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The performance of steers fed fattening rations representative of the years 1970, 1935, and 1900

John B. Loy

To the Graduate Council:

I am submitting herewith a thesis written by John B. Loy entitled "The performance of steers fed fattening rations representative of the years 1970, 1935, and 1900." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.

J.A. Corrick Jr, Major Professor

We have read this thesis and recommend its acceptance:

J.D. Smalling, W.R. Backus

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

1 of 3

May 11, 1972

To the Graduate Council:

I am submitting herewith a thesis written by John B. Loy entitled "The Performance of Steers Fed Fattening Rations Representative of the Years 1970, 1935, and 1900." 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.

James A. Carrick, Jr.
Major Professor

We have read this thesis and recommend its acceptance:

Wm R. Backus

John D Smalling

Accepted for the Council:

Hatton A. Smith
Vice Chancellor for
Graduate Studies and Research

THE PERFORMANCE OF STEERS FED FATTENING RATIONS REPRESENTATIVE OF THE YEARS 1970, 1935, AND 1900

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

John B. Loy

June 1972

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ABSTRACT

The purpose of this experiment was to compare the feedlot performance and caracss characteristics of steers when finished on a ration representative of the years 1970, 1935, and 1900.

Twenty-nine Hereford calves with an average initial weight of 714 pounds were involved in the experiment at the University of Tennessee's Knoxville Experiment Station. Three treatments (1) a ration representative of the year 1970, (2) a ration representative of the year 1935, and (3) a ration representative of the year 1900 were used in the study.

The results indicated that feedlot performance was significantly influenced by treatments. The 1970 ration had significantly larger final weights and average daily gains. Also, average daily gain for the 1935 ration was significantly greater than daily gains for the 1900 ration.

Carcass performances were also significantly affected by treatments. Carcass weights, U.S.D.A. grades, marbling scores, and carcass fat thickness were significantly larger for the 1970 ration than for either of the two remaining rations. Likewise, carcass fat thicknesses of the steers fed the 1935 ration were significantly greater than carcass fat of steers fed the 1900 ration.

Returns over initial and feed costs were found to be greater for the 1970 ration than either the 1935 or 1900 ration. Returns for the 1900 ration were lowest for all three treatments. Therefore, it may be concluded that the 1970 ration is a superior quality ration for fattening steers than the other two rations.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Ensminger (1969) states that prior to 1900, the majority of slaughter cattle sent to market were four to six year old steers that primarily had been finished on grass.

Cattle feeding, according to Ensminger, has greatly expanded in recent years. Since 1930, it has increased from 3 million to 11.3 million head (1967). The primary reasons and transitions responsible for this increase are:

1. Increased human population, from 122 million in 1930 to over 215 million in 1970.
2. Increased per capita beef consumption, from about 53 pounds in the 1930's to over 113 pounds in 1970.
3. Increased percent of consumers' income spent for beef, from 2 1/4 percent in the 1930's to 2 3/4 percent in 1970.
4. Improved cattle feeding methods and mechanization.
5. Shorter feeding periods and a tendency to feed to Good and Choice grades, rather than Prime.
6. Increased cattle feeding in the West where six to seven times more cattle are being fed than in the 1930's.

When considering the improvements made in beef cattle feeding in the past seventy years, one cannot overlook the improvements made in the field of animal breeding. These improvements have brought about strains of cattle which will grow faster to weaning and do a better job in the feedlot. Prior to 1900, the three British breeds of beef cattle had been imported and were established in this country. It is with this foundation of breeding stock that much selection and improvement has occured.

Early work by Sheets (1932) at Beltsville, Maryland, showed that cattle varied in their ability to grow, in the efficiency of gains made, and in the quality of final products as measured by selling price. Sheets proposed a complicated experiment in which calves were kept in drylot and allowed to nurse twice daily. Weights were taken before and after nursing and used to estimate milk production of the dam each 28 days. Calves were allowed access to creeps and weaned on the 252nd day of age. After weaning, calves were started on a fattening ration and fed individually until they reached 900 pounds and were slaughtered. Detailed carcass data were obtained. This information was used as a progeny test to evaluate the breeding stock from which the test animal came. Sheet's attempt to evaluate breeding stock was one of the first attempts to evaluate the performance of beef cattle and relate it to inheritance.

Vast changes have taken place in the cattle industry from 1900 to 1970. In an effort to show the improvements in feeding slaughter cattle, this study was initiated for presentation at the celebration of the 175th Anniversary of the University of Tennessee.

The objective of this study was to compare the feedlot performance of steers when finished on rations representative of the years 1970, 1935, and 1900.

CHAPTER II

REVIEW OF LITERATURE

I. NUTRITIONAL RESEARCH 1900-1970

Emil Wolff in Germany published the first feeding standards in 1864. Little was done with Wolff's conclusions until they were modified by Lehmann in 1896. These standards, which were known as the Wolff-Lehmann standards, were used widely until 1915 in Europe and the United States in computing rations for livestock. The original Wolff standards were in terms of digestibility or availability to the animal. Digestibility was determined by subtracting the undigested material excreted by the animal from the total dry matter eaten in the ration (Wherry, 1947).

Experimental work soon showed that the old Wolff-Lehmann feeding standards recommended a much larger amount of protein for certain classes of animals, especially dairy cows and fattening animals, than was actually needed. This led to further investigation and improved standards. Later standards were developed by Armsby, Savage, Haecker, Woll, Henry, and Morrison (Wherry, 1947).

Beginning in 1915, the best known feeding standards were those of Professor F. B. Morrison, who colaborated with W. A. Henry in writing the textbook, "Feeds and Feeding."

This book has been considered the feeding bible of stockmen for many years (Wherry, 1947).

Stephen M. Babcock, who is most widely known for his invention, the Babcock test, made many pioneer contributions in the field of dairy chemistry and animal nutrition. Following six years at the New York Experiment Station, he served for 25 years as chemist and assistant director at the Wisconsin Experiment Station. Babcock planned a feeding experiment with single plants at Wisconsin and carried it out around 1910. He recognized that when cows were being fed a combination of several feeds from different sources, there was no way of knowing what particular contribution each was making to the animal's needs. He conceived the idea of trying out rations made up entirely from a single plant. Babcock, through inspired leadership, had shown through research the way to better practices before the need for it was recognized.

Eventually Babcock was given the use of two cows for experimentation; but when one cow died after three months, the experiment was abandoned. Later, his idea was carried out in an extensive experiment by Hart and Humphrey and also McCollum and Steembock (Maynard and Loosli, 1962).

Another example of a farsighted scientist was Herbert Mumford, who in 1907 wrote about alfalfa hays. Mumford stated in his book, "Beef Production," that it was generally

known that alfalfa and clover hay were superior roughages for cattle. He believed that the extent of their superiority was not appreciated as it should have been at that time. If this superiority had been known, more alfalfa and clover hay and less timothy and other grasses would have been grown for feed purposes.

During this period (1907) Mumford was unable to find any published data concerning the relative value of alfalfa and clover hays when used with corn for fattening cattle. He concluded that cattle feeders who had fed both were unanimous in the belief that alfalfa was the better roughage.

The 1964 United States Census of Agriculture actually shows what Mumford was talking about in 1907. In 1899 only 2,094,011 acres of alfalfa were grown in the United States with a total production in 1899 was 5,220,671 tons of alfalfa hay. These figures are relatively small compared to the 1964 statistics when 28,211,434 acres of alfalfa were grown which produced 68,380,940 tons of hay.

Mineral requirements for livestock were next recognized. For many years, salt was considered to be the only mineral needed. Scientific investigation, begun in 1908 at the Wisconsin Experiment Station, showed that when other minerals (especially calcium) were added to the ration, better results were obtained with growing heifers and milk cows. Professor Hart at Wisconsin found that a heifer fed on grain and grain

by-products, with straw as a roughage, usually produced a weak or dead calf. When alfalfa or clover hay was substituted for half of the straw, better results were obtained, and the heifer usually produced a normal calf. Not only did the alfalfa hay supply calcium and phosphorous, but also the vitamins needed to help assimulate calcium. Vitamins were yet unknown in 1908 and minerals were given all the credit (Wherry, 1947).

Vitamins entered the feeding picture between 1910 and 1920. Vitamin A was discovered at the Wisconsin Experiment Station in 1910. Dr. E. V. McCollum first used the term "unknown factors" to describe this vitamin. From 1920 to 1930 improvements were made by incorporating vitamin-carrying ingredients in livestock rations (Wherry, 1947).

Extensive work by Weber, et al (1940) at the Kansas Experiment Station showed that fattening rations of grain, protein supplements, and carbonaceous roughages produced substantially lower and more costly gains than the same ration with a limited amount of alfalfa hay added. Adding 0.1 pound of ground limestone as a calcium supplement, however, permitted the cattle to gain almost as well as when alfalfa was included in the ration and bone strength was markedly increased.

The preceeding was reviewed and confirmed at other stations by Riggs (1958) and it is now recommended that

fattening cattle receiving less than 2 pounds of good legume hay per head daily in a full feed ration on grain, protein supplements, and carbonaceous roughages should receive 0.1 pounds of a calcium supplement in addition.

Further advances were made in the field of animal nutrition when Burroughs (1954) reported growth stimulation from feeding trace amounts of diethylstilbestrol to cattle. Earlier attempts to feed this hormone were at much higher levels, and the side-effects which resulted were undesirable from a marketing standpoint.

Antibiotics were also coming onto the scene for beef feeding. Work at Purdue University by Perry, et al. (1953), showed that chlortetracycline at a level of 24 mg. per hundred pounds of body weight administered orally by capsule daily to suckling beef calves decreased scouring and gave an apparent growth stimulation. Calves and yearlings fed 75 mg. per head daily in high roughage rations showed significant improvements in gain and feed conversion.

However, the use of both diethylstilbestrol and antibiotics in feed is now in jeopardy. All cattle now going to slaughter are required to have an accompanying certificate of diethylstilbestrol withdrawal. Cattle being fed diethylstilbestrol have to be withdrawn from the compound seven days prior to slaughter. This has all been brought about by the charge that diethylstilbestrol may be carcenogenic.

A task force of experts on infectious diseases and animal science from the Food and Drug Administration, the National Institute of Health, the U. S. Department of Agriculture, and the Center for Disease Control, together with consultants from universities and industry, was established in April of 1970 to undertake a comprehensive review of the use of antibiotics in animal feeds. The task force concluded that a hazard to human health is present whenever a significant increase of antibiotic resistant organisms capable of causing human disease occurs in animals.

The hazard to animal health relates to the development of single or multiple resistant organisms which cannot be successfully treated with the available antibiotics. The principal criteria for evaluating the animal health hazard is whether the development of resistant organisms resulting from the use of antibiotics in feed is interfering with therapeutic use of antimicrobials. The conclusion in the report is that the practice of using antibiotics in feed has been reported to compromise the treatment of certain animal diseases but that additional information is needed to measure the extent of the problem. This report was released January 31, 1972, by the Commissioner of the Food and Drug Administration.

II. HISTORICAL REVIEW OF QUALITY AND GRADE

Improvement in the quality of American Beef cattle was associated with the growth of a highly productive market economy. Similarly, beef quality regulations and standards have developed from rather simple colonial standards to those of the present, having national significance and application (Kiehl and Rhodes, 1960).

The above-mentioned authors also state that growth of cities increased economic opportunities for improvement of cattle emphasizing beef qualities. American cattlemen turned to importation of improved European cattle. Many cattle importing companies were organized beginning in 1834, but little improvement in cattle was noted until after the Civil War. Although feeding of grain to beef cattle had been practiced since the Revolutionary period, it was not until after 1900 that a significant proportion of cattle for beef were fed grain concentrates.

Kiehl and Rhodes (1960) recognized the formation of a national price reporting system using uniform terminology with the establishment of federal market reports for beef in 1916 and on live cattle in 1918. Briskey (1964) relates that marking of official U. S. grades on carcass beef was commenced in 1927 at the request of the Better Beef Association. Since that time many revisions and amendments have been added to the original grade standards.

CHAPTER III

EXPERIMENTAL PROCEDURE

I. SOURCE AND DESCRIPTION OF DATA

Data for this study were collected from 29 good grade yearling Hereford steers with an average initial weight of 714 pounds. The study was conducted by the University of Tennessee Agriculture Experiment Station at Knoxville in conjunction with the University's Institute of Agriculture Progress Show.

The Institute of Agriculture Progress Show was conducted for public exhibition at three locations across Tennessee during June, 1969. The first presentation was made at the University's Knoxville campus and drew an estimated crowd of 9,000 people. The second was at the Middle Tennessee Experiment station, Spring Hill, Tennessee, with an attendance of approximately 5,300 visitors. The final presentation before 7,600 people was made at the West Tennessee Experiment Station, Jackson, Tennessee. Each program lasted three consecutive days. At Knoxville, exhibits were displayed in the arena of the Animal Science Building and in large tents at the other locations. There was a total attendance at the three shows of nearly 22,000 people.

The animals on display were pens of two steers from each treatment. Signs indicating performance and carcass

data of previously slaughtered animals were posted above the pens. University personnel were present at all times to explain the exhibits to visitors and answer questions concerning the treatment of the animals on experiment. Various papers concerning livestock production, present and future, also were presented by staff members of the University of Tennessee at the Progress Show.

The study, conducted during 1969, consisted of a feeding trial involving three treatments of 10 animals each, divided into two pens of five animals each. One steer died during the experiment. The purpose of the experiment was to demonstrate differences in performance of animals fed rations typical to cattle feeding in 1900, 1935, and 1970.

II. CLASSIFICATION OF DATA

The experiment consisted of a full feed period of 75 days during which animals were fed a high concentrate ration. At the onset of the trial each animal was identified, weighed, and condition graded. For the duration of the trial animals were weighed at 28-day intervals. At the termination of the test the animals were again weighed and condition scored. Twenty-three of the animals used in the trial were taken to a local packing plant where they were slaughtered and hot carcass weights were recorded and subsequent dressing percentages were determined. Following a

48-hour chilling period, U.S.D.A. grades, including values for maturity, kidney fat, conformation, and marbling scores were assigned each carcass by a U.S.D.A. meat grader. Rib-eye area and fat thickness over the twelfth rib were determined according to procedure described by the American Meat Science Association (Schoonover, et al., 1967).

III. TREATMENTS

The experimental treatments were as follows:

Treatment I. Treatment I consisted of a commercial finishing ration typical to a 1970 steer finishing program. This consisted of flaked corn, cob meal, 41 percent protein supplement, fat, salt, minerals, and vitamins (Table I).

Treatment II. Treatment II, representative of a 1935 finishing ration, consisted of a full feed of ground shelled corn, salt, and dicalcium phosphate, plus limited alfalfa hay (Table I).

Treatment III. Treatment III, designed to represent a typical 1900 fattening ration, consisted of only ground shelled corn, limited grass hay, and salt.

IV. STATISTICAL ANALYSES

Performance and carcass data in this study were analyzed using analysis of variance according to Harvey (1960).

TABLE I

TREATMENT RATIONS

Treatment	1970	1935	1900
Number of Animals	9	10	10
Days on Treatment	75	75	75
Starting Date	3-13-69	3-13-69	3-13-69
Daily ration, lb.:			
Grass Hay	-----	-----	3.0
Alfalfa Hay	-----	4.0	-----
Ground Shelled Corn	-----	13.8	11.3
Flaked Corn	12.9	-----	-----
Ground Corn Cobs	4.0	-----	-----
41% Protein Supplement	2.1	-----	-----
Dehydrated Alfalfa Meal	0.6	-----	-----
Cane Molasses	0.8	-----	-----
Animal Fat	0.3	-----	-----
Salt	0.1	0.05	0.05
Limestone	0.1	-----	-----
Defluorinated Rock Rhosphate	0.1	-----	-----
Dicalcium Phosphate	-----	0.05	-----
Vitamin A	21,200 I.U.	-----	-----
Vitamin D	5,300 I.U.	-----	-----
Tetracycline	74.2 mg.	-----	-----
Stilbestrol	10.6 mg.	-----	-----

CHAPTER IV

RESULTS AND DISCUSSION

I. PERFORMANCE

Final Weight

Average final weights for the feed test were significantly greater ($P<.05$) for the 1970 ration than the 1900 ration. There was also a significant difference ($P<.05$) between the 1970 ration and the 1935 ration (Table II). The range in final weights (962, 873, 842) were for Treatments I, II, III respectively with a standard deviation of $\pm$ 88.45 pounds from the mean weight of 892 pounds for the experiment (Tables II and III). No significant difference was observed between the 1935 and 1900 rations ($P<.05$) in final weight.

Final Fat

Final fat thickness at the end of the experiment measured ultrasonically was significantly higher ($P<.05$) for the 1970 ration than the 1900 ration. No significant difference was found between final fat measurements of the 1970 ration and the 1935 ration. There was also no significant difference in fat between 1935 and 1900 rations (Table II).

TABLE II

LEAST-SQUARES MEANS FOR FEEDLOT PERFORMANCE OF STEERS AS INFLUENCED BY TREATMENT

Traits	Treatment		
	1970	1935	1900
Number of Animals	7	8	8
Initial weight, lbs.	741.[a]	704.[a]	716.[a]
Initial fat, mm.	5.1[a]	4.7[a]	4.3[a]
Initial condition, score	13.0[a]	12.9[a]	12.0[a]
Final weight, lbs.	962.	873.[a]	842.[a]
Final fat, mm.	11.9[a]	9.7[ab]	6.9[b]
A. D. G., overall	2.94	2.24	1.67

[ab]Means with same superscript are not significantly different (P>.05).

TABLE III

MEANS AND STANDARD DEVIATIONS OF ANIMAL PERFORMANCE AND CARCASS CHARACTERISTICS

Trait Measured	Mean	S.D.
Initial weight, lbs.	717.83	± 33.47
Initial fat, mm.	4.57	± 1.27
Initial condition score	12.35	± 1.58
Final weight, lbs.	892.42	± 88.45
Final fat, mm.	9.22	± 3.26
A. D. G., overall, lbs.	2.30	± 0.62
Carcass weight, lbs.	514.39	± 43.25
Dressing percent	58.63	± 1.87
U.S.D.A. carcass grade	10.26	± 0.75
Marbling score	3.74	± 0.65
Rib-eye area, sq. in.	10.30	± 1.11
Carcass fat, mm.	9.82	± 3.90
Kidney fat, percent	3.09	± 0.19
Yield grade score	2.78	± 0.49

Average Daily Gains

Average daily gains for the 75 days on experiment were significantly affected by all three treatments. The average daily gains in Table II (page 16) (2.94, 2.24, 1.67) for treatments I, II, III respectively, were significantly different ($P<.05$)

Feed Consumption, Costs, and Returns

Average daily rations for the three treatments are presented in Table I (page 14). Returns over initial and feed cost were greater for the 1970 ration than either 1935 or 1900. The returns for the 1900 ration were the lowest for the experiment (Table IV).

II. CARCASS CHARACTERISTICS

Carcass Weight

Average carcass weights for the 1970 ration were significantly larger ($P<.05$) than weights for 1935 and 1900 rations. There was no significance between the 1935 and the 1900 rations where carcass weights were concerned. Average carcass weights of 567,496, and 489 pounds were recorded for treatments I, II, III respectively (Table V).

U.S.D.A. Grade

U.S.D.A. grades for the steer carcasses on the 1970 ration were significantly higher ($P<.05$) than grades given carcasses of steers on the 1900 ration. There was no

TABLE IV

AVERAGE TREATMENT FEED COSTS AND RETURNS

Treatment	1970	1935	1900
Number of Animals	9	10	10
Days on test	75	75	75
Average feed costs ($):			
Per head	47.16	29.28	22.93
Per cwt. gain	20.56	17.38	19.17
Purchasing price per cwt. ($)	29.75	29.75	29.75
Selling price per cwt. ($)	33.18	31.92	31.20
Average purchase cost per head ($)	215.39	211.82	210.33
Average sale value per head ($)	316.87	281.22	258.34
Return per head over initial and feed costs ($)	54.32	40.12	25.08

TABLE V

LEAST-SQUARES MEANS FOR CARCASS TRAITS OF STEERS AS INFLUENCED BY TREATMENT

Traits	Treatment		
	1970	1935	1900
Number of Animals	7	8	8
Carcass weight, lbs.	567.	496.[a]	489.[a]
Dressing percent	59.9[a]	58.7[a]	57.8[a]
U.S.D.A. grade	10.9[a]	10.2[ab]	9.9[b]
Marbling score	4.3[a]	3.8[ab]	3.3[b]
Rib-eye area, sq. in.	10.7[a]	10.5[a]	9.8[a]
Carcass fat, mm.	12.4	9.4	8.1
Kidney fat, percent	3.1[a]	3.1[a]	3.1[a]
Yield grade	3.1[a]	2.6[a]	2.7[a]

[ab]Means with same superscript are not significantly different (P>.05).

significant difference between the 1970 and 1935 grades or between 1935 and 1900 grades.

Marbling Score

Average marbling scores for the experiment are given in Table III (page 17). There was a significant difference ($P<.05$) in marbling scores. The marbling scores of the 1970 ration were significantly larger than those of the 1900 rations. No significant difference was observed between the other treatments.

Dressing Percent

Differences in dressing percent, shown in Table III (page 17), were not significantly different due to either ration or muscling.

Rib-eye Area

Average rib-eye (square inch) for steers are presented in Table III (page 17). These values varied slightly, but differences were not significantly affected by treatment.

Fat Thickness

Average carcass fat thickness measurements made at the twelfth rib are presented in Table III (page 17). The 1970 ration produced carcasses significantly fatter than either 1935 and 1900 rations ($P<.05$). There were also significantly fatter ($P<.05$) carcasses produced on the 1935 ration than on the 1900 ration.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this study was to compare the feedlot performance of steers when finished on rations representative of the years 1970, 1935, and 1900.

The experiment involved 29 Hereford calves with an average initial weight of 714 pounds. The animals were divided into three treatments with two pens of five animals per treatment. The steers were put on a 75-day full feed of concentrate typical of rations fed in the years 1970, 1935, and 1900. Animals on the experiment were weighted periodically and graded at the beginning and end of the feed period. Of the original 30 head started on test, one animal died and six were kept for demonstration purposes. The remaining 23 head were marketed, slaughtered, and carcass data obtained.

The ration utilized in the 1970 treatment consisted of a commercial finishing ration of flaked corn, cob meal, 41 percent protein supplement, fat, salt, minerals, and vitamins (Table I, page 14). Treatment II (1935 ration) consisted of ground shelled corn, salt, and dicalcium phosphate, plus limited alfalfa hay. Treatment III (1900 ration) consisted of only ground shelled corn, limited grass hay, and salt.

There were significant differences ($P < .05$) in feedlot performance and carcass characteristics between treatments. Average final weights for the steers were significantly greater for the 1970 ration than final weights of steers on the 1935 and 1900 rations.

Average daily gains were also significantly affected ($P < .05$). Treatment I had a significantly larger A.D.G. than either 1935 or 1900. The 1935 ration also made significantly higher gains than the 1900 ration. Likewise, carcass weights for steers fed the 1970 ration were significantly greater ($P < .05$) than carcass weights for the other rations.

U.S.D.A. grades of carcasses on Treatment I were significantly higher ($P < .05$) than grades on carcasses from Treatment III. Marbling scores were significantly higher for the 1970 ration, and carcass fat thickness was significantly greater for this treatment than the others. Carcasses of the 1935 treatment were also significantly fatter than the 1900 treatment.

Returns over initial and feed costs were found to be greater for the 1970 ration than either 1935 or 1900. The returns for the 1900 ration were the lowest for the experiment (Table IV, page 19).

Results of this study emphasize the dramatic changes which have taken place in feeding slaughter cattle over the past seventy years. By realizing the need for ingredients

other than corn and grass hay in the ration, cattle feeders have increased performance of slaughter cattle in the feedlot and also have improved the quality of carcasses which they market.

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APPENDIX

TABLE VI

ANALYSIS OF VARIANCE FOR THE EFFECTS OF RATION ON FEEDLOT PERFORMANCE

		Mean Square				
Source	df	Initial Weight	Initial Fat	Final Weight	Final Fat	ADG Overall
Ration (R)	2	2244.506	0.940	24503.728***	40.774*	2.629***
Residual	17	1114.068	1.668	1798.970	8.311	0.076

*P<.05

***P<.001

TABLE VII

ANALYSIS OF VARIANCE FOR THE EFFECTS OF RATION ON CARCASS TRAITS

		Mean Square							
Source	df	Carcass Weight	Dressing Percent	USDA Grade	Marbling Score	Rib-eye Area Sq. In.	Carcass Fat mm.	Percent Kidney Fat	Yield Grade
Ration (R)	2	11423.379***	7.057	1.645*	1.576*	1.755	0.047*	0.117	0.367
Residual	17	683.449	2.782	0.415	0.345	1.290	0.010	0.043	0.259

* P<.05.

*** P<.001.

TABLE VIII

FEED COSTS

Item	Treatment Year Fed	Cost Per Ton (in Dollars)
Commercially prepared ration	1970	63.00
Ground shelled corn	1935, 1900	47.26
Alfalfa hay	1935	35.00
Grass hay	1900	25.00
Salt	1970, 1935, 1900	32.80
Dicalcium phosphate	1935	92.00

VITA

John B. Loy was born in Knoxville, Tennessee, on September 2, 1947. He attended elementary school in Corryton, Tennessee, and graduated from Gibbs High School in 1965. In June, 1965, he entered the University of Tennessee and received his Bachelor of Science degree in Animal Husbandry in the spring of 1969. In the fall of 1969, he accepted an assistantship in animal husbandry at the University of Tennessee and began study toward a Master's degree. While studying for a Master's degree, he worked at the University of Tennessee's Alcoa Farm. In June, 1972, he received a Master of Science degree from the University of Tennessee, with a major in Animal Husbandry.

He is married to the former Elizabeth Ann Humphrey of Knoxville, Tennessee.