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Effects of Length of Grain Feeding and Backgrounding Programs on Beef Carcass Characteristics

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When carcass data are compared at equal fat endpoints, it appears that backgrounding system has little effect on marbling (quality grade).

Summary

Data from 534 cattle serially slaughtered indicate percentages of carcasses grading Choice increased 30 + 2.4 percentage units for each .1 in increase in rib fat. Marbling score increased 75 units (200 = Slight^{00}) for each .1 in increase in fat. If cattle are fed to a common rib fat endpoint, and within the ranges of winter (.51-1.35 lb/day) and summer gains (1.26-1.85 lb/day) studied, we conclude backgrounding program has little or no effect on marbling or carcass quality grade. Also, systems that increase age of cattle will reduce tenderness, but if meat is cooked properly, risk of tough steaks is small.

Introduction

Calves and yearlings enter feedlots at varying weights, ages and nutritional backgrounds. This variation could produce differences in carcass quality. Two basic measures of carcass quality can be made at the present time in commercial beef production. The first is yield grade or degree of fattening and the second is quality grade which is primarily dependent upon degree of marbling. Because both are measures of lipid content, they are related — the greater the amount of fat (higher yield grade) the greater the amount of marbling (higher quality grade). As cattle are fed (high grain diets) for longer periods, they become fatter and quality grade (marbling) increases. Therefore, an analysis of relationships of length of feeding period, fat thickness, quality grade and marbling as influenced by backgrounding program is important.

Results

Several experiments have been conducted which will allow for endpoint comparisons with some adjustments of data in order to compare animals at equal rib fat. Effects of time-on-feed are well illustrated in a study using Angus bulls with low and high EPD for marbling (1994 Nebraska Beef Cattle Report, pp. 54-56). The cattle fattened with time on feed (.0025 in/day increase in rib fat for the steers and .003 in/day for the heifers). Marbling increased by 1.48 units per day (200 = Slight^{oo}; 300 = Small^{oo}). Clearly as cattle are fed for more days, they increase in 12th rib fat (and yield grade) and in marbling. The second slaughter date for the high marbling steers and heifers was at the average fat thickness for commercial cattle (about .55 in). At that one slaughter time, the correlation between fat thickness and marbling score was .48. When both slaughter dates were analyzed as a continuum of time on feed, the correlation was .64 for the relationship of fat thickness to marbling score for the high marbling cattle.

Both steers and heifers sired by high marbling bulls had significantly higher marbling scores than calves sired by low marbling bulls. Interestingly, the relationship of fat thickness to marbling score was stronger for the high marbling cattle than the low marbling cattle (r = .64 vs .48). Further, the slope of the relationship was greater for the high marbling cattle than that for the low marbling cattle.

The percentage of calves grading Choice or higher increased with fattening similar to the change in marbling score. However, the rate of change was less with the high EPD calves because they were approaching 100% Choice.

To study adjustments of quality grade and marbling score for cattle of unequal fat depths to a common endpoint, we analyzed data from several serial slaughter experiments. There were 534 head, including calf-feds and yearlings, covering the range of cattle production systems. Fat depth at the first slaughter averaged .33 in and .50 in at the second slaughter. Cattle grading Choice increased 30 + 2.4 percentage units for each .1 in increase in fat depth. Marbling scores were available on some of the cattle. Marbling score increased 75 units (200 = Slight^{oo}) for each .1 in increase in fat depth. For cattle in different pens or treatment groups, it seems logical to adjust percentage Choice or marbling score using these values.

We can illustrate the adjustment with a comparison of yearlings to calf-feds (1991 Nebraska Beef Cattle Report, pp. 42-43). Calves were allotted randomly at weaning to calf-fed or yearling systems. The calf-feds were placed on high grain diets within 60 days of weaning. The yearlings were backgrounded on cornstalks in the winter and grazed grass in the summer. The yearlings were finished on high grain diets similar to those fed to the calf-feds. The yearlings con-

Table 1. Finishing performance and carcass characteristics for calves vs yearlings.[a]

Item	Calf-Fed	Yearling
DMI, lb/day	17.4	24.9
% of weight	2.1	2.5
ADG, lb	2.78	3.40
Feed/Gain	6.19	7.33
Fat thickness, in	.48	.38
Choice, %	76.0	64.9 (95.3)[b]

[a]1991 Nebraska Beef Cattle Report, pp. 42-43; 5 years, 489 head, 48 pens.
[b]Adjusted to .48 in fat thickness.

sumed more feed and gained more rapidly in the feedlot than the calves (Table 1). The calves were more efficient than the yearlings. Contrary to the common perception that calf-feds are leaner than yearlings, the yearlings had less fat and a lower percentage of carcasses grading Choice. It all depends on how long the cattle are fed. In this case the yearlings were not fed to a similar degree of fatness as the calves. We used the adjustments mentioned above and when the yearlings were adjusted to a fat thickness equal to the calves, the percentage of carcasses grading Choice was greater (95.3 vs 76%). These data suggest that calf-feds and yearlings have similar carcass quality when slaughtered at an equal fat endpoint and demonstrates how important it is to compare cattle at equal fat endpoints. We are reluctant to conclude yearlings grade better than calf-feds because the amount of adjustment was large.

Effect of Winter Gain on Carcass Quality

Several experiments have been conducted to study the effect of winter gains on subsequent compensatory gain on pasture and feedlot performance. This research allows us to evaluate the effect of rate of winter gain on subsequent carcass quality. In previous research at the University of Nebraska (1989 Nebraska Beef Cattle Report, pp. 34-35) calves were wintered over two years at .62 or 1.10 lb/day gain. The cattle grazed cool- and warm-season grasses, and were then finished in the feedlot for 112 days. Fat thickness ranged from .43 to .49 in (SE = .03 in) and quality grades were similar (Table 2). However, when adjusted to equal rib fat, calves wintered at a faster rate of gain had a somewhat higher quality grade compared to cattle wintered at a slower rate of gain.

In another trial, calves were wintered at .42 or 1.59 lb/day. Corn gluten feed was fed to calves on cornstalks to achieve the added gain. The cattle grazed smooth bromegrass or native range pastures and were finished for 71 to 124 days in the feedlot. Feedlot diets contained 35% corn gluten feed to minimize acidosis. Compensating yearlings are aggressive eaters and acidosis may limit their ability to make the compensatory gain. The cattle finished with nearly similar fat — the slow gaining winter cattle had .02 in less fat (Table 2). Quality grades were slightly less for the slow cattle as were the percentages of carcasses grading Choice. There was no difference in quality grade after adjusting to equal fatness (1998 Nebraska Beef Cattle Report, pp.63-65; 1999 Nebraska Beef Cattle Report, pp. 26-28).

In two additional trials, calves were wintered at .46 and 1.37 lb/day. Corn gluten feed was supplemented to the calves while grazing cornstalks to produce the difference. The cattle grazed native range and cool-season grass until entering the feedlot. They were fed for 92 to 96 days on a 35% corn gluten feed diet. Feedlot gains were similar, and the lower winter gaining cattle were slightly less fat than the higher winter gaining cattle with correspondingly lower marbling scores. However, when adjusted to equal fat thickness, the cattle had similar marbling scores and percentages grading Choice (Table 2; 2000 Nebraska Beef Cattle Report, pp. 30-32; 2000 Nebraska Beef Cattle Report, pp. 23-25).

The three previous studies used a total of 356 cattle over five years. Winter gains ranged from .42 to 1.59 lb/day over the four studies. There were no differences in quality grades due to rate of winter gains when cattle were adjusted to equal fat thickness at slaughter. We conclude winter gain does not influence carcass quality.

Effect of Summer Gain on Carcass Quality

Three studies were summarized to study the effect of summer gain on carcass quality. In the first study, summer gains were influenced by the quality of forage available (1998 Nebraska Beef Cattle Report, pp. 66-69). The cattle gained .68 lb/day over the winter on corn stalks. Summer gains were 1.59 and 1.81 lb/day, respectively, for cattle grazing bromegrass and bromegrass rotated to warm-season grass (Table 3). Feedlot gains were similar but the higher summer grass gains slightly reduced intakes and increased feed efficiency. Both fat depths and quality grades were similar.

In another trial, yearlings grazed on native Sandhills range and smooth

(Continued on next page)

Table 2. Effect of winter rate of gain on finishing performance and carcass characteristics.

	Experiment					
Item	1989 Beef Report[a]		1998 Beef Report[b]		2000 Beef Report[c]	
No. of steers	40	40	72	72	48	48
Winter ADG, lb	.62	1.10	.42	1.59	.46	1.37
Summer ADG, lb	1.41	1.04	1.61	1.15	1.41	1.23
Finishing						
ADG, lb	3.62	3.84	4.28	4.63	4.72	4.76
DMI, lb/day	26.4	27.2	28.3	30.5	30.8	31.5
Feed/Gain	7.30	7.09	6.62	6.58	6.54	6.62
Carcass data						
Fat thickness, in	.49	.43 (.49)[d]	.49 (.51)[e]	.51	.40 (.46)[f]	.46
Quality grade	7.24[g]	7.24 (7.69)[dg]	19.1 (19.3)[eh]	19.4[h]	—	—
Marbling score	—	—	—	—	490 (534)[fi]	532[i]
Choice, %	—	—	84.6 (91.8)[e]	87.0	50.3(68.3)[f]	66.9

[a]1989 Nebraska Beef Cattle Report, pp. 34-35; 80 hd.
[b]1998 Nebraska Beef Cattle Report, pp. 63-65; 1999 Nebraska Beef Cattle Report, pp. 26-28.
[c]2000 Nebraska Beef Cattle Report, pp. 30-32; 2000 Nebraska Beef Cattle Report, pp. 23-25.
[d]Adjusted to .49 in fat thickness.
[e]Adjusted to .51 in fat thickness.
[f]Adjusted to .46 in fat thickness.
[g]Low Choice = 7.17, average Choice = 7.5.
[h]Low Choice = 19.
[i]Select = 400-499, low Choice = 500-599.

Table 3. Effect of summer rate of gain on carcass quality.

	Experiment					
	1989 Beef Report[a]		1998 Beef Report[b]		2000 Beef Report[c]	
Item	Brome	Brome/WS	Slow	Fast	Slow[c]	Fast[d]
No. of steers	100	100	40	40	90	48
Winter gain, lb	.68	.68	1.18	1.18	.93	.93
Summer gain, lb	1.59	1.81	.62	1.79	1.12	1.98
Finishing						
ADG, lb	3.60	3.60	4.76	4.37	4.74	4.74
DMI, lb/day	26.7	25.8	30.3	30.1	31.4	31.4
Feed/Gain	7.46	7.25	6.37	6.90	6.62	6.62
Carcass data						
Fat thickness, in	.42	.42	.50	.48 (.50)[e]	.43 (.48)[f]	.48
Quality grade[g]	18.7	18.7	19.5	19.1 (19.3)	—	—
Marbling score[h]	—	—	—	—	529 (567)	517.0
Choice, %	—	—	90.0	74.0 (82.4)[e]	70.0 (85.2)[f]	68.0

[a]1998 Nebraska Beef Cattle Report, pp. 66-69.
[b]1998 Nebraska Beef Cattle Report, pp. 63-65.
[c]2000 Nebraska Beef Cattle Report, pp. 23-25.
[d]2000 Nebraska Beef Cattle Report, pp. 30-32.
[e]Adjusted to .50 in fat thickness.
[f]Adjusted to .48 in fat thickness.
[g]Select = 18, low Choice = 19, average Choice = 20.
[h]Low Choice = 500 - 599.

bromegrass following wintering on cornstalks (1.19 lb/day). Summer gains on the bromegrass were quite poor because of precipitation distribution during the summer. The low summer gains on bromegrass apparently produced some compensatory gain in the feedlot including improved feed efficiency. The slow (bromegrass) summer gaining cattle were slightly fatter at slaughter with slightly higher quality grades (Table 3). When adjusted to equal fat depths, quality differences essentially disappeared (1998 Nebraska Beef Cattle Report, pp. 63-65).

Two other trials had yearlings on two different summer native range pastures following wintering on cornstalks at .93 lb/day. One summer range had about one half the forage supplied as wet meadows containing cool-season species. With abundant rainfall, forage production was high and cattle gains were low (1.12 lb/day), probably due to overly mature forage. Rates of gain in the feedlot were similar as were feed efficiencies. The faster summer gaining cattle were slightly fatter at slaughter while marbling scores and quality grades were similar (Table 3). Adjusted to equal fat depths, the cattle gaining slower during the summer had somewhat higher quality grades. They were fed 23 days longer in the feedlot (2000 Nebraska Beef Cattle Report, pp. 30-32; 2000 Nebraska Beef Cattle Report, pp. 23-25).

The three reports reviewed provide a summary of 418 cattle over a seven-year period. When summer pasture gains varied by only .22 lb/day, there was no effect on carcass quality. In the two latter studies, the summer gain differed by 1.01 lb/day. The slower summer gaining cattle were fed for an average of 25 days longer than the cattle gaining faster in the summer. When adjusted to an equal fat depth, the slower summer gaining cattle had higher marbling scores and higher percentages grading Choice (16.2 percentage units). Because of the increased cost of gain with low pasture gains, it probably would not be feasible to attempt to enhance economics through increasing quality by having low summer pasture gains.

Carcass Palatability and Tenderness

Another major concern facing the beef industry is the issue of tenderness and variation in tenderness. We have conducted one study to investigate the influence of calf-feds vs yearlings on carcass palatability and tenderness (1995 Nebraska Beef Cattle Report, pp. 53-56). When the data were adjusted to equal marbling scores, no differences were observed for flavor or juiciness of steaks from cattle at 14, 19, or 21 mo of age. Results also showed that the risk of cattle of different ages being tough or undesirable was less than .05% for 14-mo old cattle, less than .52% for 19-mo old cattle, and less than 2.8% for 21-mo old cattle. While yearlings were statistically less tender than calves, the risk of producing tough or undesirable carcasses was very small.

Clearly, age reduces tenderness, but that doesn't mean yearlings are tough. The ribs in this study were aged 14 days and the steaks were not overcooked. In fact, a subsequent study with these steaks showed that the tenderness differences disappeared when steaks were cooked to 167°F rather than 149°F. While some would argue that calf-feds assure tenderness, subsequent aging and cooking can mitigate the differences. We conclude that backgrounding system has little if any effect on tenderness and has little risk of producing "tough" steaks if they are handled appropriately.

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