September 2, 1969

To the Graduate Council:

I am submitting herewith a thesis written by Jerry Donald Cole entitled "Effects of Selected Variables on Prices Received for Calves in the Cookeville Demonstrational Feeder Calf Sales." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.

Haley M. Jamison
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Vice Chancellor for Graduate Studies and Research

EFFECTS OF SELECTED VARIABLES ON PRICES RECEIVED FOR CALVES IN THE COOKEVILLE DEMONSTRATIONAL FEEDER CALF SALES

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Jerry Donald Cole

December 1969

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ABSTRACT

Records of 1,049 lots of steers and heifers sold in the Cookeville Demonstrational Feeder Calf Sales held each fall from 1964 through 1968 were studied to determine the effects of grade, sex, pen size, and the average weight per pen on the prices received per hundredweight and on the prices received per head for feeder calves sold.

Choice calves sold for an average of $2.24 per hundredweight more than calves of the medium grade. The choice calves sold also for an average of $0.60 per hundredweight more than the calves in the good grade. Medium calves sold for an average of $1.64 less per hundredweight than good calves.

Choice calves sold for $11.45 more per head than the medium grade calves. The choice calves sold also for $3.31 more per head than those calves grading good. Medium calves sold for an average of $8.14 less per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves, on the average, sold for $3.64 and $15.14 more per hundredweight and per head, respectively, than did heifers of a comparable grade.

The data indicate that calves in pen sizes greater than 91 sold for more per hundredweight and more per head than calves in any other pen size group. However, the differences in price per head were not significant.

When the price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant;

these data indicate that as average weight per pen increased, the price received per hundredweight decreased.

When the price received per head was regressed on the average weight per pen; within the range of the data, as average weight per pen increased, so did the average price received per head.

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CHAPTER I

INTRODUCTION

The feeder calf sales in Cookeville, Tennessee, were organized in 1953. They were sponsored by the Cumberland Beef Breeders' Association which is an organization made up of beef cattle producers in the Upper Cumberland area. The sales were organized in cooperation with the University of Tennessee Agricultural Extension Service, the State Department of Agriculture and local livestock producers for the purpose of providing a market for feeder calves. Although this area is well suited for cow-calf production, most of the herds are too small to attract buyers to individual farms.

The sales were developed from an Agricultural Extension Service sponsored demonstration into an independent organization operated by the membership, with only advice from Extension personnel. The number of calves marketed through this sale increased until 1965 when the success of this sale caused local associations to start sales on a county basis. In 1968 five local sales were held in the area previously served by this sale.

Since the beginning of the sales, no organized statistical analysis has been made of the effects of various factors on the price of feeder calves sold. The objective of this study was to evaluate the effects of grade, sex, pen size (number of calves per pen) and pen weight (average) on the price per hundredweight and price per head of feeder calves sold from 1964 through 1968.

It is hoped that conclusions drawn from this study will be helpful to breeders and feeders in planning their respective beef production programs and that this study will contribute some ideas to the sale management that will be helpful in improving the Cookeville and other feeder calf sales.

CHAPTER II

REVIEW OF LITERATURE

The practice of marketing feeder calves through organized feeder calf sales is not new in this section of the United States. However, the increased interest in this method has developed since 1945. West Virginia is credited with having the first feeder calf sale on record in 1931. The first feeder calf sale in Tennessee, in 1935, was held at Shouns. This sale is now held in Johnson City. Randell and Wheeler (1955) reported that farmers in the Johnson City area, with assistance from a University of Tennessee marketing specialist, reorganized the cattlemen's organization known as the Mountain Breeders Association and established it as a cooperative in 1953.

Crossville and Morristown were next to organize feeder calf sales. Beef cattle producers in these two areas organized and started sales in 1952. Nashville and Cookeville started sales in 1953. The Cookeville organization consisted of beef cattle producers from seventeen counties in the Upper Cumberland area. The total number of calves sold in the 1953 sale was 351. According to the Tennessee Feeder Calf Sale Report, forty feeder calf sales were held in Tennessee in the fall of 1968. According to Randell and Wheeler (1955), these sales were conducted and promoted by area feeder calf associations in cooperation with the University of Tennessee Agricultural Extension Service and the Tennessee Department of Agriculture.

Since the practice of marketing feeder calves through organized feeder calf sales has reached the present level, the studies dealing

with effects of selected variables are limited in number. Several studies have been made on the general price level and the factors that influence prices received.

Prices for stocker and feeder steers are highest in April, May and June according to a study by Cox, Eisenach and Mitchell (1953), with the lowest prices occurring in October, November, December and January. Prices are generally higher during the spring than in the fall, but gains made during the summer months usually more than compensate for the seasonal decline of price in the spring, according to Nervik (1951).

Factors affecting the prices for feeder cattle, as reported by Mitchell (1941) and Robertson and Mitchell (1940) include: (1) the general price level of feeder cattle, (2) grazing conditions in the range country, (3) the position of the cattle cycle, (4) anticipated fat cattle prices for the near future, (5) size of feed crop in the corn belt and (6) recent profits from cattle feeding operations.

A study of various ways in which feeder cattle have been marketed in nine North-Central states was reported by Brensike (1952), Kristjanson (1949), Nervik (1951), Newberg (1959) and Willis and Ashby (1950).

The average annual price of "good" stocker steers at Kansas City was more closely related to the average annual price of "medium" slaughter steers at the market than the feed supply per animal unit in the United States, according to a study by Riley (1952). The study was made using the August-July crop year basis. However, he found that when other factors were held constant, the feed supply per animal unit was a highly significant factor in explaining the average annual price of good stocker steers at Kansas City.

In a study comparing feeder calves sold as singles versus group sales, St. Clergy, Goodwin and Woodin (1956) reported that the groups outsold singles, grade for grade, at the Delhi, Louisiana, feeder calf sale held in November, 1956. "Choice" animals sold in groups averaged $16.87 per hundredweight, compared with $15.48 for those sold singly. Similar results were reported for the other grades. The price advantage of groups was more evident for steer calves than for heifers. These findings generally agree with results of other feeder calf sales in Louisiana.

Williamson (1958) reported that prices of steers increased consistently and significantly as the size of the sale increased. This study was based on records of 21 feeder calf sales held in Virginia from 1951 through 1956. Sales with 901 to 1,100 head averaged 46 cents per hundredweight higher than the 701-to-900-head base group; those with 1,101 to 1,300 head, 26 cents higher; 1,301 to 1,500 head, 95 cents higher and those sales with 1,500 head, $1.72 per hundredweight higher than the base. The price averages for those sales with less than 700 head were lower than the base. The size of sale did not have the same consistent effect on the average price of heifer calves as on the price of steer calves.

Jamison and Sellers (1968) reported that Angus calves, on the average, sold for 39 cents per hundredweight more than Hereford calves.

Williamson (1958) used 401- to 500-pound lots as a base group and found that the 300- to 400-pound lots averaged 21 cents per hundredweight less than the base group. Those weighing 501 to 611 pounds to 700 pounds sold for 50 cents and $1.30 less than the base group,

respectively. Jamison and Sellers (1968) reported that as average weight per pen increased beyond 481 pounds, the price received per hundredweight decreased. Cox, Eisenach and Mitchell (1953) reported that light steers tend to be more expensive than heavy calves.

Walker (1961) reported a variation of $5.55 per hundredweight, attributed to weight difference in steers. The 301- to 350-pound classification brought the highest price and the 651- to 700-pound classification the lowest price. The variation of price for heifers was $3.65, with the 301- to 350-pound weight class bringing the highest and the 601- to 650-pound class bringing the lowest price.

Walker (1961) reported a definite price advantage for selling steer calves in larger lots. Steer calves in lots of 81 or more head averaged higher in price than those selling in smaller lots and sold for $1.81 per hundredweight more than those in lots of 1 to 10 head. Heifers in the 51- to 60-head groups sold for $1.57 per hundredweight more than those in lots of 1 to 10. These two lot-size classifications brought the extremes in price per hundredweight.

Greathouse, Cole and Magee (1968) reported that cattle selling in 1- to 5-head lot size, on the average, sold for 75 cents per hundredweight less than those in 16- to 25-head lot size sale groups. No additional significant differences were found between classifications until lot size reached 46-to-55-head groupings in 1966 and the 55-to-65-head grouping for both 1966 and 1967. The limited data for larger lot size would indicate no price advantage for grouping more than 65 head per sale lot. Williamson (1958) reported a definite price advantage for selling steer calves in larger lots and an indication that the

average price of heifers increased as the size of the sale lot increased. Jamison and Sellers (1968) reported that as pen size became larger than 26, the price per hundred decreased.

Greathouse, Cole and Magee (1968) reported that heifers brought a significantly lower price per hundredweight than steers in the studies of both 1966 and 1967. The difference was $4.27 and $4.40 per hundredweight for the two years in the study. Jamison and Sellers (1968) reported that, on the average, steer calves sold for $2.64 more per hundredweight than did heifer calves. Harper (1957) reported that the average price received for steers, all grades, was $20.85 per hundredweight and $17.81 for heifers.

Jamison and Sellers (1968) reported that the grade of calf had a highly significant effect on the price received per hundredweight of feeder calves. Choice calves sold for an average of $3.27 per hundredweight more than calves of the medium grade and $1.20 more than good grade calves. Medium calves sold for $2.07 less per hundredweight than good calves. Walker (1961) reported that steer calves grading choice averaged $1.58 per hundredweight more than those grading good, while steers that graded medium averaged $1.91 per hundredweight less than steers in the good grade. Choice heifers averaged $1.79 more than those grading good, and medium heifers averaged $1.97 per hundredweight less than those in the good grade.

Greathouse, Cole and Magee (1968) found that there were significant differences between the price paid for choice cattle and most other grades. In all cases, differences were shown, but the difference was not significant for the choice to prime grade classification in the

1966 sales and for the good to choice grade classification in the 1967 sales. Williamson (1958) found that fancy and choice grade steer calves averaged $2.11 per hundredweight more than the good grade steers, and medium grade steers averaged $2.45 lower than those grading good. The fancy and choice heifers averaged $1.45 per hundredweight more than good grade heifers, and medium grade heifers averaged $1.44 per hundredweight less than heifers grading good.

Harper (1957) found a wide variation between the high and low price received per hundredweight for calves within the same grade. For steers, the range was $9.00 per hundredweight for choice grade, $10.70 for good grade, and $12.50 per hundredweight for the medium grade. For heifers, the range was $5.90, $8.60, and $6.10 per hundredweight for the choice, good and medium grades, respectively. However, the average price received was closely related to the grade level. Choice calves averaged $22.00; good, $20.53 and medium, $18.73.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE OF DATA

The data used in this study were collected over a 5-year period (1964-1968) from the Cookeville, Tennessee, Demonstrational Feeder Calf Sales. Although sales were held in the spring of each of the years, only the fall sales were thought suitable for this study. The location of this sale and the area that it serves are shown in Figure 1.

A total of 1,049 pens of calves (31,034 animals) of varying size, weight and grade were found suitable for this study to determine the effects of grade, sex, number of calves per pen (pen size) and average weight of pen on the price per hundredweight and the price per head of feeder calves in the Cookeville sales. In some years, as many as five sales were held each fall during a 30-day period; thus, the analysis was done on a within-year and sale basis. Information was taken directly from the sales summary sheets and punched on IBM cards for processing.

II. RULES AND REGULATIONS OF THE COOKEVILLE FEEDER CALF SALES

The following regulations and procedures are applicable to all sales that are held:

1. All calves must be sired by a registered bull (Hereford or Angus) of approved merit.

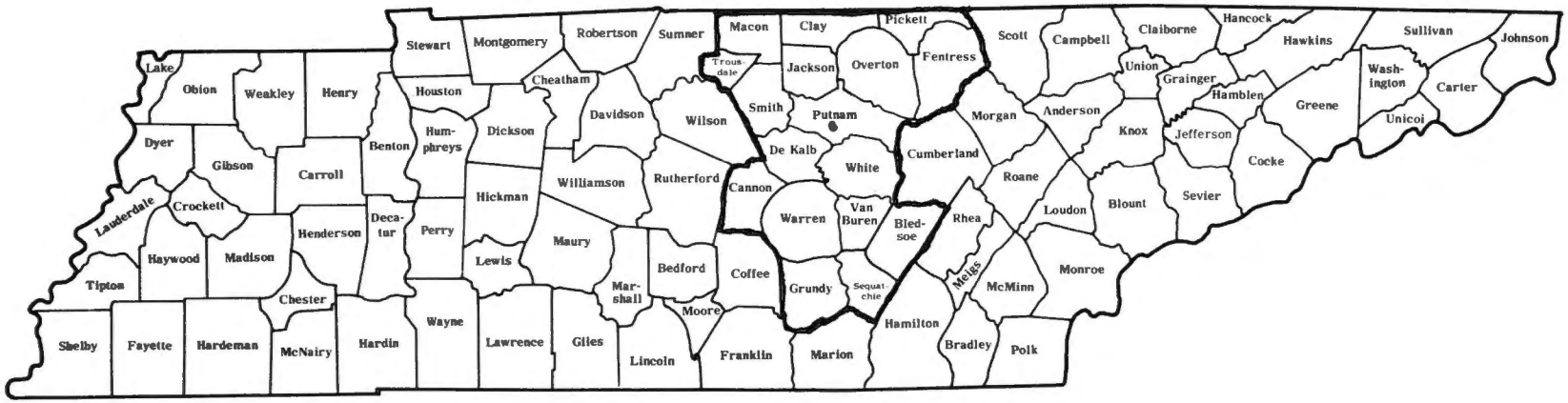

Figure 1. Location of Cookeville, Tennessee feeder calf sale and area served.

2. All calves must be out of good type beef cows, either grade or purebred.

3. All calves must be properly dehorned.

4. All bull calves must be castrated with a knife.

5. Heifers, up to 600 lbs., will be guaranteed open.

6. All calves must be vaccinated for blackleg, malignant edema, and hemorrhagic septicema (3-in-1 shot) not less than 15 days and not more than 90 days prior to sale date.

7. All calves must be produced on the farm of the consignor, and the dam must be inspected with the calf.

8. All calves entered must be listed at the time of inspection and officially accepted by the inspection committee and ear-tagged.

9. Calves will be accepted only from members of the Cumberland Beef Breeders Association.

10. A fee of sixty cents (.60) per calf will be collected from the consignor at the time of inspection. This money is to cover the cost of advertising and incidentals.

11. Final inspection will be made at the unloading docks.

12. All calves must be properly identified and graded according to U.S. Standard Grades at the sale barn. All calves will be further sorted into uniform lots according to sex, breed and weight.

13. To be eligible, steer calves must weigh 300 to 800 pounds; heifer calves must weigh 300 to 600 pounds.

14. The seller of a bred heifer will refund 20 percent of the purchase price if reported within six (6) months after sale date.

III. CONSIGNMENT PROCEDURE

Any consignor wishing to sell feeder calves in the Cookeville sale at the time of this study had first to become a member of the Cumberland Beef Breeders' Association. The cost was $5.00 for a lifetime membership. The consignor then was eligible to submit to the County Agricultural Extension Office the number of calves he expected to sell, giving a breakdown by breed and sex. Following this, the county consignment list is forwarded to the secretary of the Association.

IV. BREEDS

Angus and Hereford were the only breeds sold in the Cookeville sale, and no crossbred calves were accepted. The Angus and Hereford calves are sold in separate sales with the number of sales for each one depending on preliminary estimates. Both steers and heifers of each breed were sold in the same sale.

V. GRADES AND GRADING OF CALVES

Each calf was identified with a numbered hip tag upon arrival at the sale barn. Different color numbers were used for steers and heifers. A record of the number of steers and heifers, along with their hip tag numbers, was kept. Graders, provided by the State Department of Agriculture, placed the official grade on each calf, and this is indicated on the calf in yellow paint. Calves were graded into choice, good, medium and odd lots. In recent years, previous to

this study, the Cookeville sale has started grouping and selling odd-lot calves. However, only the choice, good and medium grades were considered in this study.

VI. WEIGHING OF CALVES

Calves may have been weighed individually or as a group. If one consignor had calves of the same sex, grade and approximately the same weight, they may have been grouped by a sale representative and weighed together. The minimum and maximum weight limitations for graded calves was 300 and 800 pounds for steers and 300 and 600 pounds for heifers. All lots were separated on the basis of 50 pound intervals within the weight limitations. Calves weighing more or less than the weight limits were grouped and sold as overweights or underweights. However, for this study, only the lots within the specified limits were used.

VII. PENNING OF CALVES

All calves were penned as to sex, grade and weight and the pen number was called by the scale operator as the calf was driven from the scales. In most cases, all calves falling into the same lot classification were penned in the same pen. However, in some instances where the number of calves in a certain pen became extremely large, the pen may have been closed and a new pen opened for this classification. This occurred most often with steers grading good and weighing from 400 to 550 pounds.

VIII. SELLING OF CALVES

The sale order always had the steer calves selling before the heifers. This order was practiced widely because of the difference in price between steers and heifers. The sale order within these classifications was decided by a committee and was based on weight, number of calves in the pen and the grade. This committee was composed of representatives of the Association, Agricultural Extension Service and State Department of Agriculture. The choice and good grade calves were usually sold first. However, these two grades were alternated, usually depending on the other factors mentioned previously. A sale clerk made a record of each buyer and the price paid for each lot sold.

IX. CLASSIFICATION OF DATA AND METHOD OF ANALYSIS

Pen summary sheets, which included the number of calves sold, sex, grade, average weight, average price per hundredweight and the average price per head were available for all of the calves used in this study.

Pen size in these data ranged from 1 to 110 calves per pen. In order to obtain a more realistic estimate of pen size effects, pen size was divided into ten discrete classes. The discrete classes represented pen sizes in increments of ten animals.

An estimate of breed effects could not be obtained due to the fact that each sale within a year had only one breed represented. Therefore, the analysis was done on a within-year-sale-basis.

Because of the disproportionate subclass frequencies, least-squares methods as described by Harvey (1960) were used in the analysis

to obtain estimates of the effects of grade, sex, pen size and the continuous variable of average weight per pen on the price received per hundredweight and the price received per head for feeder calves.

A study of the unadjusted means indicated no significant interaction between the various classes of effects.

It was thought that an estimate of the year and sale number effects would be uninformative; therefore, the analysis was done on a within sale-year basis.

The assumed model considered appropriate for the analysis was:

$$Y_{ijkl} = \mu + g_i + s_j + p_k + b\ (x_{ijk} - \bar{x}) + e_{ijkl}$$

$i = 1,2,3$

$j = 1,2$

$k = 1,2 \ldots\ldots 10$

Where:

Y_{ijkl} = the average price per hundredweight and the average price per head of the kth pen size of the jth sex of the ith grade.

μ = population mean price per hundredweight and per head when equal subclass numbers exist

g = the effect of grade with three classifications

1 = medium

2 = good

3 = choice

s = the effect of sex with two classifications

1 = heifers

2 = steers

p = the effect of pen size with ten classifications

1 = pen size 1-10	6 = pen size 51-60
2 = pen size 11-20	7 = pen size 61-70
3 = pen size 21-30	8 = pen size 71-80
4 = pen size 31-40	9 = pen size 81-90
5 = pen size 41-50	10 = pen size 91+

b = partial regression of Y on average weight of calves per pen.

x_{ijk} = average weight of lth pen of ith grade of jth sex of kth pen size

e_{ijkl} = random error.

In a preliminary analysis, the effect of the partial regression of the average weight per pen to include the linear, quadratic, cubic effects and all combinations thereof were included. Estimates of the quadratic and cubic effects did not improve the R^2 values of .75 and .95 for price received per hundredweight and price received per head, respectively.

The least-squares estimates of means were compared to see if they were significantly different at the 1 percent level of probability according to the procedure outlined by Duncan (1955) and modified by Kramer (1957).

CHAPTER IV

RESULTS AND DISCUSSION

The arithmetic means and standard deviations of traits studied are presented in Table I. The least-squares estimates of the effects on the price per hundredweight and per head are shown in Table II. The analysis of variance is presented in Table III.

I. GRADE EFFECTS

The estimates as shown in Table III indicate that grade of calf has a highly significant effect ($P < .01$) on the price received per hundredweight and on the price received per head of feeder calves. Choice calves sold for an average of $2.24 per hundredweight more than calves of the medium grade. The choice calves sold also for an average of $0.60 per hundredweight more than the calves in the good grade. Medium calves sold for an average of $1.64 less per hundredweight than good calves.

These data indicate that choice calves sold for $11.45 more per head than the medium grade calves. The choice calves also sold for $3.31 more per head than those calves grading good. Medium calves sold for an average of $8.14 less per head than calves grading good.

These estimates are within the range of the findings of Jamison and Sellers (1968) who reported that choice calves averaged $3.27 per hundredweight more than calves of the medium grade. Williamson (1958),

TABLE I

ARITHMETIC MEANS AND STANDARD DEVIATIONS OF TRAITS STUDIED

Year	Sale No.	Total Head	No. of Pens	Avg. Size of Pens Number	Avg. Wt. of Calf Pounds	Avg. Price Per Cwt. Dollars	Avg. Price Per Head Dollars
Overall means		31,034	1,049	29.58 ± 1.98	487.7 ± 3.5	25.28 ± .08	122.21 ± .82
1964	1	2,008	77	26.08 ± 19.98	482.8 ± 12.9	24.42 ± .26	116.70 ± 2.76
1964	2	1,961	67	29.27 ± 21.38	499.9 ± 15.5	25.64 ± .30	126.19 ± 3.06
1964	3	1,578	65	24.28 ± 17.16	515.0 ± 15.7	23.61 ± .26	119.96 ± 3.01
1964	4	2,426	74	32.78 ± 22.15	478.3 ± 13.4	26.51 ± .30	125.18 ± 2.92
1965	1	1,414	57	24.81 ± 20.76	502.0 ± 17.2	22.47 + .28	112.52 ± 3.96
1965	2	2,040	73	27.95 ± 18.97	470.4 ± 11.8	23.38 ± .26	109.66 ± 2.83
1965	3	1,004	47	21.36 ± 19.04	494.1 ± 16.3	23.37 ± .35	115.10 ± 3.96
1965	4	1,926	70	27.51 ± 20.05	481.8 ± 13.1	23.79 ± .31	114.10 ± 3.21
1965	5	1,406	58	24.24 ± 17.98	489.0 ± 14.7	24.79 ± .29	120.34 ± 3.39
1966	1	1,701	55	30.93 ± 24.07	455.0 ± 13.5	27.22 ± .36	123.08 ± 3.59
1966	2	1,529	56	27.30 ± 19.5	486.3 ± 15.0	26.96 ± .45	129.44 ± 3.53
1966	3	1,685	53	31.79 ± 23.5	477.7 ± 14.0	26.89 ± .31	127.51 ± 3.46
1967	1	1,886	55	34.29 ± 29.6	489.9 ± 16.1	25.78 ± .30	125.29 ± 3.72
1967	2	1,581	52	30.40 ± 24.9	501.7 ± 15.8	25.82 ± .35	128.53 ± 3.78
1967	3	1,937	52	37.25 ± 28.6	485.3 ± 15.1	26.13 ± .31	125.81 ± 3.50
1968	1	1,576	46	34.26 ± 31.8	498.6 ± 18.9	26.53 ± .38	131.32 ± 4.70
1968	2	1,731	48	36.06 ± 30.8	486.3 ± 17.1	26.97 ± .39	130.14 ± 4.30
1968	3	1,645	44	37.39 ± 28.4	492.1 ± 17.9	26.64 ± .41	130.16 ± 4.50

TABLE II

LEAST-SQUARES ESTIMATES[1] OF THE EFFECTS STUDIED

Variable	No. of Pens	Avg. Price Received Per Cwt.	Avg. Price Received Per Head
Grade			
Medium	333	-1.291[a]	-6.533[a]
Good	434	0.346[b]	1.609[b]
Choice	282	.945[c]	4.924[c]
Sex			
Females	427	-1.824[a]	-7.567[a]
Steers	622	1.824[b]	7.567[b]
Pen Size			
1-10	259	0.193[b]	-0.255
11-20	217	0.007[a]	-0.080
21-30	142	-0.137[a]	-0.071
31-40	140	-0.251[a]	-0.473
41-50	95	-0.211[a]	-0.060
51-60	72	-0.159[a]	-0.450
61-70	50	-0.123[a]	0.266
71-80	32	0.016[a]	0.320
81-90	24	0.052[a]	-0.253
91- +	18	0.613[c]	1.056
Regression of Y on:			
Average weight/pen		-0.012**	0.193**

[1]Estimates are deviations from the overall adjusted mean when equal numbers exist per subclass. The overall arithmetic mean of price per hundredweight and price per head was $25.28 and $122.21, respectively.

[a,b,c]Those estimates followed by the same letter within a column within a subclass do not differ significantly at the 0.01 level of probability.

**P < .01.

TABLE III

ANALYSIS OF VARIANCE OF PRICE RECEIVED

Source	Degrees of Freedom	Mean Squares	
		Avg. Price Per/cwt.	Avg. Price Per/head
Grade of calf	2	400.660**	10305.416**
Sex of calf	1	2652.460**	45674.910**
Pen size	9	2.985*	7.189
Regression of Y on:			
Average wt./pen	1	1131.943**	295650.710**
Residual	1018	1.544	38.857
R^2		.75	.95

*P < .05.

**P < .01.

in a study involving Virginia calves, reported that choice steer calves averaged $2.11 per hundredweight more than good grade steers.

II. SEX EFFECTS

These data indicate that sex of calf had a highly significant effect ($P < .01$) on the price received per hundredweight and on the price received per head of feeder calves. Steer calves, on the average, sold for $3.64 more per hundredweight than heifers of the same grade.

Steer calves, on the average, sold for $15.14 more per head than did heifers of a comparable grade.

These findings are in general agreement with those of Walker (1961) who reported that choice grade steer calves had an average price of $1.08 per hundredweight more than good grade steer calves and that medium grade steer calves sold for $1.91 less per hundredweight than calves grading good. Jamison and Sellers (1968), in a study involving Tennessee calves, reported that steer calves on the average sold for $2.64 more per hundredweight than did heifer calves. Williamson (1958) reported similar results.

In the present study, there appeared to be a greater difference between the price received per hundredweight and the price received per head between choice and medium heifers than between choice and medium steers. This may mean that some choice heifers were bought for breeding purposes.

III. PEN SIZE

In the analysis pen size was considered a discrete variable. Arithmetic means indicate that the effects were perhaps not linear.

These data indicate that calves in pen sizes of greater than 91 sold for more per hundredweight and more per head than calves in any other pen-size group. The differences in price per head were not significant. A possible explanation would be that calves in larger pens were purchased by order buyers rather than by feeders. The capacity of a 42-foot, double-deck cattle van for 488-pound calves is approximately 80 head. Usually, feeders will pay a premium for calves in pen sizes that approach a truck load.

Pen size did not have a significant effect on the price received per head.

These findings are not in agreement with those of Walker (1961) who reported that steer calves in lots of 81 or more head averaged significally higher in price than those selling in smaller lots and sold for $1.81 per hundredweight more than those in lots of 1 to 10 head. Jamison and Sellers (1968) reported a significant ($P < .05$) negative relationship when price received per hundredweight was regressed on the average number of head per pen.

IV. AVERAGE WEIGHT PER PEN

The average weight per pen was a significant ($P < .01$) source of variation in this study. When the price received per hundredweight was regressed on the average weight per pen, all other source of variation held constant, these data indicate that as average weight per pen increased the price received per hundredweight decreased. This indicates that the buyers were willing to pay more for light weight calves per hundredweight than those having heavier weights.

When price received per head was regressed on the average weight per pen, within the range of these data, as the average weight per pen increased, so did the average price received per head. These data indicate that calves, although selling for less per hundredweight, sold for significantly ($P < .01$) more per head.

These findings are in agreement with those of Jamison and Sellers (1968), Walker (1961) and Williamson (1958).

CHAPTER V

SUMMARY

Records of 1,049 lots of steers and heifers sold in the Cookeville Demonstrational Feeder Calf Sales held each fall from 1964 through 1968 were studied to determine the effects of grade, sex, pen size, and the average weight per pen on the prices received per hundredweight and on the prices received per head for feeder calves sold.

Choice calves sold for an average of $2.24 per hundredweight more than calves of the medium grade. The choice calves sold also for an average of $0.60 per hundredweight more than the calves in the good grade. Medium calves sold for an average of $1.64 less per hundredweight than good calves.

Choice calves sold for $11.45 more per head than the medium grade calves. The choice calves sold also for $3.31 more per head than those calves grading good. Medium calves sold for an average of $8.14 less per head than calves grading good.

Steer calves sold for significantly ($P < .01$) higher prices than did heifer calves. Steer calves, on the average, sold for $3.64 and $15.14 more per hundredweight and per head, respectively, than did heifers of a comparable grade.

The data indicate that calves in pen sizes greater than 91 sold for more per hundredweight and more per head than calves in any other pen size group. However, the differences in price per head were not significant.

When the price received per hundredweight was regressed on the average weight per pen, all other sources of variation held constant; these data indicate that as average weight per pen increased, the price received per hundredweight decreased.

When the price received per head was regressed on the average weight per pen, within the range of the data, as average weight per pen increased, so did the average price received per head.

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VITA

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He served two years in the United States Air Force and began work as Assistant County Agent with the Agricultural Extension Service in Smith County in 1956. He later served as Fieldman with Borden Foods Company for five years before returning to work as Assistant County Agent in Smith County in 1962.

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Mr. Cole was married in 1959 to the former Anne Stallings of Carthage. They are the parents of two sons, ages nine and seven.