INFLUENCE OF SIRE ON FAT LAMB QUALITY

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Introduction.

THE importance to New Zealand's farming economy of an industry which exports about 12 million lamb carcasses annually does not need to be emphasised here. The production of these lambs is based primarily on cast-for-age crossbred ewes mated to mutton sires. Throughout New Zealand the Southdown is the most important mutton breed and in the North Island 35 per cent. of all flock rams in 1947 were Southdowns; i.e., at least 96 per cent. of all single purpose mutton breeds.

Considerable effort and capital is involved in ram breeding and a wide range of prices is paid for flock rams. It is, therefore, of real importance to know what influence the sire has in determining the quality of our lamb carcasses. The question then is, "To what extent are phenotypic differences in rams reflected in the quality and commercial value of the lambs they sire?"

In this paper we present an interim report on the first year's work of an experiment at Massey Agricultural College in which a comparison is made between the carcass qualities of the progeny of two types of Southdown sires.

Experimental Technique

The data presented in this paper are from a four-year experiment laid down in the autumn of 1948 to test the merits of certain sheep husbandry practices and also, the effects of ram quality and rate of stocking on growth and production of fat lambs. A line of hill-country Romney crossbred two-tooth ewes was allotted to four Southdown rams on a restricted random basis, ensuring in each group a similar body weight range and fleece count distribution.

The four Southdown rams used were two of "good" quality (rams A and C) and two of "poor" quality (rams B and D). The "good" quality rams exhibited shortness of leg and considerable meatiness, while the "poor" quality rams were leggy and not so well fleshed but characteristic of a type many fat-lamb breeders prefer.

The nature of the experiment has enabled a progeny test to be made of the rams A and B mated to ewes on a lower rate of stocking and of the pair C and D mated to ewes on a higher rate of stocking. Within these rates of stocking groups, the ewes and their lambs have received identical treatment but no valid comparisons between sire groups on different rates of stocking can be made.

All lambs were reared as singles and these were slaughtered when they reached approximately 72 lb. live weight; a procedure adopted by Clarke et al (1949). This technique increases the precision of the experiment in that it reduces the non-genetic variability.

Differences between sire group means, by sexes, have been tested for significance, using Fisher's T test.

Data Collected

In addition to birth date, sex, type of birth and age at slaughter, the following carcass data were collected:—Live weight starved, hot carcass weight, export grade and weight and length of cannon bone.

After cooling overnight in a chiller, external and internal carcass measurements were taken using essentially the same technique and nomenclature of Palsson (1939).

(A) SOME MISCELLANEOUS CHARACTERS (Table I).

(a) Age at Slaughter.

Since, in this trial, all lambs were slaughtered at approximately 72 lb. live weight, age at slaughter is a satisfactory measure of rate of growth.

Differences in age are shown in the progeny of rams C and D. Only in the case of wether lambs, however, was this difference significant.

(b) Hot Carcass Weight.

No significant differences were found in hot carcass weights. This would be expected since the lambs were slaughtered at approximately the same live weight. The overall range in hot carcass weight was from 32.0 to 38.8 with an average of 34.9 lb. This relatively small range does not warrant corrections of carcass measurements for differences in carcass weight.

(c) Dressing Percentage.

The dressing out percentage was calculated from the hot carcass weight as a percentage of live weight starved. The period of starvation was variable and not easily controlled, thus resulting in a relatively wide range, due probably to variation in alimentary tract contents. As these contents were not removed it was impossible to calculate a percentage on the "empty live weight." The only significant difference in this feature was found between the ewe progeny of sires C and D. The progeny of both sexes of sires C and D have a lower dressing percentage than those of sires A and B due possibly to the greater age of the former sires' progeny. This is supported by the slight negative correlations between age and killing percentage found by Clarke and Barton (1949).

(d) Weight of Cannon Bone.

Hammond (1932) suggested that the cannon bones (metacarpals), because they can be obtained without damaging the carcass and be cleaned readily, would serve as a satisfactory index of total weight of bone in the carcass. Palsson (1939), for instance, found that the weight of the left fore cannon bone gave a highly significant correlation coefficient of 0.94 with total weight of bone in the carcass. Accordingly we have used the left fore cannon bone in this study.

Our data have demonstrated highly significant differences for both sexes in sire groups C and D, a significant difference for the wether lambs in sire groups A and B, and a non-significant difference for the ewe lambs in the last mentioned groups. The average cannon bone weights are consistently greater in the progeny of the "poor" quality rams.

(e) Cambridge Fat-Lamb Block Test—Carcass Total Points.

This Block Test (McMeekan, 1939) gives a useful measure of carcass quality. It does, however, entail a subjective evaluation of the fat cover over the leg region and an estimate of width and flatness of loin, but an attempt has been made to increase its objectivity by using a score card for leg conformation, based on the differences in the measurements "F" and "G." The two objective estimates combined represent a maximum of 20 points out of a total of 100. Highly significant differences have been demonstrated between sire groups.

(f) Export Grade.

This gives a useful indication of the suitability of the lamb for trade requirements to the extent that Nichols (1945) has suggested it as an estimate to be used in measuring performance in progeny evaluation with sheep. The grading is based primarily on conformation and finish in the leg and loin region (Barton, 1947) and in the North Island three quality grades are made, viz., Prime Down Cross, Prime Crossbred and Seconds, in that order of quality.

Although no statistical tests have been applied to the carcass grade data it is obvious from an inspection of Table I that the progeny of the "good" quality rams, i.e. rams A and C, all graded Prime Down Cross except one carcass which was a Prime Crossbred, while the "poor" quality rams' offspring graded approximately 64 per cent. Prime Down Cross, 34 per cent. Prime Crossbred and one carcass was a Second. The sex difference in export grade as found by Clarke et al (1949) is present in these data.

This result is in close agreement with the highly significant differences between sire groups for the Cambridge Fat-Lamb Block Test—Carcass Total Points. Economically, this result is important since the price per lb. of the various quality grades differs. The value of these grades based on the 1948-49 New Zealand Marketing Department's f.o.b. prices for meat in the range 23 to 36 lb. frozen weight (hot carcass weight less 4½%) is 10.55, 10.30 and 9.30 pence per lb. for Prime Down Cross, Prime Crossbred and Seconds respectively.

(B) MEASUREMENTS OF LEG LENGTH (Table II).

A number of measurements indicating length of leg, either actual bone length or bone length partly affected by the fat and muscle development of the carcass, have been made. Linear bone measurements are of considerable importance in carcass quality investigations as they have been demonstrated by Hammond (1932), Palsson (1939) and Verges (1939) to be a valuable indication of depth of fleshing, in that the short thick bone is associated with deep muscle covering. They contend also that improvement for meat production has resulted in a shortening of the long bones. From the viewpoint of carcass suitability for trade purposes, the value of leg length is shown by the fact that 30 per cent. of the Total Block Test Points are given for "blockiness" of leg. The development of the leg is also taken into consideration in the export carcass grading system.

(1) Length of Left Fore Cannon Bone.

The cannon bone serves as a valuable index of the length of other bones. The data show that the means of the progeny of "poor" quality rams are significantly longer in this bone measurement to the extent of up to 1.1 cms.

(2) Measurement "F." (from crutch to the anterior edge of the distal end of the tarsal).

This measurement is influenced to a varying extent by the amount of fat present and the development of muscle in the crutch region. For this reason it is not a true bone measurement but when taken in relation to measurement "G" it provides a useful figure to evaluate leg conformation. Walker and McMeekan (1944) found the "F" measurement to be correlated significantly with total weight of muscle in the carcass.

In these data the offspring of "poor" quality rams are significantly longer in this character than those of the "good" quality sires.

(3) Measurement "T." (Length of tibia and tarsus from the tubercle on the proximal end of the tibia to the anterior edge of the distal end of the tarsal).

This measurement is a more direct indication of bone length than "F" and again highly significant differences are observed, the "poor" ram progeny being the longer.

(4) **Measurement "R."** (Length of radius-ulna from the olecranon process to the styloid process).

This is also a direct measurement of bone length and highly significant differences have been established except in the case of differences between wether lambs in sire groups C and D. Significance in this instance was found to be at the 5 per cent. level.

(5) **Measurement "P."** (Length of leg from the symphysis pubis to the anterior edge of the distal end of the tarsal).

This measurement is not strictly leg length because one of the points of measurement is at the symphysis pubis. To our knowledge this character has not been used previously in sheep carcass research but because of its accuracy of measurement and its importance from a conformation point of view we considered it would be of value. Differences at the 1 per cent. level of significance were found, with "poor" quality sires' offspring having greater length.

(C) MEASUREMENTS OF CARCASS WIDTH (Table III).

In order to compare the widths of the carcasses, various measurements were taken.

(1) **Measurement "G."** (Width of Gigots).

From the analysis of this measurement the mean differences between sire groups exhibit a very small advantage in favour of the progeny of "good" quality rams. The ewe lambs, in groups A and B, are significantly different but only at the 5 per cent. level.

(2) **Measurement "WR."** (Maximum width of ribs).

Various Continental workers, Duerst (1931) and Gartner et al (1930), have studied the costal angle in lamb carcasses and have demonstrated that the more improved mutton breeds possess a small costal angle which results in a greater spring of rib. The width of rib measurement therefore, probably indicates differences in the costal angle and is of some importance in considering carcass desirability.

The ewe progeny of rams A and B are significantly different at the 1 per cent. level while the wether lambs in these groups are different at the 5 per cent. level of probability. No significant differences are apparent between groups C and D, although mean differences are again in favour of the progeny of "good" quality rams.

(3) **Measurement "WF."** (Maximum width of fore-quarter).

To a large extent this measurement evaluates the development of flesh in the fore-quarter region. Although this is a low-priced part of the carcass, good conformation here may indicate a greater depth of meat overlying the pectoral girdle.

The progeny of "good" quality rams are, on average, wider in this region, although a significant difference was not established for the ewe progeny of sires A and B.

(4) **Measurement "WTh."** (Minimum width behind the scapulae).

This measurement was expressly included because narrowness in this region is frequently a fault in the New Zealand Romney (Rae, 1946) and occasionally in evidence in Southdowns. Only in the wether progeny of sires C and D was the difference significant, although in all cases the trends were in favour of the progeny of "good" quality sires.

(5) **Measurement "Th."** (Maximum depth of thorax).

A deep thorax is undesirable in the lamb carcass. Depth in this region is a characteristic of breeds less specialised for the production of meat and furthermore this part is one of the cheapest cuts of the carcass. The general trend in the data is one of less depth of thorax in the progeny of "good" quality rams. Only in the case of ewe lambs by sires A and B is the difference significant.

(D) MEASUREMENTS OF CARCASS LENGTH (Table IV.)

From the consumer's point of view, among the most valuable muscles of the body are the longissimus dorsi which lie adjacent to the vertebral column, extending approximately from the pelvic arch to the cervical region. Increased length of these muscles may result in reduced thickness. Furthermore, it is possible that length of the body is associated with greater length of leg bones and hence reduced carcass suitability for the trade.

(1) **Measurement "K."** (Length of body from the tail head to the base of the neck).

Although this measurement cannot be taken with a high degree of repeatability, it does give an indication of effective total length of carcass. No differences in the progeny groups are apparent for this character.

(2) **Measurement "L."** (Length of body from the symphysis pubic to the anterior edge of the middle of the first rib).

This carcass length measurement can be taken more accurately than "K" because of clearly defined points of measurement. The relationship between "K" and "L" may not be good because of some variability in the angle of the first rib and lack of coincidence between the base of the tail head and the symphysis pubis.

Only in the case of the male lambs in groups A and B was a significant difference found.

(3) **Measurement "H."** (Length from the symphysis pubis to the posterior edge of the last rib, at the junction with the vertebra).

This measurement can be taken with a high degree of accuracy and it indicates, in the main, length of the valuable loin region.

Highly significant differences between the ewe progeny of sires A and B were found but other group differences were non-significant.

(E) INTERNAL MEASUREMENTS (Table V.).

(i) Muscle Development.

The quality and development of the animal for meat purposes is most effectively estimated by cutting the carcass at the last rib and taking measurements of the muscle and fat development in that region (Hammond, 1932).

(1) **Measurement** "A." (Length of "Eye Muscle"—the maximum distance (or width) across the cut surface of the longissimus dorsi from the end next the spinous process outwards along the rib).

Although, on average, the progeny of "good" quality sires are shorter in this measurement than those of "poor" quality sires, no statistically significant differences could be established. In general, it can be inferred from Hammond (1936) that animals having a long measurement "A" are those not so well developed for meat production purposes. However, Walker and McMeekan (1944) found that "A" is strongly correlated with total weight of muscle in the carcass.

(2) **Measurement "B."** (Depth of "Eye Muscle"—the greatest distance at right angles to "A" on the same surface).

Depth of eye-muscle is a later developing feature than "A" and therefore likely to be more influenced by non-hereditary factors at the lamb stage. In these data no significant differences could be found, although in most cases offspring of "good" quality sires tend to have greater depth of this muscle.

(3) **Measurement "X."** (Thickness of muscle layers (mixed with intermuscular fat) on the lower half of the rib).

In general, this measurement is less important from the carcass quality aspect than the "A" and "B" measurements. The wether progeny of sire C were significantly greater in this measure than those of sire D, but the lack of consistent differences in these measurements is very apparent.

(ii) Fat Development.

The dimensional measurements of depth of fat in the loin region provides an index of the degree of fatness of the carcass, because both the deposits of fat and the loin itself are late developing features and as a result, any lack of fat finish will tend to show up in this area. Insufficient subcutaneous fat is associated with an unfinished carcass and is detrimental to the freezing, thawing, cooking and succulent qualities of the meat. Too much fat is, however, disliked by the buying public and is wasted. Hirzel (1939) has indicated that fat cover over the "eye muscle" (measurement "C") has an optimum value, and this feature is stressed in the Cambridge Block Test (McMeekan, 1939).

(4) **Measurement "C."** (Thickness of subcutaneous fat over "B.").

The development of fat in this region is of considerable importance, hence 20 per cent. of the Total Block Test Points are allocated for this measurement. Consistent trends are apparent, with the progeny of "good" quality sires being on average deeper in fat deposits in this region. Only in the case of the male progeny of sires A and B was a significant difference found.

(5) **Measurement "D."**.. (Depth of fat over the spinous process).

For this measurement there is a definite tendency for the offspring of "good" quality sires to have a greater depth of fat in this region but only between the wether lambs of sires C and D are the differences significant.

(6) **Measurement "Y."** (Thickness of subcutaneous fat over "X.").

This measurement, although taken at a less important part of the carcass, is of some value in assessing the general fat situation in the carcass.

A highly significant difference was found between wether lambs of sire groups C and D, and a significant difference between the ewe progeny of sires A and B. In other cases, generally, the offspring of good quality rams have greater development of fat in this region.

(7) **Measurement "J."** (Subcutaneous fat overlying the rib).

At this point, excessive fat is inclined to accumulate and Palsson (1939) states the ratio of measurement "J" : "C" should remain low thus indicating little danger of over-fatness on the ribs.

Our sire group differences were non-significant although there was a general tendency for the offspring of the "good" quality sires to have greater depth of fat in this region than those by "poor" quality rams.

Conclusion:

For those characteristics of economic importance in terms of carcass quality, we have been able to demonstrate in a preliminary way, that relatively large differences do exist in the progeny of Southdown rams of two different types when mated to Romney crossbred ewes. This variability appears to be of such magnitude that fat-lamb farmers, and doubtless stud Southdown breeders, have a sufficiently large selection potential in this breed to allow of further improvement in carcass quality.

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TABLE I.

(A) GROUP MEANS OF SOME MISCELLANEOUS CHARACTERS.

	EWES			WETHERS			EWES			WETHERS		
Character	Sire A.	Sire B.	Diff.	Sire A.	Sire B.	Diff.	Sire C	Sire D	Diff.	Sire C	Sire D	Diff.
Age at slaughter (in days)	129.6	140.0	10.4	124.2	124.9	0.7	179.0	157.2	21.8	169.2	131.1	38.1
Hot carcase weight (lb.)	35.2	35.1	0.1	36.0	35.7	0.3	34.5	35.0	0.5	34.1	33.8	0.3
Dressing Percentage	52.9	53.3	0.4	53.2	53.6	0.4	51.1	52.3	1.2*	50.2	50.9	0.7
Weight of left-fore cannon bone (gms-	28.2	29.0	0.8	29.8	32.5	2.7*	26.0	28.4	2.4**	28.8	32.6	3.8**
Block Test carcass total points (max. 100).	89.7	80.0	9.7**	85.5	74.2	11.3**	87.2	80.4	6.8**	81.2	69.6	11.6**
Export Grade												
(i) Prime Down Cross	12	6		6	8		11	15		14	5	
(ii) Prime Cross-bred	—	1		—	8		—	3		1	6	
(iii) Seconds	—	—		—	—		—	—		—	1	
No. of Observations	12	7		6	16		11	18		15	12	

** = Significant at the 1% level.

* = Significant at the 5% level.

TABLE II.

(B) GROUP MEANS OF MEASUREMENTS OF LEG LENGTH (In Cms.)

Character	EWES Sire A.	EWES Sire B.	Diff.	WETHERS Sire A.	WETHERS Sire B.	Diff.	EWES Sire C	EWES Sire D	Diff.	WETHERS Sire C	WETHERS Sire D	Diff.
(1) Length of Left Fore Cannon bone	9.7	10.7	1.0**	10.0	11.1	1.1**	9.9	10.8	0.9**	10.2	11.0	0.8**
(2) "F" (from crutch to hock)	20.6	22.1	1.5**	20.7	22.4	1.7**	20.9	22.3	1.4**	21.2	22.8	1.6**
(3) "T" (tibia + tarsus)	16.4	17.4	1.0**	16.8	17.6	0.8**	16.6	17.6	1.0**	17.0	18.0	1.0**
(4) "R" (radius + ulna)	15.6	16.4	0.8**	16.0	16.9	0.9**	15.4	16.3	0.9**	16.0	16.7	0.7*
(5) "P" (symphysis publis to hock)	30.5	32.2	1.7**	31.3	32.5	1.2**	31.0	32.7	1.7**	31.3	33.3	2.0**
No. of Observations	12	7		6	16		11	18		15	12	

** = Significant at the 1% level.

* = Significant at the 5% level.

TABLE III.

(C) GROUP MEANS OF MEASUREMENTS OF CARCASS WIDTH (in Cms.)

Character	EWES			WETHERS			EWES			WETHERS		
	Sire A.	Sire B.	Diff.	Sire A.	Sire B.	Diff.	Sire C	Sire D	Diff.	Sire C	Sire D	Diff.
(1) "G" (Width of gigots)	22.1	21.6	0.5*	22.0	21.9	0.1	22.3	22.1	0.2	22.1	21.8	0.3
(2) "W.R." (Width of ribs)	22.9	21.9	1.0**	22.4	21.5	0.9*	22.8	22.7	0.1	22.6	22.0	0.6
(3) "W.F." (Width of fore-quarter)	19.7	19.1	0.6	19.6	19.0	0.6*	19.4	18.9	0.5**	19.3	18.3	1.0**
(4) "W.Th." (Width behind shoulders)	17.7	17.3	0.4	17.3	16.7	0.6	17.4	17.4	0.0	16.9	16.2	0.7*
(5) "Th." (Depth of thorax)	24.4	25.0	0.6*	24.9	25.1	0.2	24.5	24.6	0.1	24.7	24.8	0.1
No. of Observations	12	7		6	16		11	18		15	12	

** = Significant at the 1% level.
* = Significant at the 5% level.

TABLE IV.

(D) GROUP MEANS OF MEASUREMENTS OF CARCASS LENGTH (in Cms.)

Character	EWES			WETHERS			EWES			WETHERS		
	Sire A.	Sire B.	Diff.	Sire A.	Sire B.	Diff.	Sire C	Sire D	Diff.	Sire C	Sire D	Diff.
(1) "K" (base of neck to tail head)	53.4	53.2	0.2	53.8	54.4	0.6	54.1	53.2	0.9	53.8	54.1	0.3
(2) "L" (symphysis pubis to first rib)	52.5	53.0	0.5	51.3	53.0	1.7**	52.6	51.7	0.9	52.7	52.7	0.0
(3) "H" (symphysis pubis to last rib)	26.0	27.5	1.5**	26.0	26.6	0.6	27.5	27.0	0.5	27.0	26.3	0.7
No. of Observations	12	7		6	16		11	18		15	12	

** = Significant at the 1% level.

TABLE V.

GROUP MEANS OF INTERNAL MEASUREMENTS (in Mms.)

(i) Muscle Development.

Character	EWES Sire A.	EWES Sire B.	Diff.	WETHERS Sire A.	WETHERS Sire B.	Diff.	EWES Sire C	EWES Sire D	Diff.	WETHERS Sire C	WETHERS Sire D	Diff.
(1) "A" (length of "eye muscle")	49.9	50.7	0.8	52.8	52.5	0.3	50.7	51.4	0.7	51.0	53.4	2.4
(2) "B" (depth of "eye muscle")	31.2	29.4	1.8	31.2	29.5	1.7	29.9	30.4	0.5	29.5	28.9	0.6
(3) "X" (width of muscle in rib region)	17.8	17.6	0.2	15.7	17.0	1.3	17.0	17.7	0.7	18.7	15.7	3.0**
(ii) Fat Development												
(4) "C" (depth of fat over "B")	5.3	4.7	0.6	4.8	3.2	1.6*	4.6	4.1	0.5	3.7	2.8	0.9
(5) "D" (depth of fat over spinous process)	8.3	7.3	1.0	6.3	5.9	0.4	6.7	6.6	0.1	4.9	3.5	1.4*
(6) "Y" (depth of fat over "X")	4.5	3.3	1.2*	3.0	2.8	0.2	2.9	3.4	0.5	2.9	1.8	1.1**
(7) "J" (depth of fat above "streak muscle")	13.9	11.9	2.0	11.3	9.4	1.9	10.3	10.7	0.4	9.2	8.5	0.7
No. of Observations	12	7		6	16		11	18		15	12	

** = Significant at the 1% level.

* = Significant at the 5% level.

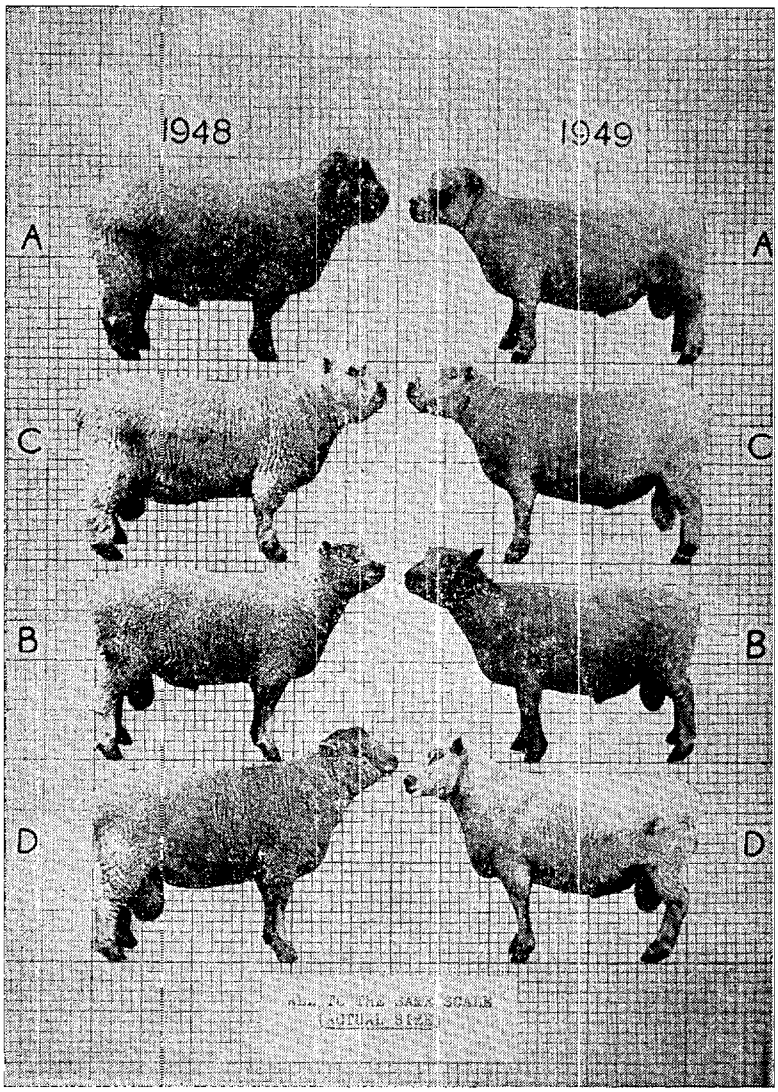

Plate 1 — The same sires in two consecutive years.

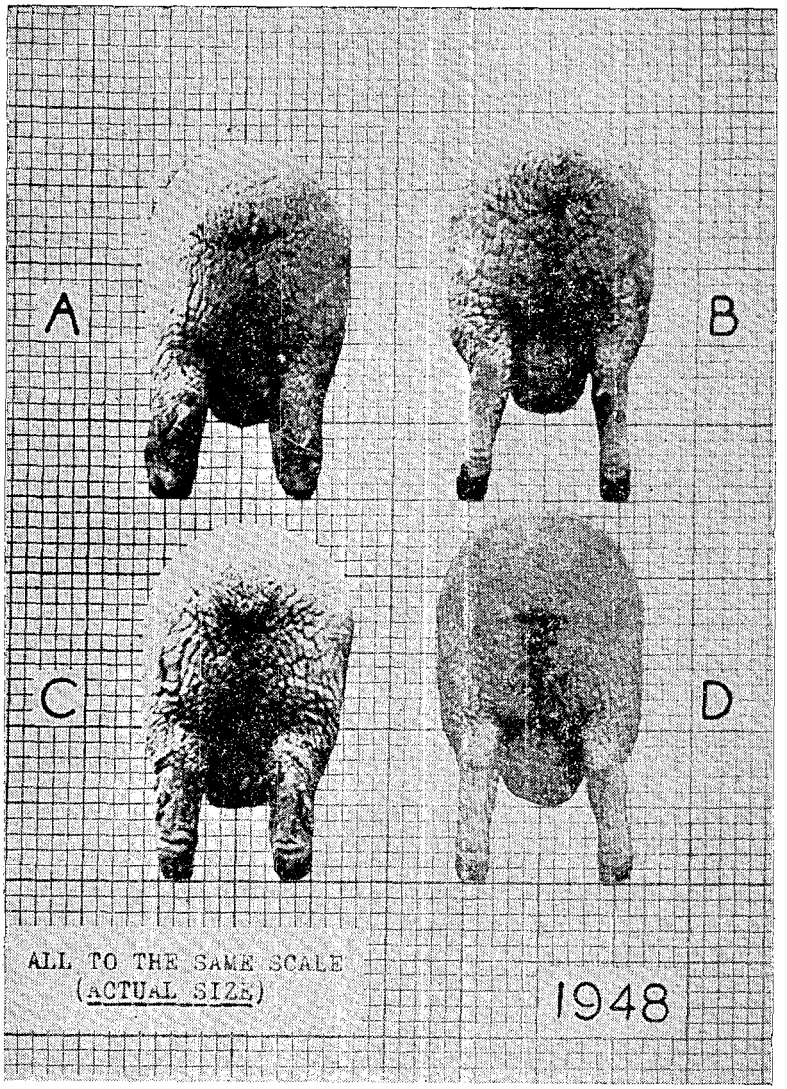

Plate 2 — Sires—hinquarter comparisons.

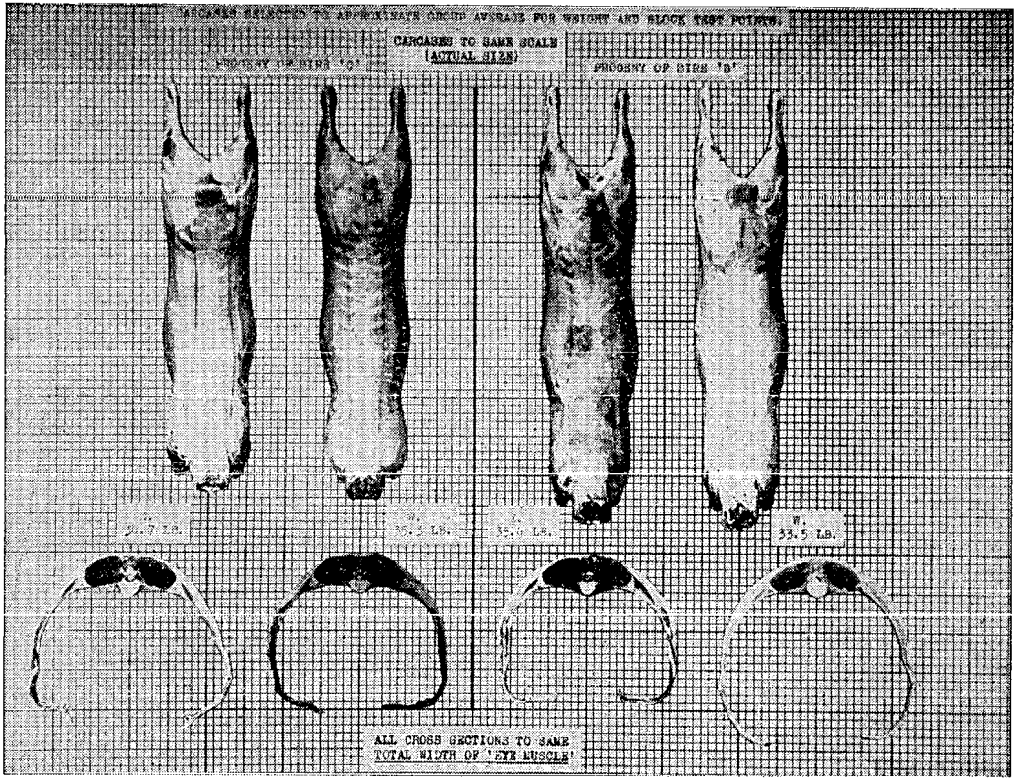

Plate 3 — Representative carcasses showing comparisons of the progeny of "good" (C) and "poor" (D) quality sires.

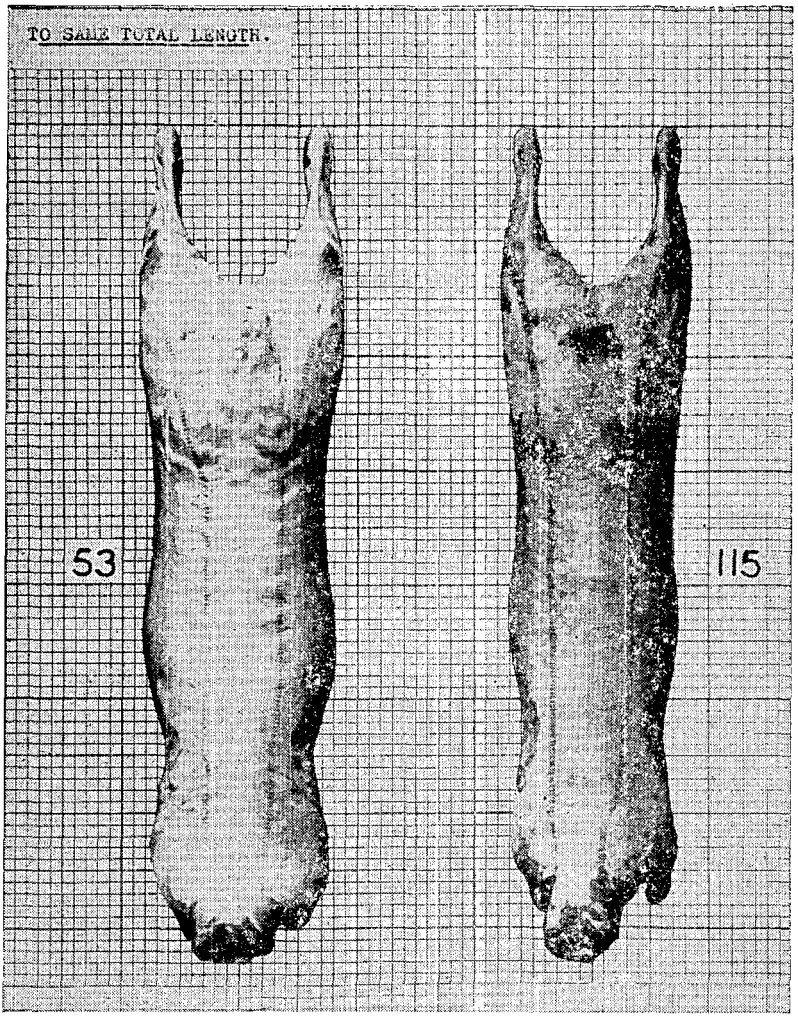

Plate 4 — Showing characteristic proportions of the progeny of "good" and "poor" quality sires.

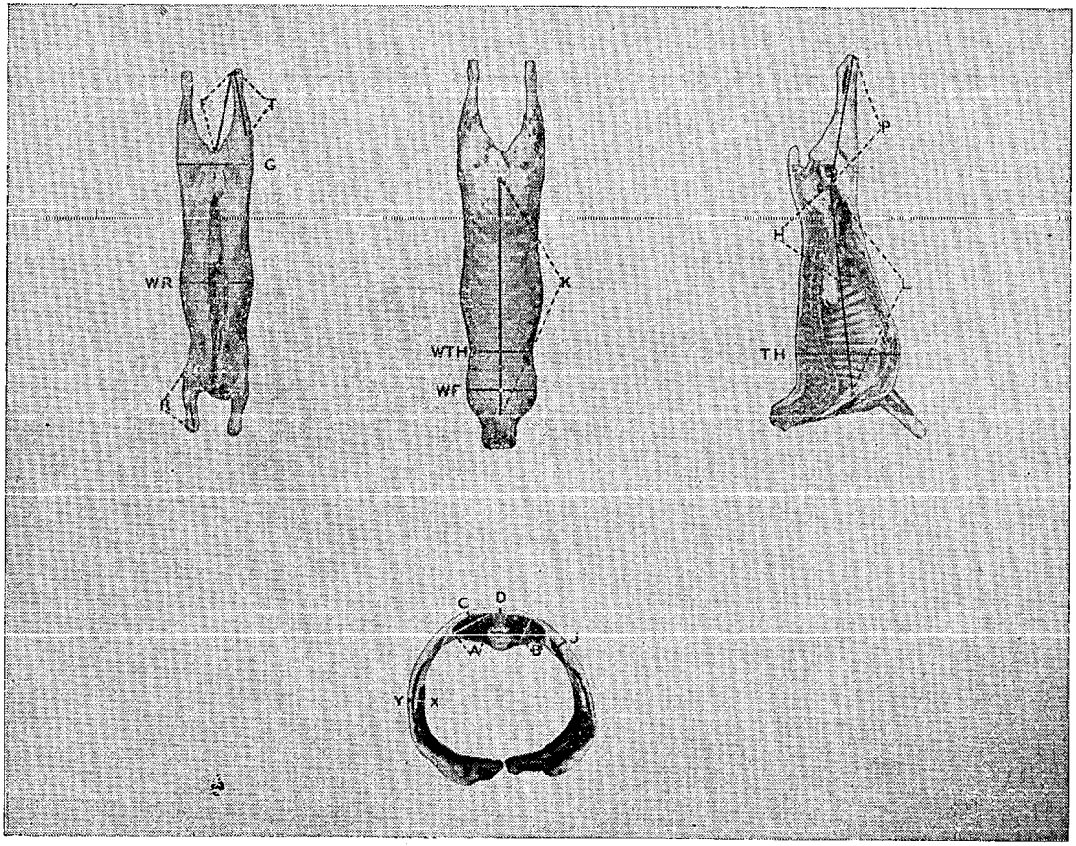

Plate 5 — Carcass measurements.

Discussion on Messrs Barton, Phillips and Clarke's Paper

Mr. FLUX: I wonder if Mr. Barton would like to comment on differences between results he has presented and those presented by Mr. McLean last year?

Mr. BARTON: Mr. McLean was progeny testing a number of Southdown rams using Corriedale ewes and found no very great differences between the progeny groups for the characters under consideration. We gather that his rams were not very different phenotypically. He did state that after these rams, from various sources and of differing prices, had been under the same environment for some time there was little to to choose between them. In our trial the rams were deliberately selected to be of two distinct types in carcass conformation and at the end of eighteen months these rams are just as different as at the outset. We also selected lambs for slaughter at a constant live-weight so that even small differences could be more readily detected.

Mr. CLARKE: I think there is one further point. The fat-lamb grading in the South Island recognises two main grades, namely, Prime Canterbury and Seconds, whereas in the North Island we have Prime Down Cross, Prime Cross-bred and Seconds which enables a clearer distinction to be made. In our trial, if the grading had been done on the South Island basis there would have been no difference between sires in carcass grade.

Mr. MITCHELL Senr.: Was there any difference in the time taken for the lambs by the differing types of rams to reach the killing stage?

Mr. BARTON: Table I showed non-significant differences except between the groups on the higher rate of stocking. This is a difference which we are unable to explain at this stage. It may be due to an interaction between genotype and plane of nutrition.

Dr. McMEEKAN: I wolud lie to congratulate the authors on their paper, particularly since it is at least a paper that gives us some hope for the future whereas, if you remember, at the end of last year's conference, as a result of Mr. McLean's paper and our own suggestions during the discussion, that the ram had nothing to do with it, we were left with the uneasy situation that we had no way of improving the quality of the fat-lamb. It would appear from these preliminary results from Massey that there is some hope of improving quality through the sire. One only hopes that that is borne out by subsequent experience. I would, however, in fairness to Mr. McLean, who is not here and with whom I have discussed his work fairly closely, like to say something. I would like to emphasise that in my opinion anyway there is no antagonism between the two sets of results. Mr. Barton has really covered the point I want to make but not in the same way. Mr. McLean's work was based on a comparison of expensive rams and cheap rams as bought and sold in the ram fairs. Now he was demonstrating as a result of his experimental work that insofar as farmer judgment of fat-lamb rams of the Southdown breed is concerned he could find no difference in the quality of the progeny resulting from expensive rams on the one hand and cull rams on the other. I think, for example, in the first year if I remember rightly, the two groups used were stud rams on the one hand and rams that were actually turned down by the inspectors of the Southdown Breed Society at the Christchurch Ram Fair as being unfit for sale. Now the point I want to make here is that, that judgment is not a judgment based upon carcass conformation alone. Carcass conformation may come into it but probably condition was the major

factor involved, plus breed type, in particular the effeminate heads that Breed Societies and producers of fat-lambs do not like. In this experiment they have taken rams sold, solely on a basis of carcass conformation. So we have two different types of experiment.

Dr. FRANKEL: As a mere geneticist who knows neither the details nor the past history of these experiments, I entirely agree with Dr. McMeekan, but even if it were not so, the small number of animals involved would not make it surprising that the two results are apparently contradictory to each other. I think if Mr. Barton had chosen any other animals the odds might have been that he would have received other results. In fact, they might have been less encouraging than these and I am surprised at Dr. McMeekan feeling so encouraged by these results. We know there is a slight difference between genotype and phenotype in many instances and I think we might feel no more discouraged if results had been less favourable to the breeder. There are a large number of genes involved and many of these genes are of a low specivity and I think that as a plant breeder who is very familiar with breeding for quantitative factors there is every reason for courage and optimism on the part of the breeders. I would like to see experiments of this kind carried out with more rams than these.

Mr. CLARKE: I would like to corroborate what Dr. McMeekan and Dr. Frankel have said. I can see no antagonism between the two experiments as they are totally different. I would like to point out for those in the audience who are not perhaps familiar with conformation characteristics that these rams are very different, so much so that the untrained observer can disinguish between them quite readily and the lambs were equally different, so much so that it was possible to draft them through the race. We have certainly sampled only a small part of the Southdown ram population and we are presenting this only as an interim report and further work must be done to substantiate the results. We felt it was desirable to present the data at this stage because they seemed so very conclusive and bore upon a very important point which received some debate at last year's Conference.

Mr. BARTON: I would like to add to Mr. Clarke's remarks and those of Dr. Frankel about the small sample of rams. Our rams are not really the most extreme types. We could have gone much further one way or the other. I am quite sure of that and many prominent Southdown breeders have said the same. In progeny testing work with Romney rams using the same technique we have also found relatively large carcass conformation differences. We feel that there is plenty of selection potential in both breeds.

Mr. BARNES: Dr. McMeekan mentioned in Miss Walker's and his paper that they used a single sire in the first year's work and a group of sires in the second two seasons. I would like to ask Dr. McMeekan just how many constituted that group and whether they were of uniform breeding and whether that would have any influence on the result?

Dr. McMEEKAN: In the first year a single ram was used to cut down variance. We had an experiment designed where we were interested in the ewe side of the problem and there was some merit in using a single sire over both ewe groups. We were criticised at the end of the year on the grounds that the single sire may have exerted such marked dominance upon the picture that the whole thing might be slightly wrong. So to meet that situation in the second season we used a group of six Southdown rams all from the same stud. In the third year another group of rams was used, again from the same stud but from a different strain. I would like to ask Mr. Barton one question. He has suggested that if he had used more diverse types of rams he would have expected even greater differences than he ob-

served. I understood the two types of rams he used came from diffrent studs. Would he have expected larger or smaller differences than reported if he had chosen a good and a poor conformation ram from the same stud?

Mr. BARTON: If we had selected a good and a poor quality ram from the same stud I do not know what the results would be. There would perhaps be a regression back to the average and the differences less marked.

Dr. McMEEKAN: The point is very important from the practical point of view in that the man who goes out to buy rams has two possibilities. He can go to a stud producing sheep of the poor carcass type or the good carcass type, or he can go to a single stud and "stick" to it. From the practical point of view, assuming that these results continue to be real, then it is very important to know just what the variance situation is within studs of the short blocky type of Southdown compared with the larger, more leggy type.

Mr. BARTON: That aspect I'm afraid, would have to be investigated in another trial.

Mr. CLARKE: Dr. McMeekan asked me that question months ago and I have since been tentatively examining the possibilities of getting those two types of rams in the same stud and have come to the conclusion it might be difficult. There are two distinct types and both are popular. In the eyes of many farmers the long legged and less blocky type enjoys a reputation for being a producer of good heavyweight lambs. That is one aspect that we still have to investigate. I do think it might be very difficult to get those two types or rams in one stud unless two diverse strains are being bred.