

## CONSUMER ACCEPTANCE OF FORAGE FINISHED BEEF\*

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Consumer acceptance of Choice, grain-finished beef has been attested in millions of American homes. Abundant feed grain and feeder calf supplies has made it possible for almost all Americans to purchase and consume feedlot beef.

Consumer acceptance of any product, however, can be changed when input substitutions in production are made. For various reasons, livestock producers may feel justified in changing inputs before analyzing an effect on the product or its demand. An example of input substitution occurred in mid-1974, when some beef producers began to market beef for slaughter directly from forage (or limited-grain) diets rather than after normal full-grain feeding. Consumer acceptance of forage-finished and limited-grain finished beef was uncertain at that time, particularly among customers of large supermarkets accustomed to Choice grade beef.

Published research on consumer acceptability of forage-finished beef has been very limited. However, two recent studies compared forage-finished and grain-finished beef using taste panels and shear tests. In 1974, Huffman [1] evaluated 20 mixed-breed steers finished on forage or on 90 days of grain. Trained laboratory taste-panel members could not distinguish between the beef produced by the two treatments. Warner-Bratzler shear scores were not significantly different between the two feeding treatments.

Kropf [2] selected 30 steers of predominantly Hereford breeding from three different sources to compare forage, 70 days grain and 150 days grain finishing treatments. Laboratory taste-panel ratings indicated eating quality improved as length of grain feeding increased. Warner-Bratzler shear readings followed the same pattern. However, differences in panel ratings due to genetic background of the animals could not be separated from those due to feeding treatment.

The Louisiana Agricultural Experiment Station initiated a three-phase research project in November 1974, to evaluate consumer acceptability of beef from forage-finished and short-term grain finished animals.<sup>1</sup> Phase One results are presented here.

Fifty Angus and Angus X Hereford calves of known breeding, produced under similar forage programs by the Experiment Station, were used in Phase One. In the fall of 1974, the steers were assigned in equal numbers to five feeding treatments: Pasture; Pasture supplemented with grain; 63 days grain in drylot; 78 days grain in drylot; and, 108 days in drylot. The steers were custom slaughtered over a four-week period in February 1975, at an average liveweight of 968 pounds and an average age of 22.5 months.<sup>2</sup>

Carcasses were aged for five days and then separated into wholesale cuts at the central warehouse of a large retail food chain. The larger portion

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\*The authors acknowledge the contributions of the remaining joint project leaders: Thomas Bidner, John Carpenter, Jr. and William McKnight. Also gratefully acknowledged are Fred Wiegmann and Steve Reiling for critical reviews of the manuscript.

<sup>1</sup>Phase One involved steers of similar age and breeding finished to heavy weights. Phase Two used younger, less mature animals produced on slightly different feeding treatments. Phase Three animals will be fed to similar weights prior to slaughter for all feeding treatments.

<sup>2</sup>Treatment average liveweights were 930, 954, 956, 1,004 and 998 pounds, respectively, for the five treatments.

of the cuts was delivered to three of the chain's Baton Rouge food stores, where meat-department personnel cut and packaged the beef for fresh marketing.<sup>3</sup> Steaks and roasts were identified as produced by LSU and the remainder mixed in with the stores' normal marketings. The smaller portion of the wholesale cuts were delivered to LSU, where it was frozen and stored for subsequent testing. Four methods were used to evaluate the LSU beef. Cuts were evaluated by: (1) retail meat purchasers, (2) a household consumer panel, (3) a laboratory taste panel and (4) Warner-Bratzler shear tests. Each are discussed below.

## EVALUATION PROCEDURES

### Retail Purchasers

The LSU beef was marketed for four weekends, beginning each week on Thursday and continuing until sold out. Sales were encouraged by rather extensive radio, television and newspaper coverage. Shoppers were not informed of the feeding treatment which produced particular cuts. They did know, however, that feeding treatment was being evaluated. The LSU beef was priced equal to or lower than similar cuts of Choice grain-finished beef to encourage purchase and return of evaluation forms attached to each package. Cuts from pasture-finished and grain-on-pasture finished beef were price discounted ten cents per pound from those of the three remaining treatments, to compensate for lower quality grade. The mail-in form requested evaluation of tenderness, flavor, juiciness and overall acceptability, as well as an indication of "willingness to repurchase the cut at the same price or at a higher price," other things equal.

### Household Panel

A 150-household (300-member) consumer panel was selected by cluster sampling in Baton Rouge. Each household received, free of charge, two loin, two chuck and two round steaks over a three-week period in April 1975. Panel members (husband and wife) completed and returned an evaluation form for each steak delivered. Panel members were encouraged to prepare the steaks in their preferred manner. Members were requested, however, to prepare the steak in its original form without use of artificial tenderizers. Panel members compared the LSU beef with that normally purchased for tenderness, flavor and overall acceptability. Since most consumers

regularly patronize the same store, their comparisons were with Choice beef.

### Laboratory Taste Panel

A five-member laboratory taste panel evaluated round steak, loin steak and rib roast from each of the 50 carcasses on the basis of tenderness, juiciness, flavor and overall acceptability. Meat samples were prepared and tasted under standardized conditions. Round steaks were pan fried in light gravy, loin steaks were oven broiled, and roasts were cooked, uncovered, in an oven.

### Muscle Quality Measures

Warner-Bratzler shear measurements were obtained from each carcass. These scores measure tenderness of the *longissimus* muscle and are considered excellent indicators of overall tenderness. Quality grade, marbling score and fat color were also estimated by University researchers.

## EVALUATION RESULTS

### Retail Purchasers

All the LSU beef was sold by Saturday afternoon of each week. Over 900 completed evaluation forms were returned (23 percent of those distributed). Table 1 shows the average retail ratings by feeding treatment. Beef from pasture-finished and 78-day feedlot steers received the best ratings. Average treatment ratings differed very little on a 1-3 hedonic scale.

Many customers were willing to repurchase cuts from the different treatments at the same or higher prices (Table 1). Over 20 percent of the purchasers of cuts from any of the five feeding treatments would repurchase at a higher price. The larger price discount used for the pasture-finished and grain-on-pasture treatments helps explain the greater number of positive responses to "repurchase at a higher price" for these two treatments.

Analysis of variance was used to determine whether differences in ratings could be attributed to feeding treatment or to store effects. Differences in ratings among feeding treatments were significant at  $P=.038$  for flavor and  $P=.017$  for juiciness (Table 2). Tenderness and overall acceptability ratings were not significantly different among feeding treatments at  $P<.05$ . Ratings did not differ significantly ( $P<.05$ ) among stores or for the Treatment\*Store interaction.

Any differences in customers patronizing the three stores (income, race, etc.) were not reflected in

<sup>3</sup>The three stores represented different income, race and rural-urban mixes.

**TABLE 1. RETAIL PURCHASER RATINGS AND WILLINGNESS TO REPURCHASE AT TWO PRICE LEVELS, FIVE FEEDING TREATMENTS, LSU MARKETING STUDY, 1975**

Treatment	Rating <sup>a</sup>				Percentage of Purchasers Indicating a Positive Repurchase Decision	
	Tenderness	Flavor	Juiciness	Overall	Same Price	Higher Price
	Pasture	1.63	1.60	1.64	1.62	86.1
Pasture + grain	1.78	1.78	1.83	1.77	78.3	27.2
63 days drylot	1.71	1.65	1.74	1.71	81.3	20.5
78 days drylot	1.66	1.58	1.66	1.60	88.3	25.4
108 days drylot	1.66	1.61	1.60	1.65	84.4	22.4

<sup>a</sup>1-3 hedonic scale (1=highest rating).

their ratings. The Steer (Treatment-Store) effect, the variability that can be assigned to differences among steers sold at the same store and finished on the same ration, was statistically significant for tenderness at  $P=.035$  and at  $P=.051$  for overall acceptability.

#### Household Panel

Household panel-member ratings by feeding treatment are given in Table 3. Best ratings for tenderness and flavor were given to beef fed 108 days in drylot. Least favorable ratings were given to beef finished on pasture. Average ratings by feeding treatment differed by only one-half unit for tenderness and by .16 of a unit for flavor—on a 1-7 hedonic scale. Average overall acceptability ratings by feeding treatment differed only by .26 of a unit—on a 1-9 hedonic scale.

Analysis of variance was used to test hypotheses of no differences in ratings among feeding treatments. Tenderness ratings among feeding treatments were significant at  $P=.014$ . Individual differences among

animals accounted for the variation in ratings for flavor and overall acceptability.

#### Laboratory Taste Panel

Laboratory panel ratings by feeding treatment are also given in Table 3. Beef finished for 78 days in drylot received the best ratings for flavor, juiciness and overall acceptability. Tenderness, flavor and overall acceptability were least favorable for beef finished with grain-on-pasture. Average ratings by feeding treatment differed only by .50, .21, .11 and .23 for tenderness, flavor, juiciness and overall acceptability, respectively,—on a 1-7 hedonic scale. Analysis of variance indicated that only tenderness ratings differed significantly among feeding treatments ( $P=.0047$ ).

#### Muscle Quality Measures

Average Warner-Bratzler shear measurements for the five feeding treatments were 19.4, 19.9, 20.2, 19.4 and 18.8, respectively.<sup>4</sup> Shear scores among feeding treatments were not significantly different at  $P<.05$ . Average quality grades for each of the five feeding treatments were within the USDA "Good" grade. Amount of marbling ranged from slight (pasture-treatment average) to small minus (78 days drylot treatment average). Fat color ranged from medium yellow (pasture treatment average) to white (78 days drylot treatment average).

#### ECONOMIC FEASIBILITY OF FEEDING TREATMENTS

Economic feasibility of the five feeding treatments was determined under the integrated production and marketing conditions used in Phase

**TABLE 2. ANALYSIS OF VARIANCE OF TREATMENT AND STORE EFFECTS WITH SELECTED INTERACTIONS, LSU BEEF MARKETING STUDY, 1975**

Source	DF	Probability of "F"			
		Tenderness	Flavor	Juiciness	Overall
Treatment	4	.2922	.0376	.0171	.0839
Store	2	.5367	.6141	.2064	.6189
Trt*Store	8	.5185	.1443	.0655	.1317
Steer (Trt*Store)	35	.0351	.2464	.5482	.0507
Error	858	--	--	--	--
Total	907	--	--	--	--

<sup>4</sup>Warner-Bratzler shear is a widely accepted, objective means of evaluating meat tenderness. The score indicates the pounds of pressure required to shear a one-inch core of cooked meat.

**TABLE 3. HOUSEHOLD AND LABORATORY PANEL RATINGS BY FEEDING TREATMENT, LSU BEEF MARKETING STUDY, 1975**

Treatment	Rating <sup>a</sup>						
	Tenderness		Flavor		Juiciness <sup>d</sup>	Overall	
	Household <sup>b</sup>	Laboratory <sup>c</sup>	Household	Laboratory	Laboratory	Household	Laboratory
Pasture	3.11	2.97	2.03	3.32	3.45	3.15	3.31
Pasture + grain	2.89	3.47	1.94	3.35	3.42	3.02	3.46
63 days drylot	3.11	3.27	1.89	3.34	3.51	3.08	3.44
78 days drylot	2.67	2.99	1.92	3.14	3.35	2.89	3.23
108 days drylot	2.61	3.17	1.87	3.30	3.53	3.00	3.37

<sup>a</sup>All except Household Overall on 1-7 hedonic scale, (1=highest rating). Household overall on 1-9 hedonic scale, (1=highest rating).

<sup>b</sup>“F” statistically significant at .014.

<sup>c</sup>“F” statistically significant at .0047.

<sup>d</sup>Juiciness was not evaluated by household panel.

One (Table 4). Production records were used to determine the average cost, using 1973-74 input prices, of producing a pound of chilled carcass. The only costs excluded were custom slaughter charges, marketing costs and all management charges. Costs per carcass pound were converted to costs per retail pound, using a constant yield factor of 72 percent.<sup>5</sup> A constant 25 percent retail markup was then added to determine an integrated production to retail “breakeven” price, based upon costs for each treatment. The “breakeven” prices ranged from \$1.15 per pound for pasture finishing to \$1.47 for 108 days in drylot.

**TABLE 4. ESTIMATED ECONOMIC FEASIBILITY, FIVE FEEDING TREATMENTS, LSU BEEF MARKETING STUDY, 1975**

Feeding Treatment	Cost of Carcass <sup>a</sup>	Cost of Retail Yield <sup>b</sup>	Cost of Retail Cuts <sup>c</sup>	Composite Retail Price <sup>d</sup>
-----dollars per pound-----				
Pasture	.66	.92	1.15	1.21
Pasture + grain	.69	.96	1.20	1.21
63 days drylot	.76	1.06	1.33	1.24
78 days drylot	.76	1.05	1.31	1.24
108 days drylot	.85	1.17	1.47	1.24

<sup>a</sup>Total costs of production (Costs of marketing, slaughter and management are excluded).

<sup>b</sup>Assumes 72 percent of chilled carcass weight is saleable as retail cuts.

<sup>c</sup>Assumes a 25 percent retail markup is added to costs.

<sup>d</sup>Average retail price received for all cuts sold at retail.

Actual prices charged in the store for the LSU beef were used to determine an average “composite retail price” for each feeding treatment. These composite prices included the LSU-identified steaks and roasts at price discounts, and remaining unidentified saleable retail portions of the carcass at the chains’ regular prices. Composite prices were the same for pasture and grain-on-pasture treatments (\$1.21 per pound) and for the remaining drylot treatments (\$1.24 per pounds).

Beef from pasture and grain-on-pasture treatments was sold at prices which exceeded the “breakeven” price of \$1.15. However, retail prices for the remaining treatments were insufficient to reimburse the producer for the grain consumed. Furthermore, purchasers of beef finished on pasture or with grain on pasture were more willing to pay higher prices than were purchasers of beef from the drylot treatments (Table 1).

## DISCUSSION AND CONCLUSIONS

The results of Phase One indicate that heavy forage-finished, and short-term, grain-finished beef can be marketed in supermarkets in competition with Choice, grain-finished beef. Retail price differentials were used and are probably needed to market this type of beef in large volumes in most Southern cities. Phase One results do not suggest the size of differential required; however, Phase Two should provide limited answers. Replies to the repurchase question

<sup>5</sup>Constant yield was used because average USDA Yield grade differed only by .18 among the feeding treatments.

suggest that the price differential used in Phase One (between forage-finished and the drylot-finished beef) was larger than required to sell the product.

Fat color of forage-finished beef was considered acceptable by purchasers of LSU beef and by other evaluators. Radio, television and newspaper coverage mentioned that lean and fat color was due to feeding and not to some other existing or imaginary cause.

Household and laboratory panel members were unable to distinguish among feeding treatments in their evaluations. Ratings did not necessarily improve for animals fed more grain. Panel members did not consistently find differences in eating satisfaction among the five feeding treatments.

The beef marketed by LSU from the five treatments in Phase One was heavy beef, comparable in weight to the stores' normal offering of Choice, grain-finished beef. The weight varies at which

forage-finished beef cannot compare with Choice grain-finished beef. Phase Two will provide some information on this aspect of the problem.

While the 1973-1974 input prices used in budgeting the five treatments favored forage-based treatments, composite retail prices obtained for the latter were not much less than for grain treatments. The production of slaughter beef, using primarily forage diets, was feasible under these conditions.

Phase One results indicate consumers will purchase heavy forage-finished beef and find it acceptable when consumed under home conditions. Heavy beef can be produced on forage alone. Development of a market for forage-finished beef depends on more than consumer acceptance and production capability, however. Institutional restrictions, inertia, seasonality of production and other problems must be overcome. Assessment of these factors is beyond the scope of this research.

#### REFERENCES

- [1] Huffman, D. L. "Carcass Characteristics—Current Research," Proceedings of the Alabama Beef Industry Conference, Auburn University, 1974.
- [2] Kropf, D. H., D. M. Allen and G. J. Thouvenelle. "Short Fed, Grain Fed and Long Fed Beef Compared," Kansas State Cattleman's Day Report 62:78, 1975.

