August 9, 1954

To the Graduate Council:

I am submitting herewith a thesis written by Don Allison Bowman entitled "The Effect of Type and Weight on the Yield of Primal and Miscellaneous Pork Cuts." 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.

Charles S. Hobbs
Major Professor

We have read this thesis
and recommend its acceptance:

J. M. Cobb

D. V. Ikold

Accepted for the Council:

R. A. Waters
Dean of the Graduate School

THE EFFECT OF TYPE AND WEIGHT ON THE YIELD OF PRIMAL AND MISCELLANEOUS PORK CUTS

2 P
33

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

---

by

Don Allison Bowman

August 1954

ACKNOWLEDGEMENT

The author wishes to express his sincere appreciation to Professor J. W. Cole for his astute considerations, suggestions, and encouragement in evaluating both this thesis and the accuracy of the computations presented.

The author is deeply indebted to Dr. C. S. Hobbs, Dr. L. N. Skold, and Dr. Eric Winters for their assistance in reading and preparation of the thesis.

327860

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
II.	REVIEW OF LITERATURE	5
III.	SOURCE OF MATERIAL AND PROCEDURE	11
IV.	RESULTS AND DISCUSSION	16
V.	SUMMARY AND CONCLUSIONS	32
BIBLIOGRAPHY		35

LIST OF TABLES

TABLE		PAGE
I.	Standard Barrow and Gilt Carcass Grade Schedule	2
II.	Slaughter Data	18
III.	The Influence of Type upon Packer and Shipper Style Dressing Percentages and Shrinkage	20
IV.	Percentage Offal Data of the Various Types and Weight Groups of Hogs	21
V.	The Effect of Type and Weight on Physical Measurements	24
VI.	The Correlations of Gastro-Intestinal Tract with Chest Depth	25
VII.	Comparison of the Chest Depth, Dressing Percentage, and Per Cent Gastro-Intestinal Tract of the 215 Pound Weight Groups	27
VIII.	The Percentage Yield of Primal Cuts of Various Types and Weight Groups	28
IX.	The Yield of Miscellaneous Cuts of Various Types and Weight Groups	30

LIST OF FIGURES

FIGURE PAGE

1. Barrow and Gilt Carcasses Representing the United States Department of Agriculture Grades of Pork 3
2. Carcass Measurement Guide 14
3. The Three Types and Six Weight Groups of Hogs Together with Their Carcasses and Representative Cuts 17

CHAPTER I

INTRODUCTION

Hogs are marketed with less emphasis on carcass value than any other class of livestock. In the past, average weight has largely determined market grade in buying and selling of slaughter hogs. Dressing percentage combined with weight has largely determined the value of hogs to the packer buyer. Average weight and dressing percentage do not give adequate consideration to the carcass difference among market hogs. The packer is becoming more aware of this situation. On many markets an honest attempt is being made to revamp and improve hog buying techniques.

The Standardization and Grading Division of the Agricultural Marketing Service of the United States Department of Agriculture has recently adopted standards for grading hogs as shown in Table I and Figure 1. These standards for grading hogs have been submitted to encourage buying and selling of hogs on a merit basis rather than on weight schedules. A merit basis for buying and selling hogs should benefit the producer, the packer, and the consumer. If the producer is given full value for his hogs on a quality basis, he will increase his efforts toward producing a more desirable hog. The packer could pay full value for the "honest killers", discount those that do not fulfill requirements of the standards, and still have similar or greater returns. The consumer should receive a higher quality and more desirable product each succeeding year that a merit selling plan is in progress.

However, to encourage and promote the adoption of this system of

TABLE I

STANDARD BARROW AND GILT CARCASS GRADE SCHEDULE[a]

Carcass Length (Inches)[c]	Length and Backfat Thickness Average[b] Backfat Thickness for Carcasses That Grade				
	Choice No. 1	Choice No. 2	Choice No. 3	Medium	Cull
	Inches	Inches	Inches	Inches	Inches
26	1.46-1.78	1.78-2.10	more than 2.10	0.99-1.46	less than 0.99
28	1.53-1.85	1.85-2.17	more than 2.17	1.06-1.53	less than 1.06
30	1.61-1.92	1.92-2.24	more than 2.24	1.13-1.61	less than 1.13
32	1.68-2.00	2.00-2.31	more than 2.31	1.21-1.68	less than 1.21
34	1.75-2.07	2.07-2.39	more than 2.39	1.26-1.75	less than 1.28
36					

[a]Table furnished by the Standardization Grading Division, Livestock Branch, Production and Marketing Administration, United States Department of Agriculture.

[b]Average of measurements made opposite first and last ribs and last lumbar vertebra.

[c]Measured from first rib to lowest point of aitch bone.

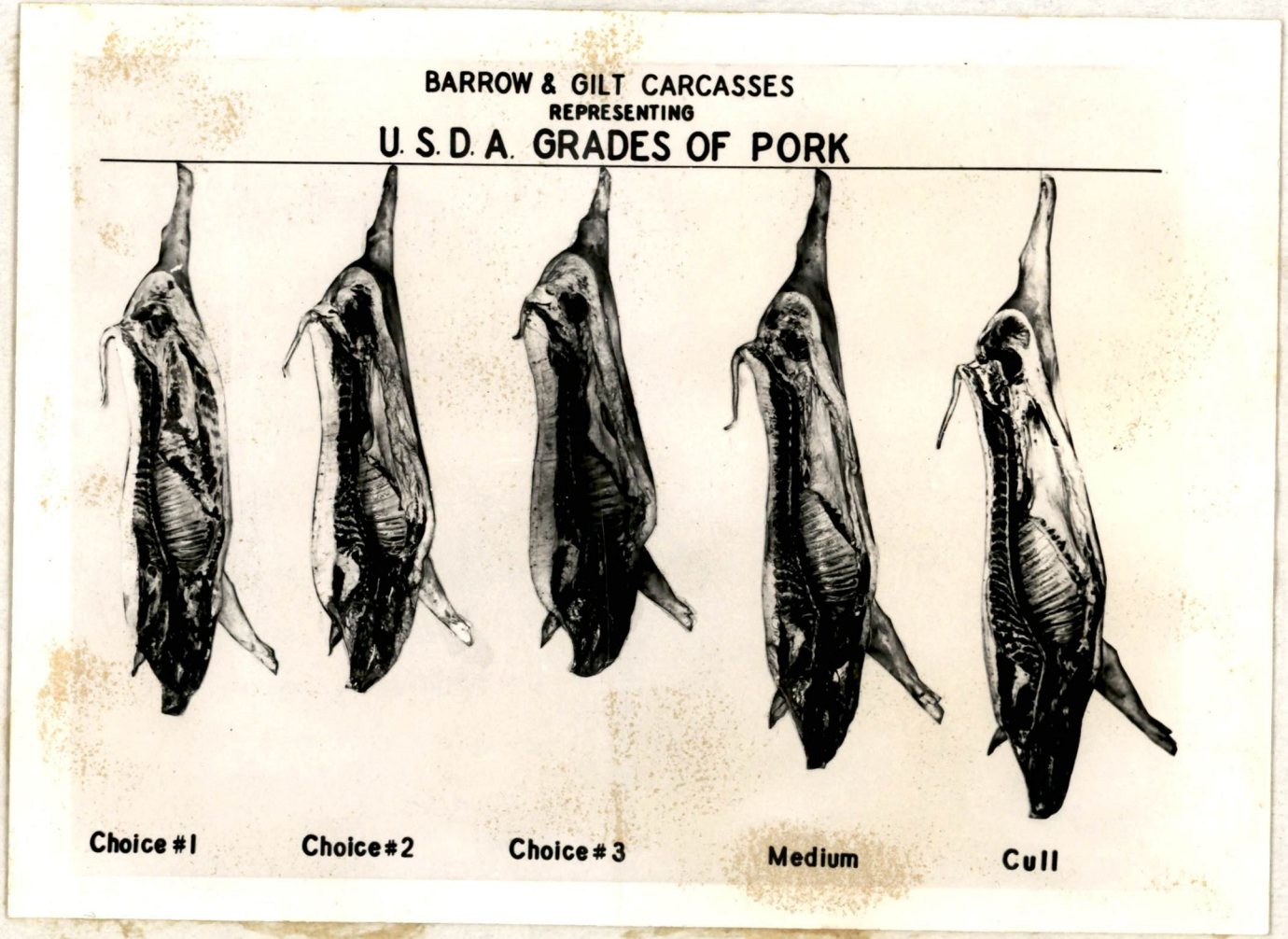

BARROW & GILT CARCASSES
REPRESENTING
U. S. D. A. GRADES OF PORK
Choice #1
Choice #2
Choice #3
Medium
Cull

Figure 1.

buying and selling by the packers and producers, we need more information on the differences in carcass value of various weights and grades of hogs.

There has been a considerable amount of experimental data obtained regarding dressing percentage and yield of primal cuts, but for the most part miscellaneous cuts, particularly offal data, have not received adequate emphasis in pork carcass evaluation. Since the offal is made up of all the by-products of the killing floor with the exception of the carcass, it accounts for the differences found in dressing percentage. Therefore, it would seem that this phase of pork carcass evaluation should warrant further study.

Mr. W. W. Prince, President of the Chicago Union Stockyards, in a recent market talk summarized the present-day hog situation as follows: "The problem of marketing hogs on a quality basis can only be solved by the full cooperation of the entire industry, buyer, salesman, the terminal market, the universities, county farm agents, and the farmers themselves. No one interest can succeed alone. The consumer wants lean meat. The demand from the housewife is overpowering and we must satisfy that demand."

CHAPTER II

REVIEW OF LITERATURE

Research work dealing directly with the combined effects of type and weight on the yield of primal and miscellaneous cuts of pork is limited. Data dealing with offal are still more limited. Those portions of less monetary value classed as miscellaneous cuts have not been given proper consideration in most pork carcass studies. Throughout the literature, there is evidence of carcass weights and measurements being used as indices of the amount of fat, lean, and various cuts, but few, if any, have been used to determine percentage yield of miscellaneous cuts.

Bull et al. (1932, 1933, 1935) found in comparing chuffy, intermediate, and rangy types of swine no significant differences in the dressing percentage among the various types of hogs, although the chuffy hogs dressed slightly higher. They also found that the longer carcasses of the rangy type hogs were due to longer bodies and longer legs. The shorter carcasses were due to shorter bodies, legs, necks, and heads. The covering of fat of the shorter carcasses was considerably thicker. They found that the chuffy type hogs yielded a higher percentage of the fat cuts such as leaf fat, clear plates, bellies, and backfat, and a smaller percentage of feet, neckbones, Boston butts, picnics, loins, and hams.

Based on a study of 155 hogs, United States Department of Agriculture workers (1937) found the length of the carcass from the first rib to the aitch bone (Pubis symphysis) to be a good index of dressing per-

centage and cutting yields. Hogs of approximately 225 pounds were divided into three groups -- short, intermediate, and long on the basis of carcass length. The mean lengths for these groups were 30.1, 31.4, and 32.7 inches, respectively. The hogs of the long bodied group yielded the largest percentage of leaner cuts, including the ham, loin, picnic shoulder, Boston butt, and sausage trimmings. The short bodied hogs were fatter and yielded a larger percentage of the fatter cuts including bacon, leaf fat, backfat, and cutting fat.

Hankins et al. (1939) in a study of 5,000 hogs ranging in weight from 60 to 380 pounds in live weight, found that dressing yield increased from 67 to 80 per cent, with increasing weight and fatness. There was also an increase in percentage bacon, cutting fat consisting of backfat, leaf fat, and fat trimmings; but they found that on a percentage basis, there was a decrease in ham, loin, shoulder, and head. The changes in proportions suggest a relatively heavy deposit of fat on the back, on the belly, and in the posterior region of the body cavity.

Bull and Longwell (1929) in a study of 189 hogs slaughtered at 175 pounds, 225 pounds, and 275 pounds reported that the chuffy type hogs slaughtered at 175 pounds dressed somewhat higher than intermediate or rangy types. There were no significant differences found in carcasses of hogs of different type similarly fed and slaughtered at 225 pounds or 275 pounds except that the dressing percentage of the very rangy hogs was somewhat lower.

Loeffel et al. (1943), in a study of medium to large type pigs ranging in weight from 150 pounds to 400 pounds, reported that the dres-

sing percentage increased from 73.3 per cent (shipper style) in the 150 pound pigs to 82.7 per cent in the 400 pound pigs. During the same time, yield of fat cuts (leaf lard, fat back, belly, clear plate, jowl, and cutting fat) increased from 29.0 per cent of the 150 pound pig to 46.0 per cent of the carcass of the 400 pound pig. Conversely, the percentage of the bony cuts (spareribs and neck bones) showed a corresponding decline. The percentage of mechanically separable fat and lean contained in the 150 pound carcasses was 32 per cent fat and 51 per cent lean, while those carcasses from the 400 pound pigs contained 55 per cent fat and 34 per cent lean.

Hankins and Ellis (1945) found that with an increase in weight of hogs there was a corresponding increase in bacon, fatback, and the cutting fat. They also found that as the weight of hogs increased the dressing percentage increased.

According to Jones (1951), the ratio between lean and fat in the carcass obviously depended upon the degree of finish. As the average backfat thickness increased, the average percentage of lean cuts decreased. With the average backfat thickness held constant, there was no apparent relationship between weight and percentage of lean cuts for all weights. This indicated that the average backfat thickness was much more important than carcass weight in determining the percentage of lean cuts. Within the various carcass-weight groups as the average backfat thickness increased, in most cases, the percentage weight of bellies also increased. Although the percentage of the four high-value lean cuts, loin, ham, picnic, and Boston butt, tended to decrease with increased backfat

thickness, this disadvantage was partially offset by the tendency for the percentage weight of bellies to increase.

Zobrisky et al. (1953) in a study based on 207 hogs weighing an average of 208 pounds, reported that total fat was highly associated with backfat thickness and, to a lesser extent, with body width and length. They also found that cooler shrink and fasting shrink increased with total lean and decreased with total fat and carcass weight.

Based on a study of 4,108 hogs weighing from 205 to 218 pounds, Purdue workers (1941) made observations regarding type and reported as follows: The finish of the hogs as indicated by the thickness of backfat in relation to warm carcass weight increased as the hind legs became shorter in proportion to body length. The average weights of loins, bellies, and hams expressed as percentages of warm carcass weight decreased as the hogs became shorter-legged in comparison with body length.

Zeller and Hetzer (1941) in a study based on the yields of large, intermediate, and small type swine fed to approximately 225 pounds, found that those of the large type were lowest in grade of carcass and yield of fat. The intermediate were lowest in dressing percentage, and highest in combined portion of ham, bacon, and loin obtained from the chilled carcass. Small type hogs were highest in carcass grade, yield of fat, dressing percentage, and lowest in the three important cuts. Those of the intermediate type ranked between the others in each instance except dressing percentage, in which they were lowest. Based on the live weight basis, there was no appreciable difference between the large and small types in the portion of ham, bacon, and loin combined, but the

intermediate type produced somewhat less than either the large or small types.

Hiner (1949) reported the following results in a study of six weight groups of hog carcasses, varying in backfat thickness from 1.2 to 2.2 inches at 0.2 inch intervals, and an average slaughter weight of 215 pounds. The six weight groups of carcasses had 11.0, 13.0, 13.9, 16.7, 17.7, and 19.4 pounds of skinned backfat. Similar increases were noted in cutting fat from 5.8 to 8.2 pounds. Leaf fat increased from 5.0 to 7.6 pounds. The weight of ham changed slightly as backfat thickness increased. However, weight of bacon increased until the latter reached approximately 2.0 inches, then the weight of bacon decreased. Picnic shoulders gradually decreased in weight as backfat thickness increased, whereas the shoulder butt remained approximately the same until backfat thickness of 2.0 inches had been reached, after which there was a sharp decrease.

Craft (1943) from work done at the Regional Swine Breeding Laboratory reported that carcasses from 225 pound pigs should measure 30 to 31 inches from the aitch bone to the first rib, and should show 1.2 to 1.5 inches of backfat of reasonable firmness. Hogs that meet these requirements will have approximately the following measurements on foot: (1) 40 to 42 inches in length along the side from the base of the tail to a point between the ears, (2) 14 inches in depth back of the shoulders, and (3) 11 to 12 inches in width back of the shoulders. Craft states that hogs of this type are called intermediate by Corn Belt breeders and judges.

United States Department of Agriculture workers (1937) in a study of 50 Danish Landrace carcasses compared similar numbers of Duroc Jersey and Poland China carcasses from hogs that had been fed the same ration and were slaughtered at the same weight of 225 pounds, and were graded intermediate in type. A further comparison was made of 240 hogs of similar weight representing several breeds produced in this country.

The dressing yield of the Landrace was 74.15; Duroc Jerseys, 74.82; and the Poland Chinas, 73.62 per cent. The yield of the Landrace breed was slightly lower than that of the Duroc Jerseys.

Duroc Jersey carcasses had the greatest thickness of backfat, the Landrace intermediate, and the Poland China least. In plumpness of ham the Landrace carcasses ranked first, Poland China second, and Duroc Jerseys third.

CHAPTER III

SOURCE OF MATERIALS AND PROCEDURE

All data in this experiment were obtained from 271 hogs which were handled uniformly as to feed, fill, and shrink. These hogs were slaughtered at the University abattoir within the period from September, 1951 to September, 1953. The hogs selected for this experiment were obtained, for the most part, from local markets and were predominantly Poland China, Duroc, Hampshire, and O.I.C. breeds and resulting crosses. The hogs marketed at Knoxville come from the eastern half of Tennessee, Western North Carolina, Virginia, portions of Georgia, and Kentucky. A small percentage of the hogs came from the University herd.

These hogs were divided into six weight groups from 155 pounds to 305 pounds at 30 pound intervals. Each of these groups was subdivided into Chuffy (small), Intermediate (medium), and Rangy (large) types.

After selection from the local market, the hogs were moved to an isolation unit on the University farm and given a standard ration of corn, protein supplement containing alfalfa meal with free access to water and mineral mixture. These hogs were fed on a concrete floor for a minimum of three days and, in some cases, as long as two months. The hogs that were isolated for longer periods of time to reach desired weights were injected with anti-hog Cholera serum. After the hogs were taken from the standard ration, they were weighed to the nearest one-half pound at the feed lot and transported approximately seven miles to the slaughter laboratory, where they were fasted for approximately twenty-

four hours. During the fasting period they had access to water. After the pre-slaughter period they were reweighed and this weight was used as the kill weight.

A modified shipper style was used in slaughtering, that is, the carcass was split; however, the head, leaf fat, and ham trimmings were not removed. Weights to the nearest one-tenth of a pound were obtained of the gastro-intestinal tract (bung, large and small intestines, stomach and all contents, ruffle fat, caul fat, and pancreas), viscera (gastro-intestinal tract plus the liver, lungs, heart, esophagus, and tongue), heart, liver, and tongue. The hot carcass weight was obtained to the nearest one-half pound.

The carcasses were chilled in a thermostatically controlled cooler at 34 to 36 degrees Farenheit for approximately 48 hours. After chilling, each carcass was weighed as a modified shipper style carcass. The head, leaf fat, and ham trimmings were then removed and the carcass reweighed as a packer style carcass. Both sides of the carcasses were then cut up by the same individual into wholesale cuts according to the method adopted by the Reciprocal Meat Conference. This method is quite similar to commercial cutting practices.

The procedure used in breaking down the carcasses into wholesale cuts was as follows: rough shoulders were taken off between the second and third ribs at the attachment of the third thoracic vertebra and at right angles to the general line of the back. Trimming of the rough shoulder was done by lifting the neck bones, removing excess brisket flap, and cutting jowl parallel to the shoulder cut. The rough shoulder

was then divided into a picnic and Boston butt by cutting one-half inch below the exposed blade bone and at right angles to the shoulder cut. The fore foot was removed one-half inch above the knee joint.

The ham was removed between the second and third sacral vertebrae and perpendicular to the line of the shank. These hams were trimmed by removing the flank corner following natural seam on flank side and removing the tail bones including excess fat in this area. After weighing the regular ham the skin was removed leaving one-third of the skin up from hock joint and three-eighths of an inch fat on the ham. A final weight was then taken which represented the yield of skinned ham. The hind foot was removed from the ham at the hock joint.

The rough loin was separated from the rough belly by dividing along a straight line made by snugging tenderloin muscle at posterior end of loin and just missing the ventral portion of the back bone at the anterior edge of the loin. This cut was made with the flat side of the blade bone parallel to the table. Trimming of the loin consisted of removing fatback leaving one-quarter inch of fat on the loin. The spare ribs were removed by splitting the secondary flank muscle along the center line and taking out most of the soft cartilages. Additional trimming was done on the belly by cutting along the teat line and squaring the ends. All wholesale cuts and trimmings were weighed to the nearest one-tenth of a pound.

The measurement data taken during the chilling process, as shown in Figure 2, were length of carcass, depth of backfat thickness at three different locations, and depth of chest cavity. Length of carcass was

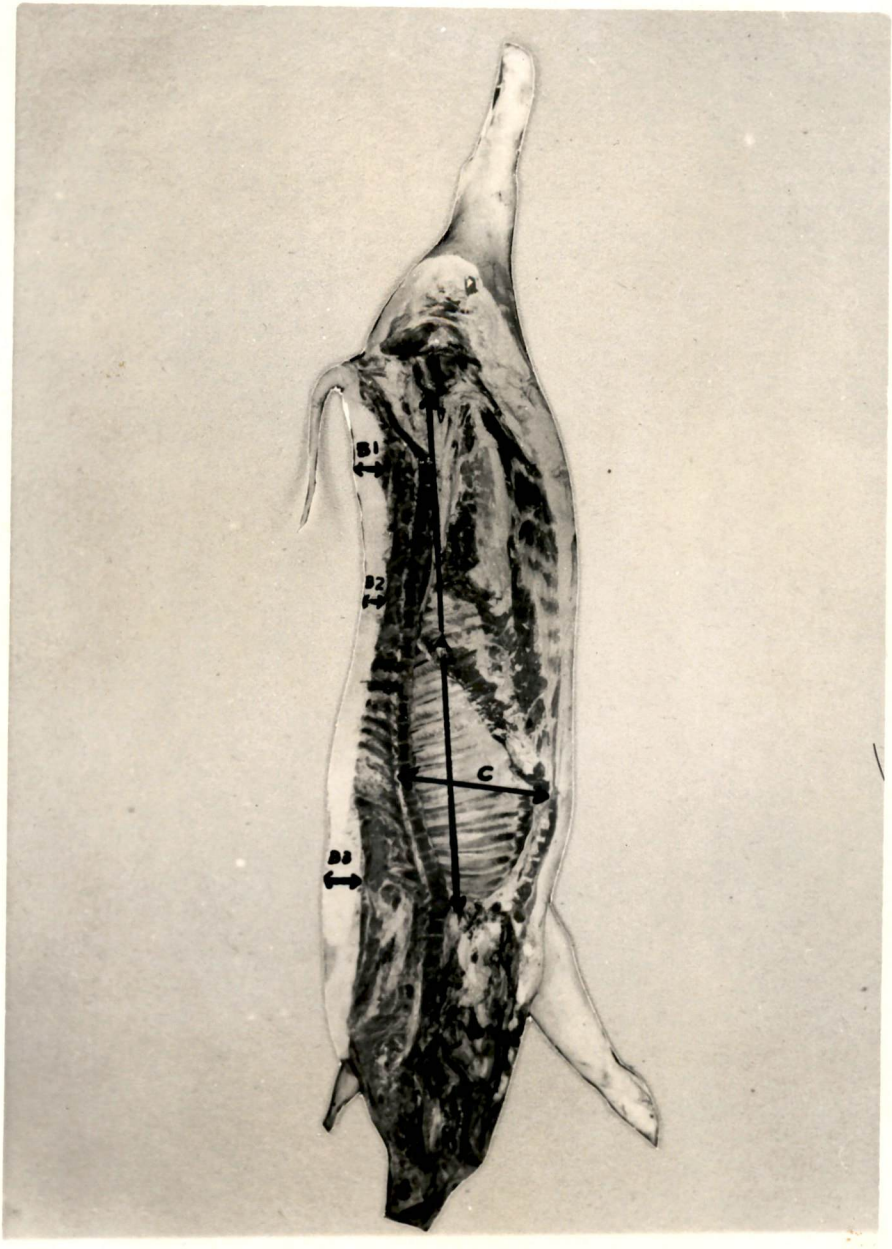


Figure 2. Carcass Measurement Guide: Length of Carcass, Line A; Backfat Thickness, Average of B_1, B_2, B_3; Chest Depth, Line C.

taken as the distance from the anterior edge of the first rib to the anterior edge of the aitch bone. The depth of backfat was measured at the first and last thoracic vertebrae. These measurements were taken from the outside edge of the skin to the separation line between the backfat and underlying muscles. Depth of chest cavity was measured as the distance from the lower edge of the vertebral foramen to the lower edge of the sternum. From the measurements of the length of carcass and the average of three backfat thicknesses, the grade of each carcass was determined by the use of standards set up by the United States Department of Agriculture.

Dressing percentage was based on kill weight after a forty-eight cooler shrink for both packer and shipper styles. The percentage yield of primal cuts was based on kill weight as well as packer and shipper style carcass weight, while miscellaneous cuts were based on kill weight only.

Photographs were made of representative live hogs of each of the six weight groups and each of the three types within the weight groups. The representative carcass photographs included an outside and inside view of the pork carcass as well as a composite of wholesale cuts including the unskinned ham, loin, and belly.

CHAPTER IV

RESULTS AND DISCUSSION

The composite photographs on Page 17 clearly depict the three types of hogs studied in this thesis. This picture also shows the effect of increased weight upon the live hog, carcass, and composite sample of cuts. Some recent workers have referred to the three types as being meaty, intermediate, and fat. In this thesis there has been no attempt to isolate the present day, so-called "meat type hog." However, the data presented will justify a classification for rangy or medium carcasses in pork evaluation.

Approximately one-half of the hogs marketed in the Knoxville area are of the chuffy or overfinished type. The balance is divided about equally between a desirable type hog and one that is too rangy. The picture story of type and weight clearly shows the chuffy type to have a thicker covering of fat throughout than either the intermediate or the rangy. This fat thickness increases as the carcass increases in weight which is in agreement with data observed by Hankins et al. (1939). They reported that with increasing weight from 60 to 380 pounds there was an increase in leaf fat, backfat, and fat trimmings. In a detailed study of the composite cuts produced by rangy carcasses, it will be noted that they have a soft watery appearance. This is generally associated with low quality pork.

In analyzing the slaughter data shown in Table II, there appears to be a difference in dressing percentage among the three types. When

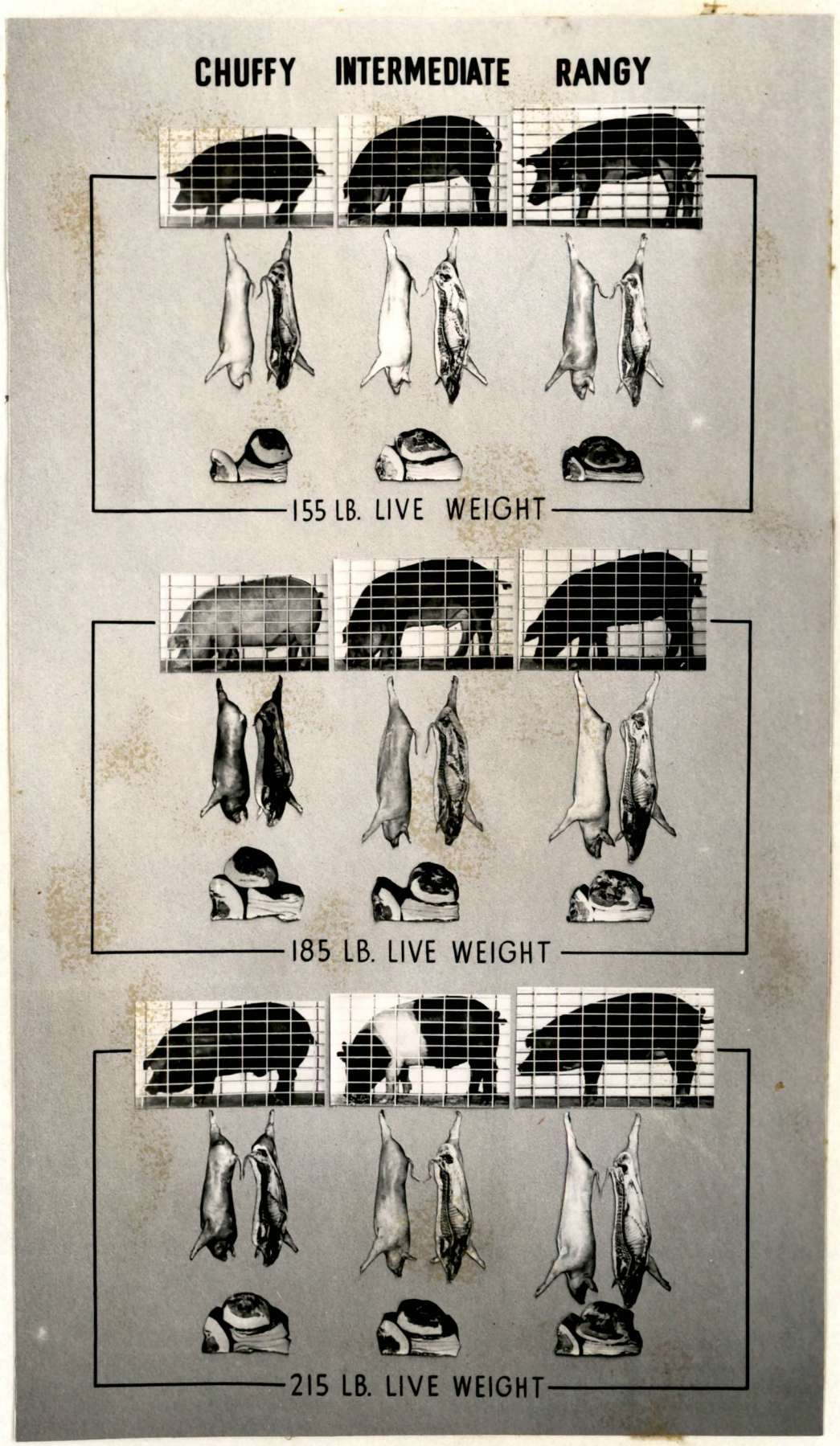


Figure 5. The Three Types and Six Weight Groups of Hogs Together with Their Carcasses and Representative Cuts.

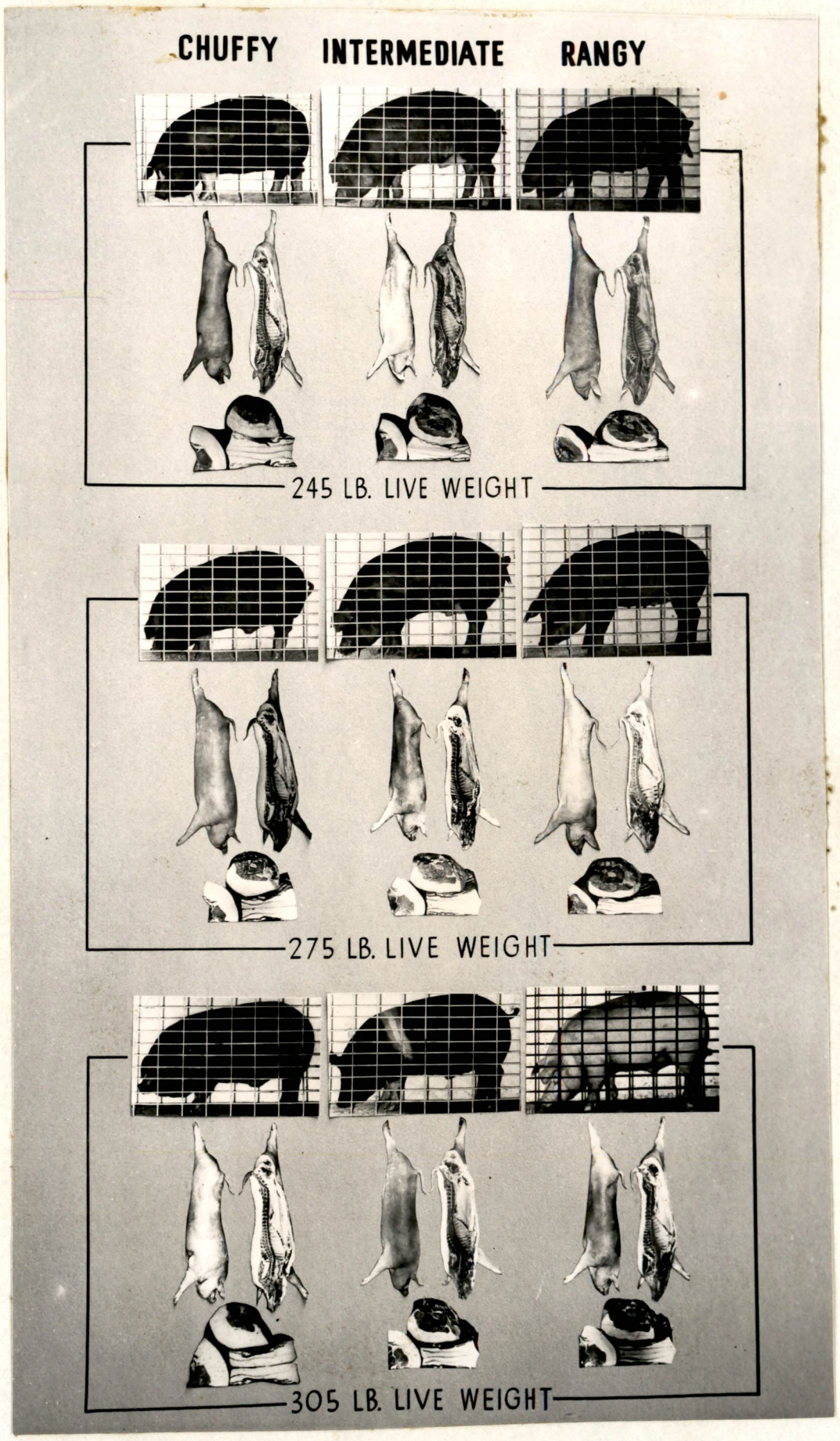


TABLE II

SLAUGHTER DATA

Live Weight Group (pounds)	Type	Number Animals	Kill Weight (pounds)	Cold Weight		Dressing %		24 Hr. Pre-Slaughter Shrink (per cent)	Cooler Shrink (per cent)
				P.S.[a] (pounds)	S.S.[b] (pounds)	P.S.	S.S.		
	Chuffy	10	161.3	121.6	133.4	75.1	82.5	2.0	1.2
155	Intermediate	10	166.3	115.8	129.6	69.6	77.9	3.3	1.6
	Rangy	10	159.0	109.1	122.1	68.8	76.0	1.2	1.3
	Chuffy	18	188.1	134.0	153.4	74.1	81.5	2.4	1.4
185	Intermediate	18	185.0	134.1	142.6	72.8	79.9	3.6	1.3
	Rangy	19	183.0	127.2	140.2	69.2	76.3	3.2	1.9
	Chuffy	17	215.3	158.9	176.4	73.8	81.9	2.4	1.3
215	Intermediate	65	204.1	153.6	167.7	73.6	81.0	4.8	1.6
	Rangy	11	212.2	146.8	162.0	69.2	76.2	3.1	1.5
	Chuffy	11	242.1	181.1	199.6	74.9	82.4	2.4	1.4
245	Intermediate	10	245.0	178.1	194.7	72.1	80.1	2.7	1.4
	Rangy	14	244.0	172.7	190.4	65.6	77.8	2.6	2.3
	Chuffy	12	278.8	197.1	216.1	77.2	84.8	3.1	1.4
275	Intermediate	8	269.5	199.5	220.6	74.1	81.9	2.8	1.1
	Rangy	9	273.6	194.8	218.3	72.0	79.8	2.9	1.2
	Chuffy	9	301.6	233.3	258.0	76.3	84.6	2.0	1.4
305	Intermediate	13	305.0	230.1	246.8	76.0	83.9	1.8	1.4
	Rangy	7	299.2	214.2	241.1	72.4	80.6	1.7	1.7

[a]Packer Style - carcass with head, leaf fat, and ham facing removed.
[b]Shipper Style - carcass with head, leaf fat, and ham facing left on.

the hogs were divided into the five United States Department of Agriculture grades as shown in Table I, the following dressing percentages were observed for the various grades: cull, 67.4; medium, 70.6; choice number one, 72.9; choice number two, 74.2; and choice number three, 76.0. According to these data there is a highly significant correlation of .540 between United States Department of Agriculture grades and dressing percentage. To be highly significant at the one per cent level, a correlation of only .138 is necessary. These data also show a slight trend toward a higher dressing percentage as the weight increases on all three types of hogs.

Since the hogs were killed a modified "shipper style" and later had the head, leaf fat, and ham facing removed converting them to "packer style," it was possible to accurately determine the difference between the two styles of dressing on the two styles of hogs.

It is interesting to note the effect of type upon differences between packer style dressing percentage and shipper style dressing percentage as shown in Table III. The differences are smallest with the chuffy type (7.7 per cent) and the largest with rangy type (8.3 per cent). The intermediate fits in between the chuffy and rangy types. This can be explained by the fact that rangy hogs have a higher percentage of head based on kill weight.

There are wide differences in per cent of viscera, gastro-intestinal tract, head, heart, liver, and tongue among the three types. Table IV shows that rangy hogs have 32 per cent more gastro-intestinal tract, 23 per cent more head, and 18 per cent more heart, liver, and

TABLE III

THE INFLUENCE OF TYPE UPON PACKER AND SHIPPER STYLE
DRESSING PERCENTAGES AND SHRINKAGE

Type	Dressing Percentage		Difference between P.S. and S.S. (per cent)	24 Hr. Pre-Slaughter Shrink (per cent)	48 Hr. Cooler Shrink (per cent)
	P.S.[a]	S.S.[b]			
Chuffy	75.3	83.0	7.7	2.3	1.3
Intermediate	73.0	80.8	7.8	3.2	1.4
Rangy	69.5	77.8	8.3	2.4	1.7

[a]Packer Style - carcass with head, leaf fat, and ham facing removed.
[b]Shipper Style - carcass with head, leaf fat, and ham facing left on.

TABLE IV

PERCENTAGE OFFAL DATA OF THE VARIOUS TYPES AND WEIGHT GROUPS OF HOGS
(BASED ON KILL WEIGHT)

Weight Groups (pounds)	Chuffy				Intermediate				Rangy			
	Viscera	Gastro-Intestinal Tract	Head	Heart Liver Tongue	Viscera	Gastro-Intestinal Tract	Head	Heart Liver Tongue	Viscera	Gastro-Intestinal Tract	Head	Heart Liver Tongue
155	10.6	7.8	3.9	1.8	12.7	9.4	4.6	2.0	15.4	11.4	5.6	2.2
185	11.3	8.4	4.2	1.9	12.3	8.9	4.2	2.1	14.3	10.7	4.9	2.2
215	10.3	7.4	3.9	1.7	11.6	8.5	3.9	1.9	14.3	10.7	4.8	2.1
245	10.6	7.8	3.8	1.8	10.5	8.1	3.8	1.9	13.5	10.2	4.5	2.0
275	9.2	6.9	3.6	1.6	10.6	7.7	3.9	1.6	12.1	8.7	4.2	1.9
305	9.4	6.7	3.6	1.5	9.6	7.1	3.8	1.6	11.4	8.7	4.1	1.7
Avg. Total	10.2	7.5	3.8	1.7	11.2	8.3	4.0	1.9	13.5	10.0	4.7	2.0

tongue than the chuffy type. Some workers have used empty body weight or adjusted live weights as a basis for calculating dressing percentage. According to these data, since hogs vary so widely in percentage of gastro-intestinal tract, a standard shrink should not be used for evaluation of pork carcasses. Empty body weights, where the contents of the stomach and intestines are removed before weighing, may also give a misleading picture. The data in Table IV show that it is not correct to assume that all hogs have the same percentage of gastro-intestinal tract. Furthermore, the offal data show that dressing percentage based on an "equal fill" or empty body weight basis would give a decided advantage to longer hogs with less fat and a definite disadvantage to shorter, fatter hogs.

How can the differences in percentage of gastro-intestinal tract among types be explained? Black et al. (1934) observed what appears to be significant differences in full stomach and intestine weights between English breeds and Brahman crosses with the Brahman crosses having a lower percentage of their kill weight made up of these portions of the viscera. Warwick (1953) reported highly significant differences between paunch contents of Hereford and F_1 crosses with Brahman as part of the cross.

The rangy hog which has a higher percentage of gastro-intestinal tract than either the intermediate or chuffy may have the ability to retain more feed in the tract at any given time. The fact that rangy hogs have a larger percentage of their kill weight made up of such component parts as head, heart, liver, lungs, and tongue further substantiates

the hypothesis that the difference in percentage of gastro-intestinal tract is a real difference and that this difference cannot entirely be explained by varying amounts of fill and shrinkage.

The summary of physical measurements as listed in Table V shows the expected effects that type and weight will have on backfat thickness and carcass length. As the carcasses increased in weight, the backfat thickness and length increased gradually. The usual type differences, that is, chuffy hogs being shorter with a thicker covering of backfat than either the intermediate or rangy, are shown in all six weight groups. The chest depth measurements did not show the same clear-cut trend. It might have been expected that the chuffy hogs would have had the most shallow chest cavities in all the weight groups with the intermediate type being between chuffy and rangy types.

Correlations between the percentage gastro-intestinal tract and chest depth combining all types were made and are given in Table VI. This table shows highly significant correlations at the one per cent level between these two carcass characteristics in the first three weight groups. The correlation for the 245 pound weight group barely misses significance at the five per cent level. However, as the carcasses increased in weight above these four lighter weight groups, no significant correlations were noted. As shown in Table V, the average chest depth varies from 6.5 inches in the 155 pound weight group to 6.7 in the 215 pound weight group with all of these groups having high significant correlations. There is only three-tenths of an inch increase in chest depth in the 245 pound weight group over the 215 pound weight group. On

TABLE V

THE EFFECT OF TYPE AND WEIGHT ON PHYSICAL MEASUREMENTS

Weight Group (pounds)	Type	Chest Depth (inches)	Backfat Thickness (inches)	Length of Carcass (inches)	U.S.D.A. Grade
	Chuffy	5.7	1.8	25.3	Choice No. 2
155	Intermediate	6.6	1.4	27.3	Medium
	Rangy	7.2	1.0	27.9	Cull
Average Measurements		6.5	1.4	26.8	
	Chuffy	5.7	1.8	27.2	Choice No. 2
185	Intermediate	6.5	1.5	28.1	Choice No. 1
	Rangy	7.5	1.1	30.0	Medium
Average Measurements		6.5	1.4	28.4	
	Chuffy	5.7	2.1	27.7	Choice No. 2
215	Intermediate	6.4	1.8	28.7	Choice No. 1
	Rangy	7.9	1.2	30.6	Medium
Average Measurements		6.7	1.7	29.0	
	Chuffy	5.9	2.1	29.3	Choice No. 2
245	Intermediate	7.1	1.8	31.2	Choice No. 1
	Rangy	7.9	1.3	31.7	Medium
Average Measurements		7.0	1.7	30.7	
	Chuffy	7.4	2.3	30.0	Choice No. 3
275	Intermediate	7.7	2.0	31.0	Choice No. 2
	Rangy	8.6	1.6	31.8	Choice No. 1
Average Measurements		7.9	1.9	30.9	
	Chuffy	8.0	2.5	30.6	Choice No. 3
305	Intermediate	7.7	2.3	31.5	Choice No. 3
	Rangy	8.4	2.0	32.0	Choice No. 2
Average Measurements		8.0	2.2	31.3	
Mean Measurement of Values					
	Chuffy	6.4	2.1	28.3	Choice No. 2
	Intermediate	7.1	1.8	29.7	Choice No. 1
	Rangy	7.8	1.4	30.6	Medium

TABLE VI

THE CORRELATIONS OF GASTRO-INTESTINAL TRACT WITH CHEST DEPTH
(WITH ALL TYPES INCLUDED)

Weight Group (Pounds)	Correlation	L.01[a]	L.05[b]
155	.585	.537	.423
185	.646	.487	.381
215	.420	.283	.217
245	.429	.561	.444
275	.248	.487	.381
305	.057	.478	.374

[a]L.01 required for significance at the one per cent level.

[b]L.05 required for significance at the five per cent level.

the other hand, in the two heavy weight groups where there were no significant correlations between the chest depth and percentage gastro-intestinal tract, the average chest measurement has sharply increased to approximately eight inches. The difference in dressing percentage in hogs weighing over 245 pounds may be due to a greater extent to an increase in adipose tissue rather than differences in percentage gastro-intestinal tract. This poses a possibility that chest depth measurement might be a significant measurement for pork carcass evaluation of hogs having live weights of approximately 200 pounds. Carcasses in this weight range with shallow chest cavities will have a higher dressing percentage than those with deeper chest cavities. To further substantiate this observation, Table VII is presented on Page 27. It can be readily observed from this table that as the chest depth increases the dressing percentage decreases and the percentage of gastro-intestinal tract increases.

Table VIII gives the detailed breakdown of the various primal cuts with the summarized total. The usual type effects upon the percentages of these various cuts are in agreement with findings of other workers. Rangy carcasses have a higher percentage of their kill weight made up of primal cuts. This advantage decreases slightly as the live hog weight approaches 300 pounds. The chuffy type carcasses had the lowest percentage of primal cuts with the intermediate fitting in between the other two types. Although there is a slight increase in dressing percentage as hogs attain heavier weights, there seems to be no decrease in primal cuts. However, as weight increases there is a

TABLE VII

COMPARISON OF THE CHEST DEPTH, DRESSING PERCENTAGE, AND PER CENT GASTRO-INTESTINAL TRACT OF THE 215 POUND WEIGHT GROUPS

Chest Depth Group (inches)	Number of Carcasses	Dressing Percentage	Average Chest Depth (inches)	Per Cent Gastro-Intestinal Tract (kill weight)
4-5	1	73.6	4.9	8.9
5-6	23	74.7	5.6	8.3
6-7	39	73.2	6.5	8.4
7-8	18	72.1	7.3	9.2
8-9	1	70.3	8.7	11.9
9-	1	71.0	9.0	14.4

TABLE VIII

THE PERCENTAGE YIELD OF PRIMAL CUTS OF VARIOUS TYPES AND WEIGHT GROUPS

Weight Groups (pounds)	Types	Skinned Ham			Loin			Belly			Boston Butt			Picnic			Total Primal Cuts		
		K.W.[a]	P.S.[b]	S.S.[c]	K.W.	P.S.	S.S.	K.W.	P.S.	S.S.	K.W.	P.S.	S.S.	K.W.	P.S.	S.S.	K.W.	P.S.	S.S.
155	Chuffy	12.2	16.1	14.7	9.6	12.7	11.6	11.6	15.4	14.1	4.2	5.6	5.1	6.5	8.6	7.9	44.0	58.6	53.4
	Intermediate	13.5	19.4	17.3	10.6	15.2	13.6	9.6	13.8	12.3	4.0	5.8	5.2	6.6	9.5	8.5	45.2	61.1	53.4
	Rangy	14.1	20.5	18.3	11.1	16.2	14.4	8.7	12.7	11.4	4.4	6.4	5.8	6.7	9.8	8.8	45.1	65.7	58.7
185	Chuffy	13.0	17.5	15.9	10.0	13.4	12.2	11.3	15.2	13.9	4.0	5.5	5.0	6.3	8.5	7.8	44.8	60.3	54.9
	Intermediate	14.1	19.3	17.6	10.6	14.6	13.3	10.4	14.2	12.9	4.3	5.9	5.4	6.7	9.2	8.4	46.2	63.4	57.7
	Rangy	14.3	20.7	18.8	11.1	16.0	14.5	8.7	12.6	11.4	4.5	6.5	5.9	6.9	10.0	9.1	45.6	65.9	59.8
215	Chuffy	12.3	16.6	15.0	9.6	13.0	12.7	10.9	14.7	13.2	3.9	5.3	4.7	6.2	8.3	7.5	42.9	62.3	56.4
	Intermediate	13.6	18.4	16.8	10.5	14.3	13.0	11.0	15.1	13.5	4.0	5.5	5.0	6.6	8.9	8.1	44.7	64.9	59.8
	Rangy	13.9	20.1	18.2	11.0	15.9	14.4	9.8	13.2	12.0	4.3	6.2	5.6	6.8	9.9	9.0	45.2	65.4	59.4
245	Chuffy	12.8	17.1	15.5	9.6	12.9	11.7	11.5	15.3	13.9	3.9	5.2	4.7	6.5	8.7	7.9	44.4	59.2	53.8
	Intermediate	13.4	18.4	16.9	9.8	13.5	12.3	10.5	14.4	13.2	4.0	5.4	5.0	6.3	8.7	8.0	44.0	60.6	55.5
	Rangy	14.1	20.1	18.2	11.0	15.5	14.1	9.8	13.9	12.6	4.5	6.4	5.8	6.9	9.8	8.9	46.4	65.8	59.7
275	Chuffy	12.8	16.5	15.0	9.3	12.1	11.0	10.8	14.0	12.7	3.9	5.1	4.7	6.5	8.4	7.7	43.4	56.3	51.2
	Intermediate	12.4	16.7	15.1	9.5	12.9	11.6	11.5	15.5	14.0	4.1	5.5	5.0	6.4	8.7	7.8	43.9	59.4	53.7
	Rangy	14.7	20.6	13.4	10.1	14.2	12.7	10.6	14.9	13.3	4.3	6.0	5.4	6.9	9.6	8.6	46.6	65.5	53.5
305	Chuffy	12.0	15.8	14.3	8.9	11.6	10.5	12.5	16.4	14.8	3.8	5.0	4.5	6.3	8.4	7.5	43.6	57.2	51.7
	Intermediate	12.8	16.9	15.8	9.6	12.7	11.8	11.0	14.5	13.5	3.9	5.2	4.8	7.1	9.4	8.7	44.5	58.8	54.8
	Rangy	13.0	18.2	16.2	10.9	14.2	12.6	10.7	15.0	13.3	4.2	5.9	5.2	6.3	8.8	7.8	44.5	62.2	55.1

[a]Kill Weight.
[b]Packer Style - carcass with head, leaf fat, and ham facing removed.
[c]Shipper Style - carcass with head, leaf fat, and ham facing left on.

decided increase in percentage of total fat as given in Table IX which would account for the increase in dressing percentage.

From the standpoint of quality the rangier type carcasses became firmer with a brighter color as the carcasses approached the heavier weights. By the same token the chuffier type carcasses were much wastier and had a higher percentage of internal fat which could not be trimmed away. This produced pork which was highly undesirable from the consumer acceptance and marketability standpoint.

It was further observed from Table VIII that the total percentage of primal cuts based on either packer style carcass weight or shipper style carcass showed considerable variation between weight groups. Since primal cut percentage based on kill weight remains relatively constant, this would indicate that kill weight is a more accurate basis for carcass evaluation from a monetary standpoint.

In the summary of miscellaneous cuts it is interesting to note that the rangy type carcasses produced almost 25 per cent more spareribs of a meatier kind than the chuffy type carcasses. This same trend was noted for heart, liver, tongue, as well as feet, tail, and kidney with the intermediate type hogs fitting in-between. The chuffy type carcasses produced 50 per cent more total fat than the rangy type carcasses. This is particularly true for hogs of the recommended market weight of 200 to 225 pounds.

All these data presented in this thesis point out that there are real differences between types of hogs from the market standpoint. There is a definite need for more emphasis to be placed on the buying of hogs

TABLE IX

THE YIELD OF MISCELLANEOUS CUTS OF VARIOUS TYPES AND WEIGHT GROUPS
(BASED ON KILL WEIGHT ONLY)

Weight Group (pounds)	Type	Spareribs	Neckbones	Feet Tail Kidney	Lean Trim	Leaf Fat	Back Fat	Total Miscellaneous Cuts
	Chuffy	2.0	1.1	2.2	3.5	3.3	9.5	22.6
155	Intermediate	2.1	1.2	2.7	2.9	2.4	6.9	16.1
	Rangy	2.6	1.6	3.0	3.4	2.4	4.7	13.6
	Chuffy	2.0	1.2	2.3	3.5	2.8	9.0	19.7
185	Intermediate	2.2	1.2	2.5	3.6	2.5	7.1	16.2
	Rangy	2.5	1.5	3.0	3.4	1.9	5.0	12.8
	Chuffy	1.9	1.1	2.2	3.1	3.0	9.9	21.6
215	Intermediate	2.1	1.2	1.7	3.7	3.2	8.4	16.6
	Rangy	2.5	1.5	2.9	3.4	2.1	5.3	13.2
	Chuffy	2.0	1.1	2.3	3.7	2.7	9.3	22.5
245	Intermediate	2.0	1.2	2.4	3.4	2.8	8.3	18.8
	Rangy	2.4	1.5	2.6	3.9	2.1	5.8	14.5
	Chuffy	1.9	1.0	2.1	3.6	3.7	10.1	25.0
275	Intermediate	2.2	1.2	2.4	3.7	3.7	10.6	22.0
	Rangy	2.2	1.3	2.4	3.2	3.1	7.6	17.6
	Chuffy	1.8	1.0	1.8	2.7	3.7	11.4	26.5
305	Intermediate	2.0	1.1	2.2	3.6	3.4	10.0	24.3
	Rangy	2.2	1.3	2.4	3.9	3.4	8.5	20.4

at the various markets. Although the longer hogs have been claiming more recognition during the past few years, there is a possibility of placing too much emphasis on length.

CHAPTER V

SUMMARY AND CONCLUSIONS

In analyzing the data presented in this thesis the following findings and conclusions can be made.

An average difference of eight per cent was found between packer and shipper styles of dressing. The largest difference in dressing percentage was found in the rangy type group (8.3 per cent) which can be explained by the fact that they had a higher percentage of head based on kill weight.

Under standard conditions of fill and shrink, rangy (up to 245 pounds) hogs have 32 per cent more gastro-intestinal tract based on kill weight than did the chuffy type. Therefore, any attempt to evaluate hogs on an equal fill or empty body weight would give distinct advantage to the rangy hogs and disadvantage to the chuffy type hogs.

A highly significant correlation was found between percentage gastro-intestinal tract and depth of chest within the live weight groups up to 245 pounds when all three types were combined.

As carcass weight increases backfat thickness, carcass length, and dressing percentage increased gradually. Chest depth measurement did not show the same clear cut trend.

Chest depth may be a significant measurement for pork carcass evaluation of hogs having live weights of 200 pounds. The probability is that carcasses in this weight range with shallow chest cavities will have a higher dressing percentage than those with deeper chest cavities.

These data show that a highly significant correlation exists between the United States Department of Agriculture grade standards for barrow and gilt carcasses and dressing percentage. There is a real difference between chuffy, intermediate, and rangy types.

A decided increase in percentage of total fat as hogs attain heavier weights largely accounts for the increase in dressing percentage.

Rangy carcasses have a higher percentage of their carcass weight made up of primal cuts. However, this advantage decreases slightly as the live hog weight reaches 300 pounds.

Rangy type carcasses produced almost 25 per cent more spareribs of a meatier kind than chuffy type carcasses. This same trend was noted for heart, liver, and tongue as well as feet, tail, and kidney with intermediate hogs fitting in between. The chuffy type carcasses produced 50 per cent more total fat than the rangy type carcasses.

Since the percentage of primal cuts based on kill weight remains relatively more constant with increased weight as compared to either packer style or shipper style carcass weight, kill weight is a more accurate basis for carcass evaluation.

BIBLIOGRAPHY

BIBLIOGRAPHY

Black, W. H., A. T. Semple, and J. L. Lush. 1934. Beef Production and Quality as Influenced by Crossing Brahman with Hereford and Shorthorn Cattle. U.S.D.A. Tech. Bul. 417.

Bull, Sleeter and W. E. Carrol. 1933. Intermediate Hog Most Nearly Meets the Packer's Demand. Illinois Exp. Sta. Annual Report.

Bull, Sleeter and J. H. Longwell. 1929. Type in Swine as Related to Quality of Pork. Univ. of Illinois Agr. Exp. Sta. Bul. 322.

Bull, Sleeter, W. E. Carrol, F. C. Olson, and George Hunter. 1932. Swine Type Studies. Illinois Exp. Sta. to the Annual Meat Conference.

Bull, Sleeter, W. E. Carrol, F. C. Olson, and George Hunter. 1935. Value of Present-Day Swine Types in Meeting Changed Consumer Demand. Illinois Agr. Exp. Sta. Bul. 366.

Craft, W. A. 1946. Swine Breeding Research at the Regional Swine Breeding Laboratory. Report of the Review Committee of Conference on Cooperative Meat Investigations 5:169.

Hankins, O. G. and N. R. Ellis. 1945. Composition and Nutritive Value of Pork as Related to Weight of Animal and Cuts. U.S.D.A. Circ. 731.

Hankins, O. G., N. R. Ellis, and H. W. Titus. 1939. Growth, Fattening, and Meat Production. U.S.D.A. Yearbook, p. 450.

Hiner, R. L. 1949. Standard Method of Cutting Pork Carcasses for Determining the Yield and Percentage of Wholesale Cuts. Second Annual Reciprocal Meat Conference Report.

Jones, Robert C. 1951. Factors Affecting the Cutout Value of Hog Carcasses. Master's Thesis, Dept. of Agr. Econ., Purdue Univ.

Loeffel, W. J., W. W. Derrick, and Matilda Peters. 1943. Weight of Pigs as It Affects Gains and Carcass Qualities. Nebraska Exp. Sta. Bul. 351.

Purdue University Workers. 1941. The Type Pendulum. Purdue Univ. Agr. Exp. Sta. Mimeo. Circ.

United States Department of Agriculture Workers. 1937. Reliability of Certain Hog Carcass Measurements to Predict Yield of Different Cuts. Report of the Chief of the Bureau of Animal Industry, p. 12.

United States Department of Agriculture Workers. 1937. A Carcass Comparison of Danish Landrace and American Breeds. Report of the Review Committee of the Conference on Meat Investigations I. Ref. 6 and 7.

Warwick, B. L. 1953. Comparative Carcass Characteristics of Brahman Crossbreeds and British Type Cattle. Report of Annual Meeting S-10 Technical Committee, p. 27.

Zeller, J. H. and H. O. Hetzer. 1948. Influence of Type on Production Efficiency. U.S.D.A. Circ. 698.

Zobrisky, Steve, D. E. Brady, and J. F. Lasley. 1953. Significant Relationships in Pork Carcass Evaluation. Jour. Animal Sci. 33(4):904.