A COMPARISON OF CARCASSES OF PIGS FROM DIFFERENT LINES OF BREEDING

A COMPARISON OF CARCASSES OF PIGS FROM DIFFERENT LINES OF BREEDING

By

WESLEY E. JAMES

Bachelor of Science

Oklahoma Agriculture and Mechanical College

Stillwater, Oklahoma

1947

Submitted to the Department of Animal Husbandry

Oklahoma Agricultural and Mechanical College

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

1948

APPROVED BY:

J. A. Whatley
Chairman, Thesis Committee

A. E. Darlow
Head of the Department

D. C. McIntosh
Dean of the Graduate School

ACKNOWLEDGMENT

The author wishes to express his appreciation for the assistance and many valuable suggestions given him by Dr. J. A. Whatley, Jr. of the Department of Animal Husbandry in the planning and execution of this study.

TABLE OF CONTENTS

INTRODUCTION

Carcass characteristics are of prime importance in any swine breeding program. These characteristics may become important factors in determining the development and evaluation of new lines of inbred swine.

The visible characteristics of the live hog do not always exhibit the true characteristics of the carcass. The research worker is faced with the problem of finding adequate methods of evaluating these hidden merits in the carcass. Detailed studies are thus necessary to devise methods of evaluating certain qualities of the hog carcass.

With these problems in mind the workers at the Oklahoma Experiment station attempted to evaluate carcass qualities by using a carcass index. This study is only a part of a much broader project - an experiment with several lines of inbred Duroc swine. It was desired to determine the relative merits of the different lines through a detailed study of carcasses.

The results of this carcass study, together with a review of material gathered by other workers in closely parallel fields, are presented in this report.

REVIEW OF LITERATURE

Literature which deals specifically with the comparison of inbred lines by using carcass measurements is extremely limited. However, many studies have been made of other carcass problems which closely parallel work of this type.

Dickerson (1943) analyzed the carcass data obtained from 501 Poland China, 108 Danish Landrace, and 54 Poland China-Landrace crossbred pigs from Record of Performance litters at the Iowa station. A special study was made of the changes in hog carcasses associated with genetic superiority in economy of gain. The data revealed that genetic superiority in growth rate and feed requirement from weaning to final weight were significantly correlated with thicker back fat and larger yield of fat, but smaller yields of lean meat, at 225 pounds live weight. Also, the observed genetic variation in the yield of fat greatly exceeded the genetic variation in yield of lean.

Blunn and Baker (1943) likewise found a significant positive relationship between the rate of gain and fat deposition. Their data were taken from 416 hogs, slaughtered over a five-year period. Simple correlations revealed a low but positive correlation between the rate of gain and the depth of back fat. A positive correlation existed between the ham circumference and the rate of gain, but this was not significant.

A study of the genetic and environmental influences indicated that 12 percent of the variance in back fat thickness and 23 percent of the variance in length of hind leg were a result of hereditary factors. Heritability estimates of from 12 to 23 percent were obtained for ham circumference, rate of gain from 56 to 112 days of age, rate of gain from 112 days of age to time of slaughter, and rate of gain from 56 days to time of slaughter.

Dickerson, McClurg, and Beard (1943) analyzed the data on 278 Poland China hogs, slaughtered at approximately 225 pounds, to determine the relationship between carcass conformation and value per unit of live weight, as calculated from yields and prices of wholesale cuts. Measurements of external conformation indicated differences in fat thickness, length of bone, and muscle thickness. However, these were less accurate than measurements of muscling for predicting carcass value. The best measure of muscling from wholesale cuts could be obtained from the ham lean area. The loin eye muscle indicated muscling and carcass value more accurately than the ham lean area, but the fact that the loin had to be mutilated to obtain the measurement was a disadvantage in this method. The data also indicated that the value of the carcass increased as the thickness of the flank increased. Carcass value did not increase with an increase in thickness of back fat. This was also found to be true in studies by Helmreich and Roth (1930), and Scott (1929). It was noted that smaller yields of lean were associated with thicker back fat.

Bogart, Weaver, and Comfort (1940) obtained data on live hog scores, carcass measurements, and cut-out values from 69 Poland China barrows. The carcass measurements and cut-out values were obtained by using similar cutting and measuring methods as were used in the present study.

These workers reported a significant correlation coefficient of + .37 between percentage of loin and carcass length, as compared to a correlation coefficient of + .16 between percentage of loin and body length. The body length was a measurement on the live hog from poll to tail. A correlation of - .46 existed between the percentage of loin and body width of the live hog. The data did not indicate any significant correlation of ham percentage with any of the items measured.

The data also revealed that shorter carcasses had a lower percentage of loin yield than longer carcasses. This substantiates the general observations on data concerning Line 5, one of the inbred lines included in this report, in regard to length of carcass and yield of loin.

From the data obtained by Willman and Krider (1943) on 393 hog carcasses, a highly significant correlation between the area of the loin eye muscle and area of the lean face of the ham was shown to exist. This supports the statement by Dickerson, et al. (1943) that the best measure for the muscling of the wholesale cuts was the lean area of the ham.

Willman and Krider also found a correlation of the loin eye muscle with the weight of the carcass, but the loin eye muscle had a higher correlation with other factors, such as dressed weight, ham circumference, and lean area of the ham face. Little or no correlation existed between the finish of the pig and the development of the loin eye muscle, or in the size of the lean face of the ham.

Hazel, Reinmiller, and Baker (1943) studied the relationship between growth rate and eight carcass measurements. These measurements included market grade, length and depth of body, ham index, and the thickness of shoulder, as well as the flank, ham, and back fat. These workers studied data on 152 carcasses. The correlations between the carcass measurements and final market weight varied from + .18 to + .32, except for thickness of flank where the correlation was practically zero. The correlations between 180 day weight and depth of body, ham index, and thickness of back fat were - .17, + .23, and - .18 respectively. The correlations of the other measurements and 180 day weight were smaller and not of significant statistical value. The correlation of + .23 between 180 day weight and thickness of back fat is verified by later work at the same station (Blunn

and Baker, 1947).

Loeffel, Derrick, and Peters (1943) made a study on the effect of weight on the gain and carcass qualities of hogs. The data were based on studies of hogs weighing 150, 175, 200, 225, 250, 300, 350, and 400 pounds. Measurements were taken on five hogs in each weight class. The pigs were slaughtered shipper style; head on, leaf fat in, but the hams were not faced. The carcasses were split down the back.

The dressing yield was computed on the basis of hot weight rather than chilled weight. The hot weights were considered more reliable because of necessary fluctuations in chilling time, and variations in the load of the chill room, with consequent variations in humidity. This was borne out by the variation in chilling shrinkage, although not significant, which varied from 0.67 to 1.80 percent. Packers consider that the chilling shrink varies from one to two percent. An increase of 10 percent in the dressing yield from the 150 pound group to the 400 pound group was indicated. This increase was not always regular in nature, due to the fill variations in the animals. The amount of fat increased from 32.4 percent of the carcasses of the 150 pound pigs to 55 percent of the carcasses of the 400 pound pigs. The 150 pound pigs contained 51.5 percent of lean muscle, while the 400 pound group contained only 34 percent of lean muscle.

Taking data on 1,116 carcasses slaughtered during a three year period, Scott (1929) studied the dressing percentage, cutting variation, depth of fat or condition, and the size of carcass. These were considered important factors influencing the percentage of yield obtained. Scott stated that dressing percentage generally has considerable influence on the yield of wholesale cuts. Increases in carcass yield decrease the percentage yield on the primal cuts.

The data indicated that hogs which have a high dressing percentage tend to increase the yield of loin by virtue of their dressing qualities. Yet they lower the loin yield because of high percentage of fat in the carcass. This is also borne out by the carcass studies of Helmreich and Roth (1930), and Dickerson, et al. (1943). Scott found the two factors, dressing percentage and condition, to be counteracting in so far as their influence on loin yield are concerned.

A study of the data for the effect of cutting variation did not reveal significant values, with the exception of comparisons made with less than 4 carcasses. By grouping the data from four or more carcasses, the cutting variation tended to balance out, making it possible to disregard the cutting error when comparing the yields of large numbers of hogs.

It has been shown statistically that as a hog puts on finish, the percentage of lean cuts in the carcass decreases, while the percentage of fat cuts increases. Loeffel, et al. (1943) observed these same conditions in analyzing their data. A study of the data on the depth of fat covering on 997 carcasses disclosed that an increase in the depth of fat from 0.75 to 2.0 inches resulted in an increase in percentage of bacon sides amounting to 6.5 percent. At the same time, the back fat increased 5.25 percent. However, as the back fat increased from 0.75 to 2.0 inches, the percentage of loin decreased 3.25 percent, and percentage of hams decreased 2.5 percent.

Helmreich and Roth (1930) obtained results similar to those of Scott (1929). These workers collected and analyzed data on 140 butcher hogs representing various Government weights and grades. The results showed the heavy hogs to have a higher dressing percentag than lighter pigs of the same grade. In comparing the percentage of cuts with the grade of the

carcass, they found that the percentage of rough belly, fat back, and fat trimmings, based on carcass weights, increased as the grades of hogs improved. The percentage of lean cuts; ham, shoulder, and loin, increased as the grades of the hogs decreased. This relationship is of great practical importance to the hog producer and the meat packer. While trying to obtain the most efficient utilization of grain, the farmer has decreased the value of the carcass. Dickerson (1943) found that superiority in growth rate and feed requirement from weaning to final weight were significantly correlated with thicker back fat and higher yield of fat.

McMeekan (1941) disclosed the existence of a high correlation between the thickness of back fat and a chemical determination of the amount of fat in the body of the pig.

Studies made by Winkler, et al. (1941) on the quality of bacon carcasses indicated that good quality in a bacon carcass varies directly with the size of the loin eye muscle and indirectly with the fat content.

Scott (1927) secured information concerning the percentage, quality, and value of wholesale cuts obtained from hogs with different records of production. The test carcasses were grouped according to length. All carcasses which fell within 5 centimeters of the mean, 129.38, were classed as medium, while all carcasses over 134.38 centimeters in length were classed as medium-plus. All carcasses less than 124.38 centimeters in length were classed in the medium-minus group.

The data indicated that the length of lard hogs has only slight effect on the percentage of wholesale cuts. These results are contrary to those reported by Bogart, et al. (1940) and data analyzed in this paper. Bogart reported a significant correlation of + .37 between percentage of loin and body length.

Scott found condition to be a factor of considerable importance in determining the percentage of wholesale cuts. As was later verified by Helmreich and Roth (1930), Scott also found that an increase in the fat content of the carcass increased the percentage yield of sides, fat backs, and other fat cuts; while the percentage of lean cuts; loins, hams, and shoulders, decreased.

From these same data Scott observed that carcasses which have a high proportion of thickness in ham lean to length of body will have a harder fat at a lower degree of finish than carcasses with a low proportion of ham lean to length of body.

Hankins (1940) in a study on the relationship between type in hogs and plumpness of the hams, concluded that type has a definite effect on the ratio of meat to bone in the ham. A marked variation in ham plumpness associated with variation in type was indicated by the data. The ratio of ham circumference to the length of the carcass decreased as the weight of the carcass increased.

Ellis and Zeller (1931) fed three lots of swine on a basal ration of corn and supplement to determine the "utilization of feed by swine as affected by the level of intake". One lot received full feed, one lot received three-fourths of a full ration, and the remaining lot only half of a full ration. Their data showed that pigs on limited rations will produce carcasses of higher value, due to the increased yield of higher priced cuts. The ham and loin yields increased, while the yields of belly and total fat decreased. The limited feeding method was not without its disadvantages, as they cite for example, "the firmness of the carcasses was medium to soft".

Helser (1929) found very little correlation between dressing percentage and cut-out value. The data indicated a negative correlation between the size of middle girth and cut-out value. This negative correlation did not

exist after the pig attained a weight of about 210 pounds.

Bull and Longwell (1929) studied data from hogs of the Very Chuffy, Chuffy, Intermediate, Rangy and Very Rangy types of hogs, in an attempt to determine the desirability of carcasses produced by the different types. The data included carcasses and cuts of 189 hogs slaughtered at 175, 225, and 275 pounds. Their data did not show any significant differences in the dressing percentages of the different types when slaughtered near the 225 pound range. When slaughtered at 175 pounds, the Very Chuffy type dressed higher than the other types; while at 275 pounds, the Very Rangy type dressed out lower than other types.

These findings compare favorably with those of Scott (1929) who found that condition, or depth of fat, greatly influenced the dressing percent and cut-out yields of the carcass.

SOURCE OF DATA

The 94 carcasses included in this study were taken from hogs produced in a Swine Breeding Project at the Oklahoma Experiment station in cooperation with the Regional Swine Breeding Laboratory. The carcasses were from three inbred lines and one linecross as indicated in Table 1. The data cover three slaughter periods: Fall 1946, Spring 1947, and Fall 1947. Lines 3, 5, and 7 have been bred as closed lines since 1938, 1945, and 1945, respectively. The percentage of inbreeding in these lines was approximately 23 percent for Line 3, 15 percent for Line 5, and 22 percent for Line 7. The linecross was the result of a cross of inbred lines, 1 and 3. Carcass data from this cross were obtained only in the fall of 1946. The hogs slaughtered in 1946 were group fed on pasture, while those slaughtered in 1947 were fed in dry lot from weaning time until slaughter.

After reaching a weight of 215 to 235 pounds, those hogs not retained for breeding stock were taken off feed for a period of 24 hours then slaughtered at the college abattoir.

TABLE 1

Number of Hogs From Each Line Slaughtered Each Season

Lines	Seasons Slaughtered			Total
	Fall 1946	Spring 1947	Fall 1947	
3	7	11	6	24
5	0	15	11	26
7	10	11	10	31
1x3	13			13

PROCEDURE

A. Slaughtering and Cutting Methods:

The pigs were slaughtered regulation packer style; head removed, jowl left on the carcass, leaf fat taken out, and the back split.

After chilling for at least 24 hours, the carcasses were weighed and divided into wholesale cuts. The effects of the chilling time and the humidity of the cooler were not considered (Loeffel, et al. 1943).

The carcasses were divided into the wholesale cuts: ham, loin, belly, and shoulder. The regular hams were removed by cutting two inches in front of the aitch bone, at right angles to the shank. The shoulder was separated by cutting across the third rib, perpendicular to the vertebral column. The loin was removed by cutting in a straight line from the lower edge of the tenderloin muscle, on the ham end, to a point as near the back bone, on the blade end, as possible. The spare ribs were taken out and the belly trimmed to uniform width.

The shoulders were trimmed "New York style", and the loins were trimmed as uniformly as possible, leaving approximately 1/4 inch of fat. The feet were removed at the center of the hock and the knee.

Both halves of the carcass were separated into wholesale cuts. Thus the weights given for the wholesale cuts include cuts from both halves of the carcass.

The shrunk live weights were taken at the time of slaughter, after the hogs had been off feed for 24 hours. Carcass weights were taken after the carcasses had been in the chilling room for 24 hours or longer.

Dressing percentage is based on the shrunk live weights and the chilled carcass weights.

B. Measurements:

The hams were measured for plumpness and ham muscling. Ham plumpness was determined by the ratio, $\frac{\text{circumference}}{\text{length}} \times 100$. The length of ham was measured from the hock to the lower end of the aitch bone. The circumference was measured at a point halfway between the aitch bone and the hock. The circumference measurement is influenced by the amount of fat covering on the ham, as well as the length of the ham. The quantitative measurement of ham muscle was computed from the width and depth of the lean on the ham face.

In determining the loin muscle index, measurements were taken of the width and depth of the eye-muscle at the last rib. To obtain this measurement it was necessary to mutilate the loin by cutting it at the last rib.

The back fat measurements indicate the uniformity of back fat covering as well as the thickness of the covering. The depth of back fat was measured at three points; over the third rib, over the last rib, and over the sixth lumbar vertebra.

The length of carcass was measured from a point at the forward edge of the first rib, to the lower portion of the aitch bone, as the carcass hangs normally.

C. The Carcass Index:

The carcass index consists of the cut-out index and the quality index. The cut-out index was determined by multiplying the yield of each wholesale cut, as a percentage of the shrunk live weight, by the relative price value for that cut.

The relative prices were based on the average of Chicago weekly quotations during the five year period from 1937 through 1941. In computing the value of the various cuts, the loin was given a value of one, while other cuts were assigned a value proportionate to that of the loin. The cut-out index is therefore the yield of the hog carcass expressed in terms of equivalent value of loin.

The relative values, as determined from the Chicago market, were: ham, 0.929; loin, 1.00; belly, 0.804; shoulder, 0.797; fat trim, 0.348; and lean trim, 0.561.

The relative values are based on the average prices of the different cuts for the five year period. The average of prices for the five year period and the relative value of each cut are shown in Table 2.

TABLE 2

Yearly Average, Five Year Average, and Relative Value of Carcass Cuts; Based on Chicago Quotations

Carcass Cuts	1937	1938	1939	1940	1941	Average	Relative Value
Ham	17.8	16.1	14.8	13.0	19.7	16.33	0.929
Loin	21.9	17.8	15.6	13.6	19.1	17.57	1.000
Belly	18.7	14.9	11.4	9.5	16.1	14.13	0.804
Skinned Shoulder	16.5	13.8	12.1	10.6	16.9	14.01	0.797
Fat Trim	8.8	6.1	4.8	4.0	6.8	6.11	0.348
Lean Trim	13.3	9.36	7.6	6.7	12.2	9.86	0.561

It must be borne in mind that these relative values are average values for the specific period covered, and would not apply should market trends change in such a manner as to alter the relative values.

The quality index consists of those measurements which are believed to reflect the differences in the quality of ham and loin. This would prevent too much importance being placed on excessively fat carcasses or carcasses which are deficient in lean area. Carcasses not showing a uniform back fat covering are also discounted under the quality index system.

The following formula (Dickerson, 1946) was used to determine the carcass index.

$$\text{Index} = (\Sigma Yr) + (.04P + .4L + .2H - .5B - 1.5V).$$

Where: Y = Yield of wholesale cuts in percent of shrunk live weight (W).

r = Relative price, based on the average of the Chicago weekly quotations for a five year period, 1937 to 1941 inclusive.

P = Ham plumpness index $\left(\frac{\text{circumference}}{\text{length}} \times 100\right)$.

L = Loin eye muscle index (width x depth of eye muscle).

H = Ham muscle index (width x depth of lean on ham face).

B = Deviation of $\left[\text{sum of 3 back fat measurements } \left(\frac{W - 210}{40}\right)\right]$ from the optimum of 4.5 inches.

V = Back fat range (difference between the thickest and thinnest back fat measurements).

The term $\left(\frac{W - 210}{40}\right)$ in computing B permits hogs above or below 210 pounds, having more or less fat than the optimum, 4.5 inches, from being discounted.

The factors expressed in the formula were used so that each of the quality items would make equal contribution to the standard deviation.

These factors were determined by Dickerson (1946) who arbitrarily assumed, in determining how much attention should be given to the quality items and the cut-out value, that a standard deviation of 3 percent in the price of these wholesale cuts would be justified because of the differences in their quality. Each quality item contributes approximately .3 units to the standard deviation. The standard deviation of the cut-out values was approximately 3 percent of the mean.

RESULTS

The line averages are presented in Table 3. The summary of the analyses of variance are shown in Tables 4, 5, and 6. The methods followed in making the various analyses are presented by Snedecor (1946). The error terms used for the analyses of variance were the mean squares of the variation within lines. The analysis of variance of the data on the carcass index did not indicate any significant difference between lines.

The analysis of data did not indicate any significant differences between lines in cut-out index, yet when the components of this index were analyzed separately, significant differences were observed for certain items.

The differences between lines in percentage yield of ham, and percentage of fat trim were significant.

The variations between lines in percentage of belly yield, and the carcass length were found to be highly significant.

A comparison of the line averages reveals that the carcasses of Line 5 were longer and yielded a greater percentage of belly and ham than the carcasses of the other lines. Bogart, et al. (1940) found that length of carcasses had a significant influence on the yield of the carcass. The line averages also show that Line 5 had thinner back fat and a lower percentage yield of fat trim than the other lines.

Line 5 had a greater range in back fat measurements than any of the other lines which indicates a lack of uniformity in back fat covering as compared to the other three lines.

TABLE 3

Line Averages for Various Items of the Carcass Data

Lines	3		5		7		1x3	
No. Carcasses	24		26		31		13	
Shrunk Live Wt. (lbs.)	215.0		214.2		216.1		215.8	
Dressing Percentage	71.1		72.1		71.6		71.4	
Length Carcass (in.)	29.2		29.9		28.6		28.9	
Cut-out Index*	49.77		50.42		50.16		49.66	
Quality Index**	11.16		10.66		11.27			
Carcass Index**	60.79		61.08		61.48			
Range of Carcass Index	6.62		7.16		9.35			
Cut-out Index*	Cut-out %	Relative Value	Cut-out %	Relative Value	Cut-out %	Relative Value	Cut-out %	Relative Value
% Ham	14.4	13.4	14.5	13.5	14.0	13.0	14.1	13.1
% Loin	12.0	12.0	12.2	12.2	12.0	12.0	11.7	11.7
% Belly	8.9	7.1	9.6	7.7	9.2	7.4	8.6	6.9
% Shoulder	13.5	10.8	13.5	10.7	13.8	11.0	13.4	10.6
% Fat Trim	14.8	5.2	14.7	5.1	15.3	5.3	16.8	5.8
% Lean Trim	2.3	1.3	2.1	1.2	2.3	1.3	2.6	1.5
Quality Index	Measure-ments	Relative Value	Measure-ments	Relative Value	Measure-ments	Relative Value	Measure-ments	Relative Value
Σ 3 Back Fat Measure-ments (in.)	5.24	- .31	5.03	- .22	5.32	- .34	5.43	- .39
Range in Back Fat (in.)	.83	-1.25	.96	-1.44	.82	-1.23	.88	-1.32
Ham Plumpness Index**	143.8	5.75	139.0	5.56	141.6	5.66		
Ham Muscle Index	26.5	5.3	25.0	5.0	25.8	5.2	25.6	5.1
Loin Muscle Index	4.7	1.9	4.5	1.8	5.1	2.0	5.0	2.0

* Based on percentage of shrunk live weight.

** Includes only 17 hogs in Line 3 and 21 hogs in Line 7.

TABLE 4

Summary of Analyses of Variance of Carcass Index, Quality Index, and Ham Plumpness Index

Sources of Variation	$D/_F$	MEAN SQUARES		
		Carcass Index	Quality Index	Ham Plumpness Index
Total	63	3.5649	1.2348	0.1213
Between Lines	2	2.320	2.440	0.200
Within Lines	61	3.6057	1.1952	0.1186

TABLE 5

Summary of Analyses of Variance of Cut-out Index and Percentage Yield of Primal Cuts

Sources of Variation	D/F	MEAN SQUARES						
		Cut-out Index	% Ham	% Loin	% Belly	% Skinned Shoulder	% Fat Trim	% Lean Trim
Total	93	1.4824	0.5237	0.8725	0.8527	0.7791	3.6532	0.6645
Between Lines	3	2.5766	1.4233*	0.8033	3.7133**	0.9433	13.5467*	0.6667
Within Lines	90	1.4459	0.4939	0.8748	0.7573	0.7737	3.9901	0.6644

* Significant at .05 level.
** Significant at .01 level.

TABLE 6

Summary of Analyses of Variance of Four Components of Quality Index, and Carcass Length and Dressing Percentage

Source of Variation	D_F	MEAN SQUARES					
		Range in Back Fat	Σ 3 Back Fat Measure-ments	Ham Muscle Index	Loin Muscle Index	Carcass Length	Dressing Percentage
Total	93	0.0523	0.4745	0.3066	0.1046	0.8828	2.5416
Between Lines	3	0.110	0.6233	0.3767	0.300*	8.0466**	4.320
Within Lines	90	0.0503	0.4696	0.3042	0.0981	0.6440	2.4823

* Significant at .05 level.
** Significant at .01 level.

The loin muscle index was the only item of the quality index which indicated a significant difference between lines. A study of the line averages indicates that Line 7 was superior to the other lines in loin muscle index, and also in quality as measured by the quality portion of the index. However, this difference in the quality index was not significant.

The data on the other items of the carcass index did not indicate any significant differences between the lines.

DISCUSSION

The carcass index was formulated with the aim of having some means of scoring individual carcasses and using this score to determine differences between lines of different breeding.

The analysis of variance of the carcass indexes did not reveal any significant difference between lines. A study of the carcass indexes and their components indicate that the line differences are mitigated by the counterbalancing effect of the components of the index. If one line were superior to the other lines in the cut-out index but inferior in the quality index while the opposite were true of another line, the carcass indexes would tend to be equalized.

The cut-out index, a component of the carcass index, gives credit to the carcasses yielding high in primal cuts and discounts the carcasses which have a high percentage of fat trim.

The quality portion of the carcass index discounts a carcass that is over finished as well as one that is under finished. Other components of the quality index credit carcasses having larger lean areas in the ham and loin.

Conclusive statements concerning the significance of the variation of fat trim cannot be made without reservation until more data are available. Data on the percentage yield of fat trim may be confounded by seasonal and feeding differences. Carcass data on the Linecross 1x3 were obtained only in the fall of 1946. The pigs slaughtered in 1946 were group fed on pasture while those slaughtered in 1947 were fed in dry lot. Seasonal and feeding differences could possibly influence the deposition of fat, causing the data to be misleading. An inspection of the line means for fat trim, shows the lines to be inconsistent in comparative ratings from season to season. A comparison of the total mean yields showed the Line-

cross 1x3 to have 1.5 percent greater yield of fat trim than any of the other lines. The Linecross 1x3 yielded 1.0 percent more fat trim than any of the other lines when compared with the line averages for each season. This greater yield of fat trim by the Linecross 1x3 could possibly be attributed to the hybrid vigor and faster rate of gain, (Dickerson, 1943) which this linecross exhibited when its rate of gain was compared with that of the other lines.

The other items which showed a significant difference between lines did not present the same picture when their seasonal means were compared. The comparative ratings of seasonal means for ham yield, yield of belly, and the loin muscle index were consistent. This may indicate that significant differences between lines, in ham and belly yield, and loin muscle index were not confounded by seasonal variation.

The highly significant variance between lines in percentage yield of belly may be explained on the basis of carcass length. Line 5 yielded significantly longer carcasses than the other lines and might be expected to yield a greater percentage of belly than other lines, (Bogart, et al. 1940).

Differences between lines in percentage of loin yield might be expected, (Bogart, Weaver, and Comfort 1940), because Line 5 had significantly longer carcasses than the other lines. However, Line 7 had a significantly greater loin muscle index than Line 5. This would tend to counteract the tendency of the loin yield of the longer carcasses to be significantly greater than the loin yield of the shorter carcasses. The loin muscle index is a measure of the width and thickness of the loin muscle.

The fat trim variation was significantly different between lines and differences in the dressing percent might be anticipated. (Loeffel, et al. 1943). The data do not substantiate this expectation. A comparison of

line averages showed that the line having the greatest amount of fat deposition ranked third in dressing percentage. All hogs were off feed the same length of time before they were slaughtered; fill should not have greatly affected the dressing percentage. The dressing percentage was based on the shrunk live weight and the cold dressed weight. According to Loeffel, et al. (1943) the variation in the amount of shrink in each carcass may influence the dressing percentage.

These results indicate that line differences may be revealed by detailed studies and analyses of carcass data. However, more data and continued intensive studies are deemed necessary before a universal procedure for evaluating hog carcasses can be established.

SUMMARY

Carcass data from 94 hogs of the Oklahoma Swine Breeding Project were studied. Three inbred lines of Duroc swine, Lines 3, 5, and 7, and Linecross 1x3, which had an average slaughter weight ranging between 214.2 and 216.1 pounds were compared in this experiment. The data cover three slaughter periods: Fall 1946, Spring 1947, and Fall 1947.

The analysis of variance revealed a significant difference between lines in the percentage of ham yield. A comparison of the line means indicated that Line 5 was superior to the other lines in this respect.

The variance between lines in the percentage of belly was found to be highly significant. Line averages indicate that Line 5 yielded the greatest percentage of belly.

Line 5 also yielded a longer carcass than the other lines. An analysis of variance showed this difference to be highly significant.

The difference between lines in percentage of fat trim was also significant, with Line 5 having a lower yield in percentage of fat trim than the other lines.

Line 7 appears to be superior to the other lines in quality, as measured by the quality portion of the index. The variation between lines due to the loin muscle index was significant, with Line 7 being superior in this respect.

The other carcass measurements failed to reveal any significant differences between lines when analyzed statistically.

LITERATURE CITED

Blunn, C. T. and M. L. Baker. 1947. The Relation Between Average Daily Gain and Some Carcass Measurements. Jour. Animal Sci. 6:424-431.

Bogart, Ralph, L. A. Weaver and J. E. Comfort. 1940. Carcass Studies Including Scores, Measurements, and Yields. Report to Collaborators in the Reg. Swine Breeding Lab. Research Item No. 17.

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

Dickerson, G. E. 1946. Comments on Carcass Study. Record of Proc. Conf. of Collaborators Reg. Swine Breeding Lab. pp. 14-15.

_____. 1943. Changes in Hog Carcasses Associated with Genetic Superiority in Economy of Gain. Jour. Animal Sci. 2:357.

_____, B. R. McClurg and F. J. Beard. 1943. Relation Between Carcass conformation and Value of Live Hogs. Jour. Animal Sci. 2:373-374.

Ellis, N. R. and J. H. Zeller. 1931. Utilization of Feed by Swine as Affected by Level of Intake. Amer. Soc. Animal Prod., Proc. pp. 148-151.

Hankins, O. G. 1940. A Study of Carcass Characteristics in Relation to Type of Hog. Amer. Soc. Animal Prod., Proc. pp. 284-289.

Hazel, L. N., C. F. Reinmiller and M. L. Baker. 1943. The Relationship Between Growth Rate and Carcass Measurements in Swine. Jour. Animal Sci. 2:375-376.

Helmreich, F. H. and R. O. Roth. 1930. Comparative Yields of Government Grades of Slaughter Barrows and Gilts. Amer. Soc. Animal Prod., Proc. pp. 242-244.

Helser, M. D. 1929. A Study of Cut-out of Hogs. Amer. Soc. Animal Prod., Proc. pp. 148-151.

Loeffel, W. J., W. W. Derrick and M. Peters. 1943. Weight of Pigs as it Affects Gains and Carcass Qualities. Nebr. Agr. Exp. Sta. Bul. 351.

McMeekan, C. P. 1941. Part IV. The Use of Sample Joints and of Carcass Measurements as Indices of the Composition of the Bacon Pig. Jour. Agr. Sci. 31:1-17.

Scott, E. L. 1929. Factors that Influence the Significance of Hog Carcass Data. Amer. Soc. Animal Prod., Proc. pp. 136-142.

Scott, E. L. 1927. Come Factors Affecting the Killing Qualities of Hogs. Amer. Soc. Animal Prod., Proc. pp. 121-131.

Snedecor, G. W. 1946. Statistical Methods Applied to Experiments in Agriculture and Biology. Ames, Iowa: The Iowa State College Press.

Warner, B. F., N. R. Ellis and P. E. Howe. 1934. Cutting Yields of Hogs an Index of Fattness. Jour. Agr. Res. 48:241-255.

Willman, J. P. and J. L. Krider. 1943. A Study of the Characteristics of Live Market Hogs as Related to the Quality of Carcasses Produced. Jour. Animal Sci. 2:231-236.

Winkler, C. A., W. H. White and G. Abel. 1941. Canadian Wiltshire Bacon XXII. Comparative Carcass Quality of Canadian and Danish Bacons. Canadian Jour. Res. Sect. D Zool. Sci. 19:233-239.

TYPED BY: FLORENCE L. ADAMS