THE USE OF A SCORE CARD FOR APPRAISING THE CONFORMATION OF THE LIVE HOG

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TABLE OF CONTENTS

INTRODUCTION

During recent years the increased interest in animal improvement by breeding practices and the establishment of experimental breeding programs have emphasized more and more the real need of some quantitative method with which to evaluate the conformation of the live animal. Livestock breeders have long made mental comparisons in selection of individuals for their breeding herds. Such comparisons, however, are on a relative basis and give no indication of the quantitative difference between individuals in different herds or even in the same herd.

The use of a score card has been mentioned as a possible solution to this problem. To be reliable a method of scoring should meet certain requirements. The ideal as described by the score card must be accurate enough that different men would give similar scores to the same animal and one man would give similar scores to the same animal scored at different times. It must be sufficiently sensitive to distinguish differences between animals and it must give an indication of the ability of the animal to perform the function or possess the qualities for which it is produced.

It has been the purpose in the planning and execution of this study to submit the score card to the above mentioned requirements.

REVIEW OF PREVIOUS INVESTIGATIONS

Lush et al (1937) analyzed the scores given 14 pigs for "vigor, health, and thriftiness." There was a significant difference between scores given different pigs and also between the scoring levels of the four judges. About 76 per cent of the variance in the average scores resulted from things upon which all judges agreed for the character in question.

Lush et al (1938) scored 139 pigs in nine different groups during the 1937 fall season. Each pig was scored on one day only, as it approached market weight. There was reasonably close agreement between different men scoring the same pig yet the error in the scores could be markedly reduced by averaging the scores given by several men. They also observed that within the judges mind there was some changing of scoring levels as the judge went from one group to another.

The repeatability of scores made by the same man has been studied by Lush (1938). Thirty pigs were scored twice by the same man with a three day interval between the first and second scoring. More than half of the variance in single scores came from general differences between the pigs. This was obvious on both days. Nearly half of the remainder of the variance came from differences in characteristics of the same pig; that is, from a pig being good in some characteris-

tics but poor in others. Error or clumsiness of the scorer in using the scoring technique accounted for about 15 per cent of the variance. Changes from day to day in the general acoring level and in the scoring levels for the different points were very small and of uncertain significance statistically.

Knapp et al (1939) analyzed the scores awarded by seven judges to fifteen beef Shorthorn heifers and cows which were scored on three different days about a week apart. The points scored were symmetry, scale, size of bone, shape of head, smoothness, depth and width of chest, depth of rear flank, straightness of back, conformation of rump, fullness of round, and width of body. They found a highly significant difference between animals in all points scored. The judges were best able to recognize differences in width of body; conformation of rump and straightness of back were next in order. Differences between animals accounted for the smallest percentages of variance in scale, bone, and symmetry. Differences between judges were highly significant for all points scored except conformation of rump which was significant at the 5 per cent level. Differences between days were in general not significant although highly significant differences were observed for the items head, rump, and round. Interaction of days and animals was in general not significant. The interaction of animals and judges was highly significant for all points except for depth of flank and round. The interaction of days and judges was in general not signi-

ficant. The analysis for total score showed a higher percentage of variance between animals and a lower error term (days x animals x judges) than any of the scores of specific characters.

Hetzer et al (1938) studied two scoring techniques developed for the appraisal of the following characteristics in swine: shape of head, slope of rump, arch of back, shape of shoulder, shape of back, width of body, shape of ham, length of legs, depth of body, and length of body. The data analyzed included the scores awarded fifteen pigs on three different days at three-day intervals by three judges. The only difference apparent in the application of the two plans was that by one method the pigs were scored by use of descriptive terms (method A), whereas by the other method use was made of a series of drawings (method B). There was a very large and highly significant difference between the pigs scored by each of the two methods. Differences between the general scoring level of the judges were significant for all points by method A and for eight points by method B. Differences in the average scoring level of the three days as expressed by their contribution to the variance, were not large enough to be significant. There was no tendency for the variance contributed by differences in the scoring levels of the judges, differences in the scores of the pigs, differences in the scoring level of the days, or by any of the interactions to be consistently higher by one method than by the other. The results also failed to show an appreciable difference

between the two plans when compared on the basis of the correlations obtained between the scores given the same pig on different days and between those given the same pig by different judges.

Phillips et al (1939) studied the relation of scores of swine to carcass yields and certain carcass measurements. The method of analysis consisted of obtaining correlation coefficients between scores of the live animal and the percentage yields of the various cuts on the basis of the cold carcass weights. The relationships between certain scores and carcass measurements were also determined. While most of the correlations were statistically significant, the workers did not consider them large enough to be very important from a practical standpoint.

Bogart et al (1940) conducted a study on the relation of the individual items of the scores to the total score of the live hog, the relation of scores of each item of the carcass score to the total carcass score, and the relation of live-hog scores to the total carcass score. They found that the direct predicatability of total live-hog scores from any single item of the score was not large. The carcass scores for evenness of sides and smoothness of bellies were most important in determining the total carcass score. The value of the live hog scores in predicting total carcass score was surprisingly low. The total live hog score was of less value than the score for grade in determining the total carcass score.

OBJECTIVES OF THIS STUDY

This study was primarily designed to test the effectiveness of a score card for pigs in determining the following things: (1) differences between pigs at approximately the same (market) weight, (2) differences between scoring levels of different judges, and (3) differences between scores awarded the same pigs on different days.

A carcass study was in progress simultaneously and a secondary objective of this work was to determine associations between live hog scores and carcass data.

PROCEDURE

Pigs farrowed in the Spring and Fall of 1946 in a Swine breeding project of the Oklahoma A. & M. College were scored by three or four judges using a score card proposed for use in evaluating the conformation of the live animal. These pigs were Purebred Durocs from three different inbred lines and certain crosses between these lines.

The score card (Figure 1) included twelve items, each of which had a value ranging from 0 to 9, with the exception of the items, "head and neck" and "legs," which had values ranging from 0 to 5. The original plan was to score the pigs when they were in the weight range of 215 to 235 pounds. Although a large percentage of the pigs were scored in that range, it was not practical to postpone the scoring on the slower gaining pigs until they had reached this weight. However, no scores on pigs weighing less than 185 pounds were included in this study.

Spring farrowed pigs of 1946 were scored in the fall by four judges. Six groups, totaling 106 pigs, were scored on different days. At the beginning of each day's scoring, one pig was selected at random and scored without permanent record being made of his score. The scores were compared by the judges and different items discussed as differences between judge's scores occurred. This procedure was followed with the thought of standardizing the ideal of the judges.

Figure 1

Market Hog Score

Hogs to Be Scored at Weights Between 215 and 235 Pounds
Perfect Score = 100

Points	Item of Score	
9	General Appearance	- Moderately long, deep, wide, uniform in width; slightly arched top line; straight underlines and sides; trim middle, balanced, stylish; well set legs.
9	Finish	- Moderately thick, even, firm covering free from rolls and flabbiness; not excessively fat.
9	Quality	- Smooth in form and finish; free from wrinkles or flabbiness; head and ear medium fine; bone medium size; hair not coarse, bristly or curly.
9	Dressing per cent	- Degree of finish, trimness of middle, wide top, large full hams.
5	Head and Neck	- Head medium long, wide, clean cut; ears medium size and fine texture; jowl smooth, neat and trim, not flabby; neck medium length, smooth, blending neatly with shoulders and head.
9	Fore Quarters	- Shoulders smooth, blending smoothly into the sides, not wider than back and hams, compact on top, well fleshed; chest wide, deep and full.
9	Sides	- Moderately long, deep, smooth; free from wrinkles; belly straight, trim; flanks well let down.
9	Back	- Wide, slightly arched, well sprung rib covered with thick, smooth, firm flesh.

Figure 1

Market Hog Score
(cont'd.)

Points	Item of Score	
9	Loin	- Thick, strong, same width as back, rather flat from side to side.
9	Rump	- Long, wide, slightly arched but not drooping, rather flat from side to side.
9	Hams	- Wide, deep, full, heavy, firm, short shank.
5	Legs	- Medium length, straight, medium sized bone, strong pasterns. Penalize for being either too long or too short.

Only one man had previous experience with scoring. Also, this was the first use made of this score card. The pigs were scored in the central farrowing house or in the pasture as was convenient. The order in which the pigs in the same group were scored was entirely at random. After scoring each pig the total scores were compared by the judges as well as any items that seemed appropriate to mention. This procedure probably had the effect of reducing the variance caused by differences between scoring levels of the different judges in the analysis.

In order to study the effects of day to day changes in scoring level, two groups of pigs farrowed in the spring were scored a second time after an interval of seven and three days respectively. The fact that the pigs were to be scored a second time was not known to the judges at the time of the first scoring, thus there was no tendency for any judge to specifically remember the score of any individual pig. The first scores were not available on the second scoring and the judges did not remember the exact score given any specific individual; however, they did remember some of the pigs and whether they had generally liked or disliked them. The order of scoring was at random on both days.

Pigs farrowed in the fall of 1946 were scored in 11 groups on different days. Only three of the original four judges scored the 146 fall pigs. The same general scoring system was used as the one already described. The only

apparent difference in method of scoring was that the judges did not standardize their ideal by scoring a pig unofficially each day nor compare scores after each pig was scored.

Carcass data and live animal scores were available on 34 spring pigs and 27 fall pigs. The pigs were taken off feed approximately twenty-four hours previous to slaughter and slaughtered by regulation packer style (head removed, jowl left on the carcass, leaf fat removed, back split and hams faced).

The carcass Index used, Dickerson (1946), was based on the yields of wholesale cuts in per cent of shrunk live weight, and certain measurements which were assumed to indicate quality. The wholesale cuts are trimmed loin, regular ham, skinned shoulder (New York style), trimmed belly, lean trim and fat trim. The yield of each wholesale cut was multiplied by its relative price or value. The relative values (trimmed loin 1.0, regular ham .88, trimmed belly .83, skinned shoulder .70, lean trim .80, and fat trim .34) were taken from Dickerson (1946) with the exception of two cuts, the lean trim and the skinned shoulder. The value assigned, the skinned shoulder was less than the one given by Dickerson because its pre-war value (.70) was thought to be more reliable than its abnormally high value in the war time meat trade. The cut-out part of the carcass index is therefore yield of the hog in terms of equivalent yield of the trimmed loin. Measurements were taken

in the carcasses that were thought to indicate quality of wholesale cuts. The quality portion of the carcass index used in this study was comprised of the following 5 components: (1) Ham Index as indicated by $(\frac{\text{circumference}}{\text{length}} \times 100)$, (2) Width X depth ham muscle, (3) Width X depth "eye" muscle, (4) Deviation of $\left[\text{sum of 3 backfat measurements} - (\frac{W - 210}{40})\right]$ from an optimum of 4.5 inches, and (5) Difference between the thickest and thinnest of 3 backfat measurements. The factor $(\frac{W - 210}{40})$ is a correction to a standard live weight of 210 pounds. The optimum backfat thickness was 1.5 inches and a pig was scored down for having either more or less than that. The two components indicating thickness of muscle were used thinking they would indicate not only the amount of muscle in the ham and loin but also the amount of lean streaking in the bacon and muscle in the shoulder. In deciding how much attention should be given to the quality items and the cut-out value, an arbitrary assumption was made that a standard deviation of 3 per cent in the price of these wholesale cuts would be justified because of differences in their quality. The standard deviation in cut-out value also amounted to about 3 per cent of the mean. Therefore, each of the quality items was multiplied by a factor which would make its contribution to the standard deviation about .3 units. Such correction factors then give equal weight to the items making up the quality portion of the carcass index.

This carcass work was designed to determine the rela-

tionship of carcass value to live animal score and carcass yields of ham, loin, and belly to scores given these parts on the live animal. Correlation coefficients were computed on the following items.

(1) Live animal score[1] and Carcass Index of spring farrowed pigs.[2]

(2) Live animal score and Carcass Index of fall farrowed pigs.

(3) Live animal score and quality portion of Carcass Index of spring farrowed pigs.

(4) Live animal score and quality portion of Carcass Index of fall farrowed pigs.

(5) Live animal score and cut-out portion of Carcass Index.

(6) Ham score of live animal and ham yield in per cent of shrunk weight.

(7) Loin score of live animal and loin yield in per cent of shrunk weight.

(8) Sides score of live animal and belly yield in per cent of shrunk weight.

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1. The live animal score was comprised of the average score by four judges for the spring farrowed pigs and three judges for the fall farrowed pigs.

2. Due to the failure to obtain certain Measurements it was impossible to include "Ham Index" in the Carcass Index of the spring farrowed pigs.

RESULTS OF INVESTIGATION

From the Spring farrowed pigs the scores of 106 pigs scored on six different days were analyzed by the method of Analysis of Variance, Snedecor (1946). Results are shown in Table I.

TABLE I

Analysis of Variance of Market Scores on 106 Pigs Scored on 6 Different Days

Source of Variance	d/f	Sum of Squares	Mean Square
Total	423	19,420.87	45.91
Groups	5	7,103.56	1,420.71**
Judges	3	67.86	22.62
Within Groups	100	8,976.81	89.77**
Groups X Judges	15	346.49	23.10**
Error	300	2,926.16	9.75

** Probability less than .01 (Highly significant Snedecor's F Test)

The mean square between groups was significantly greater ($P < .01$) than the mean square for experimental error. This indicates that there was a difference between scores given the groups scored on different days. A plausible explanation for this could be that the thriftier, faster gaining pigs, scored in the early part of the season were

actually superior in conformation to the slower doing pigs. Another reason could be that there were differences in scoring levels on different days.

The mean square between judges' levels was not significantly greater than the mean square for experimental error. It is probable that the mean square between judges' levels was reduced considerably by the discussion of scores after each pig was scored.

The mean square between pigs within groups was significantly greater ($P < .01$) than the mean square for experimental error. This supports the hypothesis that differences between pigs within the same group were detectable by the score card.

The analysis shows a highly significant mean square for interaction of groups x judges. This shows a difference in rank of judges' scoring levels in different groups or that there was no tendency for any judge to score consistently at a level either higher or lower than that of the other judges.

From the spring farrowed pigs two groups were scored twice with an interval of seven and three days respectively. These data were analyzed by the method of Analysis of Variance and the results are shown in Tables II and III.

TABLE II

Analysis of Variance of Market Scores on 6 Pigs Scored Twice with a 7 Day Interval

Source of Variance	d/f	Sum of Squares	Mean Square	Interpretation of Mean Square	
Total	47	953.92	20.30		
Pigs	5	530.67	106.13**	I+24C+12B+8P	P = 12.25
Judges	3	56.09	18.70	I+24C+8A+12J	J = -0.06
Days	1	2.09	2.09	I+8A+12B+24D	D = -0.49
Judges X Pigs	15	164.16	10.94	I+24C	C = 0.11
Pigs X Days	5	27.16	5.43*	I+12B	B = -0.24
Judges X Days	3	50.07	16.69	I+8A	A = 1.06
Judges X Pigs X Days	15	123.68	8.25	I	I = 8.25

* Probability less than .05 (Significant Snedecor's F Test)

** Probility less than .01 (Highly significant Snedecor's F Test)

P = Variance due to differences between pigs.

J = Variance due to differences between judges scoring levels

D = Variance due to differences between scoring levels on different days.

C = Variance due to interaction between judges and pigs.

B = Variance due to interaction between pigs and days.

A = Variance due to interaction between judges and days.

I = Interaction of pigs, judges, and days.

TABLE III

Analysis of Variance of Market Scores on 12 Pigs Scored Twice with a 3 Day Interval

Source of Variance	d/f	Sum of Squares	Mean Square	Interpretation of Mean Square	
Total	95	2908.99	30.62		
Pigs	11	1808.62	164.42**	I+48C+24B+8P	P = 17.43
Judges	3	145.87	48.62**	I+48C+8A+24J	J = 1.50
Days	1	25.01	25.01	I+8A+24B+48D	D = -0.07
Judges X Pigs	33	305.00	9.24	I+48C	C = 0.00
Pigs X Days	11	276.61	25.15*	I+24B	B = 0.66
Judges X Days	3	38.03	12.68	I+8A	A = 0.41
Judges X Pigs X Days	33	309.85	9.39	I	I = 9.39

* Probability less than .05 (Significant Snedecor's F Test)

** Probability less than .01 (Highly Significant Snedecor's F Test)

Differences between pigs was by far the most important source of variance in these analyses. The mean squares were

highly significant and the pig to pig differences accounted for about 59 per cent of the total variance in each sample.

The mean square between judges was not significant in Table II yet highly significant in Table III. The reason for this difference was not clearly understood. In each case, however, differences between judges accounted for a very small percentage of the total variance.

Differences between scoring levels on different days accounted for the least amount of variance in each Table. Neither of the mean squares were significant, thus indicating there is no difference between scoring levels from one day to the next. It is to be remembered that the rescoring of the same pigs was separated by only 7 and 3 days respectively and had there been more time lapsed it might have been much more difficult to keep the scoring levels together.

The interaction between judges and pigs expressed the differences between the total scores of the same pig by different judges. It was of no significance statistically in either sample and accounted for a very small percentage of the total variance.

The interaction between pigs and days expresses the differences between the total scores of the same pig on two days. It was significant at the 5 per cent level in both tables. This difference could be accounted for by one or two pigs being sick and droopy looking the first day, yet recovered on the second, and others looking well on the

first but undesirable on the second.

The interaction of judges and days was not significant statistically and made a very small contribution to the total variance. This indicates that each judge maintained the same general scoring level on the two days.

The triple interaction of judges and pigs and days expresses the differences between individual scores that are not accounted for by differences between pigs, differences between judges scoring levels, differences between scoring levels on different days, or by interactions of any two of these.

From the fall farrowed group of pigs 146 were scored and the data analyzed by analysis of variance. Results are shown in Table IV.

Table IV.

Analysis of Variance of Market Hog Scores

Source of Variance	d/f	Sum of Squares	Mean Square	Interpretation of Mean Square	
Total	437	20,019.11	45.81		
Judges	2	876.84	438.42**	C+146J	J = 2.89
Pigs	145	14,321.11	98.77**	C+3P	P =27.38
Judges x Pigs	290	4,821.16	16.62	C	C =16.62

** Probability less than .01 (Highly significant Snedecor's F Test)

J = Variance due to difference between judges scoring levels.

P = Variance due to difference between pigs.

C = Variance due to interaction between judges and pigs.

The pigs were scored on 11 different days, but because of the non significant difference between scoring levels on different days (Tables II and III), it was decided to pool the data and analyze it as one day's scoring.

There was a highly significant difference between pigs and this bears out conclusions drawn from Tables I, II, and III.

There was a highly significant difference between judges' scoring levels. The reason for the contrasting results obtained in Table I and Table IV is not definitely known. It could possibly be due to the difference in scoring methods for the two seasons. The Spring farrowed pigs were discussed after each pig was scored and this could have the effect of standardizing scores by different judges and keeping them at about the same level. If one judge was definitely high or low in his score for one pig his consideration for the other judges' scores would tend to reduce his scoring the pigs that followed extremely high or extremely low. Whereas on the fall farrowed pigs the pigs were not discussed at all and if a judge started his scoring at a level above or below those of the other judges there was no reason that he should not continue to score at that level for the remainder of the day.

Sixty-one spring and fall farrowed pigs were included

in the Carcass study previously described. The results are shown in Table V.

Table V

Relation Between Average Scores of Live Animals and Various Carcass Data

Size of Sample	Relation	Between	Coefficients of Correlation
34	Live animal score	Carcass Index of Spring Farrowed Pigs	+ .51**
27	"	Carcass Index of Fall Farrowed Pigs	- .04
34	"	Quality portion of Carcass Index of Spring Farrowed Pigs	+ .28
27	"	Quality portion of Carcass Index of Fall Farrowed Pigs	- .20
61	"	Cut-out portion of Carcass Index	+ .32*
61	" of ham	Yield of regular ham	+ .11
61	" of loin	Yield of trimmed loin	- .12
61	" of sides	Yield of trimmed belly	+ .10

* Probility less than .05 (Significant)

** Probility less than .01 (Highly significant)

The correlation between the live animal score and carcass index of spring farrowed pigs was highly significant yet there was no correlation between the live animal score and carcass index of the fall farrowed pigs. No definite reason for this difference can be given. It could be due

to the difference in scoring method. Possibly the standardization of ideals by the judges and discussion after each pig was scored would tend to give a more accurate appraisal of the conformation of the live animal. The fact that the carcass index for spring farrowed pigs does not include the "ham index" is not believed to have affected the correlation greatly.

There was a significant correlation between the live animal score and cut-out portion of carcass index for the pooled spring and fall data.

There was no significant correlation between the average live score of the ham, loin, sides and the yield of these parts. The negative correlation between live score of loin and yield of loin may be accounted for because of the cut-out loin being trimmed. A pig that had a thick, wide loin would receive a high score on the hoof yet might have a low yield due to the large per cent of fat that would be trimmed off.

DISCUSSION

From the results of this study it would seem that the score card used definitely did pick up differences between pigs. A highly significant difference between pigs was found in all the analyses shown in this study. It also seems probable that there are differences between groups of pigs scored at the early part of the season and the ones scored later. That could be due to the thriftier, faster gaining pigs that are scored first, actually being superior in conformation to the slower doing pigs.

The results are contradictory regarding differences between scoring levels of the judges. The lack of differences between judges scoring the spring farrowed pigs possibly was due to the discussion of ideals and scores after each pig was scored. Analysis of scores of fall farrowed pigs did show differences between scoring levels of the judges. In that season the ideal was not discussed nor were any scores compared until the scoring for the day was completed.

The analysis of pigs rescored after an interval of a few days did not show any significant differences between scoring levels of the two days. The scoring was only a few days apart, however, and had there been a few weeks separating the scoring days it would probably have been more difficult to keep the levels together.

Interaction of pigs and days was significant at the 5

per cent level. The reason for the difference between total scores that a pig would receive on different days could be due to some pigs being sick on one day and looking well on the other.

The interactions of judges and pigs, and judges and days were not statistically significant. This indicates there was no tendency for one judge to change his scoring level from pig to pig or from day to day independently of the other judges.

The relation between live scores and Carcass data was not great. The highly significant correlation between the average live score and the carcass index of the spring farrowed pigs was contradicted by there being no correlation between average live score and carcass index of fall farrowed pigs. Correlations between average live score of ham, loin, and sides and their yield in per cent of live shrunk weight were small and of no significance statistically.

SUMMARY AND CONCLUSIONS

1. One hundred and six pigs farrowed in the spring of 1946 and 146 pigs farrowed in the fall of 1946 were scored at a weight ranging from 185 to 235 pounds. These pigs, barrows and gilts, were purebred Durocs from three different inbred lines and certain crosses between these lines.

2. A carcass study was made on 61 of the pigs scored.

3. It is believed that the score card used will pick up differences between pigs.

4. The differences between scoring levels on different days was not considered significant.

5. The variance due to differences between judges scoring levels was believed to be reduced by standardizing the judges' ideal by discussion of total scores, and scores for various items, after each pig was scored.

6. The rank in scoring levels of judges will probably vary from day to day.

7. The predictability of carcass index from average live score is small.

8. The predictability of carcass yield of the ham, loin, and belly from the average live scores of these parts is extremely low.

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