	817.5	793.4	11.4	35.6
Dressing percent	60.0	60.4	60.2	62.2	60.5	60.9	61.1	60.5	.51	1.60
REA, sq. in.	12.8	13.3	13.6	13.4	13.4	14.1	14.0	13.4	.32	1.00
Fat thickness, in.	0.33	0.33	0.48	0.50	0.25	0.23	0.44	0.43	.03	.09
KPH, %	1.6	1.5	2.1	2.0	1.4	1.4	1.8	1.8	.11	.33
Marbling[d]	445	419	441	444	391	415	454	428	10.8	33.7
Quality grades										
Choice	8	6	10	9	7	7	9	7		
Select	2	4		1	2	2	1	3		
Standard					1	1				
% Choice	80	60	100	90	70	70	90	70	7.3	22.6
Yield grade										
1	2	3	2	3	6	6	2	2		
2	7	6	4	3	3	4	5	4		
3	1	1	4	4	1		3	4		
Calculated YG	2.39	2.26	2.78	2.85	1.95	1.78	2.60	2.66	.14	.44

[a]Sorted on initial height at hips.
[b]Sorted on initial fat cover measured by ultrasound.
[c]Standard error of mean.
[d]Least significant difference.
[f]Practically devoid = 100, Small = 400, Slightly abundant = 700.

above average group of market steers, grading 79% Choice and 77.5% yield grades 1 and 2, with no yield grade 4. There was, however, considerable variation of carcass measurements from individual steers within the group. Sorting the group into a taller or shorter group with less initial fat cover tended to reduce the variability compared with the whole group.

The average carcass data for the different experimental groups are summarized in Table 2. Initial sorting of cattle based on hip height resulted in the taller cattle initially having 30 lbs. greater weight, 0.4 sq. in. greater ribeye area, and no difference in fat cover. The steers with more initial fat cover were 67 lbs. heavier, had 0.08 greater fat thickness, and averaged 0.3 sq. in. larger ribeyes at the beginning of the study.

Sorting the cattle for hip height did not alter carcass weight, dressing percentage or marbling. Carcasses from the taller cattle had 0.07 in. less fat cover, 0.4 sq. in. larger ribeye and 0.3 reduced yield grade number. The difference of 2.7 in. of height at the start of the study was reduced to 1.7 in. at the end. Sorting these steers for height as feeders seemed to have had minimal effects on final carcass measurements.

The steers with less initial fat cover were 58 lbs. lighter at the end, but had 92% yield grades 1 and 2 carcasses compared with 62% for the fatter group. There were 20% fewer Choice carcasses in the steers with less initial fat cover. The steers with more initial fat had 42 lbs. heavier carcasses, 5.8% increased marbling, 27% increased KPH fat, 0.2 sq. in. larger ribeye area, 62% more fat cover, and 0.7 greater yield grade number. On average the steers with less initial fat cover gained less fat and had less fat at the end of the trial.

Concentration of dietary energy fed to the steers had no effect on final live weight or any of the carcass measurements. The steers fed the lower-energy diet consumed more feed dry matter, but the same amount of energy as the steers fed the higher-energy diet, so it was not surprising that the concentrations of dietary energy evaluated in this study had no effect on the carcasses.

Table 3. Effects of using different methods for sorting on value of cattle for commodity- and close-trim boxed beef market using two price quotations.

	--------1996[a]--------		--------1997[a]--------	
	Commodity	Close	Commodity	Close
Net carcass value, $/cwt				
Initial hip height				
Short	124.32	129.84	107.18	112.04
Tall	123.85	129.75	107.51	112.78
Dietary energy				
0.59	125.23	131.04	107.80	112.86
0.64	122.94	128.54	106.89	111.96
Initial fat thickness				
Lo	123.45	129.76	107.70	113.28
Hi	124.72	129.83	106.99	111.54
Initial weight				
Light	120.72	126.87	105.80	110.53
Heavy	127.45	133.51	108.89	114.29
Final weight				
Light	120.52	125.87	105.64	110.34
Heavy	127.65	133.72	109.05	114.48
Net live value, $/steer				
Initial hip height				
Short	963.17	1005.83	830.24	867.81
Tall	969.76	1015.93	841.36	882.59
Dietary energy				
0.59	972.83	1017.88	837.00	876.21
0.64	960.11	1003.88	834.59	874.19
Initial fat thickness				
Lo	935.91	983.83	816.32	858.69
Hi	997.02	1037.93	855.28	891.72
Initial weight				
Light	896.97	936.62	785.14	820.27
Heavy	1039.39	1088.93	887.94	932.01
Final weight				
Light	890.96	930.40	780.11	814.86
Heavy	1045.40	1095.15	892.96	937.41

[a]Boxed beef cuts priced 11/18/96 and 10/17/97. Carcass value determined using individual carcass weights and grades. All calculations based on drop credit of $9.30/cwt; processing costs in $/head: YG 1 = $80, YG 2 = $83, YG 3 = $86, YG 4 = $102.

The average and range of net carcass economic values, as predicted by the OSU Boxed Beef Calculator, for all the steers and those with less initial fat are given in Table 1. The steer with the greatest value was worth $700 more than the steer with the least value in 1996 and $500 more in 1997. The two lowest value steers had Standard grading carcasses. The lowest value Select grading steer was worth $561 less that the most valuable in 1996 and $407 less in 1997. Sorting the cattle based on initial fat cover tended to reduce the variation in the economic value of the cattle.

The effects of the variables studied in this experiment on the market value of the steers when expressed as $/cwt of carcass in commodity- or close-trim boxed beef are shown in Table 3. All groups of cattle had greater value in 1996 than 1997 because of the difference in cattle prices. Sorting the cattle based on hip height and initial fat thickness or feeding two levels of energy did not affect the value of the cattle when expressed as $/cwt. Even though sorting the steers on initial fat cover resulted in a greater percentage of yield grade 1 and 2 carcasses, the decrease in percentage of Choice carcasses more than offset the advantage of improved yield grade using the 1996 prices with a high discount for Select grading carcasses. The steers with less initial fat cover had more final value using the 1997 prices because there was a smaller discount of Select carcasses. All of the groups of steers had more value in the close-trim

Table 4. Economic advantages of sorting feeder cattle when sold as boxed beef.

	--------1996--------		--------1997--------	
	Commodity	Close	Commodity	Close
Sort 50:50[b]	--------$/head[a]--------			
Tall steers	-12.69	-9.19	8.17	4.51
Steers with less fat	-4.70	2.31	17.45	23.38
Sort 75:25[b]				
Steers with less fat	-6.18	30.39	26.66	44.17

[a]Corrected for initial cost of steers as feeders and feed costs during finishing. Calculations based on $80/cwt for feeder cattle and $110/ton of feed dry matter.
[b]50:50 sort means cattle were divided into two equal groups. 75:25 means that 75% of the steers were placed into the group with less initial fat cover (0.04 to 0.13 in. fat cover vs 0.14 to 0.36 in. in the fatter group).

market than as commodity trim, probably because of the high proportion of yield grades 1 and 2 in this group of steers.

Expressing value as $/steer resulted in somewhat different interpretation of the results. Sorting based on hip height or initial fat thickness resulted in the taller and fatter steers being heavier. Consequently, the taller steers as well as those with more initial fat cover were worth more when finished (Table 3). Feeding the two levels of energy did not affect the final value of the cattle.

Because the steers were purchased as one group, the heavier steers in the taller group and those with greater initial fat cover would have cost more per head. The steers with less initial fat gained slightly more and were more efficient in the feedlot (A.S. Leaflet R1537). The results of adjusting the value of the steers for purchase cost and feed costs and calculating the returns from the initial sort of the steers on hip height and fat cover are given in Table 4. The economic advantage of the taller steers was negative in 1996 because of the greater purchase cost of the steers as feeders and the large discount for Select. In 1997, with less discount for Select, there was some advantage for the taller steers. Sorting based on initial fat cover resulted in $4.70 per head loss compared with the fatter group in the 1996 commodity-trimmed market because of lighter carcasses and the discount for Select carcasses. There was a $2.31 per head advantage for the steers with less fat in the close-trim market in 1996. Use of the 1997 prices when there was less discount for Select resulted in $17.45 and $23.38 per head advantage for the steers with less initial fat in the commodity- and close-trim boxed beef markets, respectively. The two Standard grading carcasses are included in these comparisons.

It could be argued that some different sort of the steers should have been used for more effective marketing. Overall this group of steers was high yielding and maybe more animals should have been placed in the initial group with less fat. Because selecting steers with more initial fat cover also tended to select heavier steers, maybe sorting the cattle based on weight would have been as effective as the use of the more costly ultrasound measurement. Because cattle perform differently during the finishing period, maybe sorting the cattle based on weight when finished would have been the most effective. Placing 75% of the steers in the initial low-fat group did not greatly change differences in initial weight, gain, or value of the carcasses, but did result in a lesser percentage of the low-fat group grading Choice and a lesser percentage of the high-fat group having yield grades 1 and 2. The smaller group of steers with more initial fat cover were worth more in the commodity-trim market for both years and worth slightly less than the steers with less fat cover in the close-trim market. Adjustments of these carcass-based values for initial cost as feeders and feed costs increased the economic advantage of sorting on initial fat cover up to $30 to $44/head in the close-trim market (Table 4). The value of the leaner cattle in the 75:25 sort increased relative to the fatter steers because of the reduction in the proportion of yield grades 1 and 2 carcasses in the fatter group. Sorting the steers on initial or final live weight resulted in a group of heavier steers but no difference in percentage of Choice or yield grades 1 and 2 carcasses. The heavier steers had more value because of the increase in carcass weight and tended to have a greater increase in value when moving from the commodity- to the close-trim market (Table 3).

An important point of this analysis is the extreme variation in value of individuals from an above average group of steers in a value-based market. Sorting the steers into a group with less initial fat cover tended to reduce the variation and increase their value as close-trim boxed beef. The results indicated that sorting the steers into two equal groups did not place enough steers in the group with less fat cover. As more knowledge is obtained, each animal should be evaluated against some internal standard, and prediction equations should be developed so each animal can be placed in a potential market group based on future carcass quality. In some groups of cattle only 10% may be selected, while in others 90% may be selected.

As cattle are fed in more uniform groups, there will be less over- and underfeeding. Also there should be less extreme variation in carcass value. Potential economic returns were estimated from improving the bottom 20% of cattle to the average of the group. In this study, the bottom 20% were worth $753 and $712/head compared with an average value of $814 and $749/head in the 1996 and 1997 markets, respectively. Improving the bottom 20% up to the average would have improved the average value of all the animals $40 and $25 in 1996 and 1997, respectively. The increased economic returns from improving 20% of the cattle was of the same magnitude as using technology to sort the cattle.

To realize the opportunities presented in this report, producers should align themselves with packers and retailers to market their product based on its value. They will then obtain the information necessary to begin to implement changes to improve their cattle. In doing so, however, producers will be assuming a greater portion of the risk and they will have to be able to supply quantities of a predictable product. To get the most value from their cattle, it is important that producers learn how their cattle fit various potential markets.

Implications

Selling boxed beef rather than live cattle or carcass beef will allow producers to participate in a genuine value-based market. There can be extreme variation in the value of cattle in a boxed beef market. Sorting yearling feeder steers based on initial fat cover can significantly increase the number of yield grades 1 and 2 carcasses, which potentially increases the value of the cattle as boxed beef, especially for close-trimmed beef. However, if the increase in yield grades 1 and 2 carcasses results in significant reductions in carcass weight or percentage of Choice carcasses, all or more of the advantage of higher yielding cattle may be lost, especially if the price spread between Choice and Select is wide.

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