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A Study of Wool from Merino Stud Rams.

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INTRODUCTION.

THE wool characteristics of Merino stud rams are of significance to the sheep and wool industry of the Union, since it is the progeny of these rams that influence the flock breeder's wool clips. It is, therefore, of importance to the woolman to have an intimate knowledge of the wool produced by stud rams, and a study concerning these wools has been made.

Leading breeders in the Union were approached for wool samples from their Merino stud sires, and the collection thus obtained is representative of stud rams in use in 1931. The material is of particular value in that the history of the studs, pedigrees and breeding performances of the sheep concerned have, in most cases, been supplied. Although this paper does not consider the wools from a genetic point of view, it is intended as a preliminary to a more extensive study of wools from a breeding aspect. The investigation seeks to establish facts of a fundamental nature and gives a wool analysis from the point of view of crimping, fibre thickness, and degrees of variability.

NATURE OF MATERIAL.

Wool samples from 123 stud rams were analysed. These comprise material from 40 leading stud breeders and include many wools from valuable animals with noteworthy show and sale ring records. The samples were mostly of twelve months' growth and in the form of small staples cut from the shoulder region, wool from skin folds being avoided as far as possible as it has been shown that folds influence wool characteristics (Bosman, 1933) (1). Shoulder samples were taken as a basis for comparison, as this class of wool forms the largest portion of the fleece and serves as an indication of the bulk of the fleece. (Duerden and Bell, 1931.)

The samples were fairly uniformly grown, although some showed a variation in crimping and fibre thickness along the staple, presumably due to differential nutritive treatment (Probst, 1926; Bosman and Maré, 1933) (2). Some showed the defects often met with in the wool from rams used for service, and known to the practical man as "service breaks."

(1) "Influence of Skin Folds on Merino Wool."—Bosman, V. Report in preparation.

(2) "Influence of Feed on Merino Wool."—Bosman, V. and Maré, G. S. Report in preparation.

WOOL ANALYSIS AND METHODS.

The wool characteristics of crimping, fibre thickness, and thickness variability form the basis of the study. Crimping was measured in one region of the sample near the skin end and expressed as number of crimps per unit length.

For the estimation of fibre thickness, the wool grease was removed and small clippings taken through the same region as for crimping. The wool fragments thus obtained were intermingled in ether, mounted in Euparal and 500 fibres measured on a Zeiss Hegener Micro-Camera, the unit of measurement being 2·5 microns. The frequency distribution of fibre thickness of each sample was thus obtained and the mean thickness, standard deviation and coefficient of variability calculated. The sampling for fibre thickness and crimping differs slightly from the usual method employed in analysing wools for commercial purposes, in that in the latter, a mean of the whole length of the staple is obtained (Duerden, 1929). In the present investigation it was deemed necessary to confine measurements of crimping, fibre thickness and fibre distribution to one region only in order to eliminate regional differences that may be due to influences of nutrition and service.

When the whole length of the staple (where regions vary in thickness) is considered, the fibre distribution is different from that obtained when only one of these regions is studied.

EXPERIMENTAL RESULTS.

A.—Results of Analysis.

Table 1.

Sample.	Thickness in μ.	Qual. No. on Thickness.	Crimps per Inch.	Qual. No. on Crimps.	Stand. Dev.	C. of V. Per-cent.
39/11	16·95	90's	20–21	90's	0·863	5·1
17/1	18·01	70's	14–15	66's	1·208	6·7
10/2	18·05	„	12–13	64's	1·470	8·1
21/2	18·18	„	14–15	66's	1·340	6·2
15/4	18·39	„	14–15	„	1·529	8·3
21/1	18·19	„	14–15	„	1·007	5·5
23/3	18·50	„	10–11	60's	1·097	5·9
44/6	18·87	„	18–19	80's	1·071	5·7
14/1	19·00	66's	12–13	64's	1·153	6·1
17/2	19·18	„	12–13	„	1·562	8·0
10/1	19·44	„	16–17	70's	1·228	6·3
5/3	19·44	„	14–15	66's	1·356	7·0
3/7	19·54	„	12–13	64's	1·401	7·2
6/2	19·73	„	16–17	70's	1·523	7·7
12/1	19·91	„	16–17	„	1·367	6·9
2/1	20·03	64's	14–15	66's	1·277	6·4
1/2	20·10	„	14–15	„	1·288	6·1
32/1	20·21	„	12–13	64's	1·207	6·0
7/2	20·34	„	16–17	70's	1·248	6·1
12/5	20·38	„	14–15	66's	1·492	6·9
1/3	20·39	„	14–15	„	1·304	6·4
16/1	20·59	„	14–15	„	1·134	5·5
28/2	20·63	„	14–15	„	1·544	7·5

TABLE 1—(*contd.*)

Sample.	Thickness in μ.	Qual. No. on Thickness.	Crimps per Inch.	Qual. No. on Crimps.	Stand. Dev.	C. of V. Percent.
37/2	20·95	„	14–15	„	1·221	5·8
19/2	20·95	„	12–13	64's	1·504	7·2
30/1	20·96	„	16–17	70's	1·456	6·9
26/1	20·99	„	16–17	„	1·588	7·6
39/8	21·05	„	12–13	64's	1·435	6·8
23/1	21·09	„	12–13	„	1·175	5·6
32/2	21·09	„	14–15	66's	1·382	6·6
39/3	21·14	„	18–19	80's	1·204	5·7
5/4	21·26	„	14–15	66's	1·463	6·9
23/4	21·28	„	14–15	„	1·374	6·4
18/3	21·32	60's	10–11	60's	1·575	7·5
41/7	21·44	„	12–13	64's	1·486	6·9
44/7	21·48	„	16–17	70's	1·594	7·4
19/10	21·53	„	14–15	66's	1·121	5·2
9/1	21·54	„	12–13	64's	1·206	5·6
6/1	21·54	„	10–11	60's	1·694	7·9
39/6	21·55	„	14–15	66's	1·609	7·5
3/2	21·58	„	16–17	70's	1·397	6·5
41/1	21·65	„	12–13	64's	1·425	6·6
10/4	21·70	„	14–15	66's	1·231	5·7
39/1	21·72	„	14–15	„	1·686	7·8
2/4	21·75	„	10–11	60's	1·302	6·0
10/3	21·75	„	16–17	70's	1·466	6·7
2/3	21·83	„	10–11	60's	1·533	7·0
25/5	21·89	„	12–13	64's	1·342	6·1
19/3	21·90	„	14–15	66's	1·227	5·6
39/2	21·91	„	12–13	64's	1·631	7·4
23/2	22·00	„	8– 9	58's	1·430	6·5
39/5	22·09	„	8– 9	„	1·465	6·6
18/4	22·16	„	10–11	60's	1·656	7·5
19/1	22·22	„	14–15	66's	1·351	6·1
9/2	22·42	„	12–13	64's	1·439	6·4
5/2	22·72	„	14–15	66's	1·518	6·6
4/3	22·72	„	12–13	64's	1·985	8·7
39/7	22·73	„	14–15	66's	1·524	6·7
3/1	22·76	„	12–13	64's	1·727	7·6
24/2	22·80	„	12–13	„	1·612	7·1
6/3	22·88	„	12–13	„	1·329	5·8
39/4	22·89	„	10–11	60's	1·833	8·0
1/5	22·91	„	10–11	„	1·703	7·4
11/1	23·02	58's	14–15	66's	1·472	6·4
38/1	23·03	„	10–11	60's	1·396	6·1
34/1	23·08	„	12–13	64's	1·296	5·6
37/1	23·12	„	14–15	66's	1·236	5·3
25/2	23·16	„	14–15	„	1·703	7·4
35/1	23·18	„	12–13	64's	1·516	6·5
34/4	23·21	„	10–11	60's	1·602	6·9
12/4	23·27	„	12–13	64's	1·381	5·9
34/3	23·41	„	12–13	„	1·757	7·5
8/2	23·42	„	12–13	„	1·605	6·9
4/1	23·45	„	14–15	66's	1·611	6·9
24/6	23·47	„	14–15	„	1·492	6·4
12/3	23·50	„	12–13	64's	1·549	6·6
33/3	23·56	„	8– 9	58's	1·690	7·2
15/2	23·57	„	14–15	66's	1·701	7·2
23/8	23·58	„	14–15	„	1·666	7·1
2/2	23·63	„	12–13	64's	1·542	6·5

TABLE 1—(*contd.*)

Sample.	Thickness in μ.	Qual. No. on Thickness.	Crimps per Inch.	Qual. No. on Crimps.	Stand. Dev.	C. of V. Per-cent.
8/3	23·64	„	8– 9	58's	1·524	6·4
41/3	23·68	„	12–13	64's	1·528	6·5
41/2	23·78	„	12–13	64's	1·448	6·1
41/5	23·79	„	12–13	„	1·600	6·7
41/4	23·85	„	8– 9	58's	1·868	7·8
41/6	23·92	„	8– 9	„	1·654	6·9
33/4	23·93	„	10–11	60's	1·508	6·3
5/6	23·98	„	12–13	64's	1·773	7·4
4/2	23·99	„	10–11	60's	1·732	7·2
35/7	24·11	„	10–11	„	1·647	6·8
3/3	24·16	„	12–13	64's	1·746	7·2
14/2	24·20	„	12–13	„	1·365	5·6
15/3	24·35	„	14–15	66's	1·411	5·8
15/5	24·36	„	14–15	„	1·338	5·5
7/1	24·40	„	14–15	„	1·727	7·1
12/2	24·43	„	12–13	64's	1·431	5·9
18/1	24·51	„	12–13	„	1·827	7·5
24/1	24·52	„	12–13	„	1·695	6·9
5/5	24·60	„	14–15	66's	1·554	6·3
3/6	24·60	„	12–13	64's	1·810	7·4
26/2	24·64	„	14–15	66's	1·451	5·9
8/1	24·65	„	12–13	64's	1·423	5·8
39/10	24·66	„	12–13	„	1·451	5·9
33/1	24·72	„	12–13	„	1·582	6·4
34/5	24·82	„	10–11	60's	1·748	7·0
40/1	24·91	„	12–13	64's	1·857	7·5
24/3	24·94	„	8– 9	58's	1·591	6·4
15/1	25·09	„	14–15	66's	1·443	5·8
1/4	25·18	„	8– 9	58's	1·793	7·1
29/1	25·30	„	14–15	66's	1·498	5·9
25/3	25·41	„	12–13	64's	1·486	5·8
25/4	25·43	„	12–13	„	1·528	6·0
34/2	25·65	56's	12–13	„	1·563	6·1
20/2	25·65	„	8– 9	58's	1·998	7·8
44/8	25·65	„	6– 7	56's	2·064	8·0
39/9	25·68	„	16–17	70's	1·629	6·3
20/1	25·81	„	12–13	64's	1·942	7·5
25/1	25·87	„	12–13	„	1·742	6·7
28/1	26·26	„	10–11	60's	1·683	6·4
1/1	27·06	„	14–15	66's	1·667	6·2
33/2	27·33	„	8– 9	58's	1·566	5·7
18/2	27·58	„	12–13	64's	1·988	7·2
33/5	27·62	„	10–11	60's	2·094	7·6

B.—FIBRE THICKNESS AND CRIMPING.

In Table 1 is given the fibre thickness, quality number, standard deviation, and coefficient of variability, as well as the crimps and quality number on crimps of the samples. They are arranged in order of increasing fibre thickness, and present a range of from 16·96μ to 27·62μ, i.e. from 90's to 56's, which includes practically all the Merino qualities, as well as a few coarser ones. A similar result is obtained when quality number on crimps is compared. The range is from 20-21 per inch (a 90's) to 6-7 (a 56's). The proportions in which the qualities occur both on fibre thickness and on crimping in Table 1 are summarised in Table 2.

TABLE 2.

DISTRIBUTION OF QUALITY NUMBER ON THICKNESS.				DISTRIBUTION OF QUALITY NUMBER ON CRIMPING.			
Thickness Range.	Quality Number.	Frequency.	Per-cent.	Crimp Range.	Quality Number.	Frequency.	Per-cent.
16·2–17·0	90's	1	0·8	20–21	90's	1	0·8
17·0–17·9	80's	0	0	18–19	80's	2	1·6
17·9–18·9	70's	7	5·7	16–17	70's	10	8·1
18·9–20·0	66's	7	5·7	14–15	66's	38	30·9
20·0–21·3	64's	18	14·6	12–13	64's	45	36·6
21·3–23·0	60's	30	24·4	10–11	60's	16	13·0
23·0–25·5	58's	49	39·8	8– 9	58's	10	8·1
25·5–29·0	56's	11	8·9	6– 7	56's	1	0·8

The range and assigned qualities based on crimps per inch and fibre thickness are those established for South African commercial wools (Duerden, 1929; Duerden and Bosman, 1929), where the authors describe an analysis of grease wools procured from experienced woolmen and representative of the quality numbers recognised in wool buying practice. The standard limits for fibre thickness and for crimps per inch have since been used in the Wool Laboratory for comparing wools from Merino experiments. The frequency and percentage frequency for each quality are shown in Table 2.

Of 123 wool samples analysed 0·8 per cent. are 90's on crimping; 1·6 per cent. are 80's; 8·1 per cent. are 70's; 30·9 per cent. are 66's; 36·6 per cent. are 64's; 13·0 per cent. are 60's; 8·1 per cent. are 58's; and 0·8 per cent. are 56's. The largest percentage, namely, 6·75 per cent., of stud rams in the Union are 64-66's, or a medium quality on crimping (Schuurman, 1929). This method of estimating the quality number of wool is frequently made use of by Merino breeders and woolmen.

In Table 2 is also given the frequency distribution of qualities as based on fibre thickness. In this case 0·8 per cent. are 90's; 5·7 per cent. are 70's; 5·7 per cent. are 66's; 14·6 per cent. are 64's; 24·4 per cent. are 60's; 39·8 per cent. are 58's; and 8·9 per cent. are 56's. The largest proportion, i.e. 64·2 per cent. of the Union's stud rams are 58's and 60's when based on fibre thickness, and for commercial purposes would be classed as strong wool.*

It is thus shown that 67·5 per cent. of stud ram wools are of a medium quality on crimps, while on fibre thickness 64·2 per cent. are a strong quality. These facts are expressed graphically in Figure 1, where curve A represents the distribution of the qualities based on crimps and curve B the distribution of qualities on thickness. If there were agreement between the quality number on crimps and that on thickness, the Modes of A and B would coincide. However, the Mode of A is at 64's and that of B at 58's, indicating that the larger percentage of the samples is 64's on crimping and 58's on fibre thickness.

* The terms "fine," "medium" and "strong" wool are employed as used in South Africa for grading Merino wool (Schuurman, 1929).

A closer analysis of Table 1 is given in Table 3, where a comparison is made between the relationship of the quality number on crimps and that on thickness. Columns one and two indicate the quality numbers on crimps and on thickness respectively, while the third column gives the frequency. The fourth column indicates the relationship between the quality on thickness and that on crimps, Table 3 is summarised as follows:—

TABLE 3.

Quality on Crimps.	Quality on Thickness.	Frequency.	Quality on Thickness in Relation to Quality on Crimps.
90's	90's	1	Agreement.
80's	70's	1	Coarser by 1 qual.
„	64's	1	„ „ 3 „
70's	66's	3	„ „ 1 „
„	64's	3	„ „ 2 „
„	60's	3	„ „ 3 „
„	56's	1	„ „ 4 „
66's	70's	4	Finer by 1 „
„	66's	1	Agreement.
„	64's	10	Coarser by 1 qual.
„	60's	8	„ „ 2 „
„	58's	14	„ „ 3 „
„	56's	1	„ „ 4 „
64's	70's	1	Finer by 2 „
„	66's	3	„ „ 1 „
„	64's	4	Agreement.
„	60's	10	Coarser by 1 qual.
„	58's	23	„ „ 2 „
„	56's	4	„ „ 3 „
60's	70's	1	Finer by 3 „
„	60s'	7	Agreement.
„	58's	6	Coarser by 1 qual.
„	56's	2	„ „ 2 „
58's	60's	2	Finer by 1 „
„	58's	6	Agreement.
„	56's	2	Coarser by 1 qual.
56's	56's	1	Agreement.

1 or 0·8 per cent. of samples are finer on thickness than crimps indicate by 3 qual.

1 or 0·8 per cent. of samples are finer on thickness than crimps indicate by 2 qual.

9 or 7·3 per cent. of samples are finer on thickness than crimps indicate by 1 qual.

20 or 16·3 per cent. show agreement between quality on crimps and that on thickness.

32 or 26·0 per cent. of samples are coarser on thickness than crimps indicate by 1 qual.

36 or 29·3 per cent. of samples are coarser on thickness than crimps indicate by 2 qual.

22 or 17·9 per cent. of samples are coarser on thickness than crimps indicate by 3 qual.

22 or 1·6 per cent. of samples are coarser on thickness than crimps indicate by 4 qual.

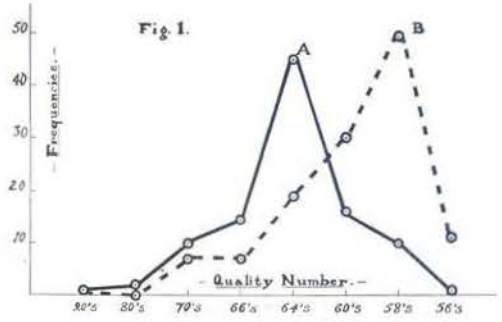
It is thus shown that:

8·9 per cent. of the samples are finer in fibre thickness than the crimps indicate.

16·3 per cent. show an agreement between quality on thickness and quality on crimps.

74·8 are coarser on fibre thickness than the crimps indicate.

An analysis of commercial wool samples, where standard limits for crimps and fibre thickness were established (Duerden and Bosman, 1929) showed that 75 per cent. of the samples analysed were in agreement with the standards. In the present study where these same standards were taken as a basis and wool from stud rams was considered, there is a 16·3 per cent. agreement, while 74·8 per cent. of the samples are coarser on fibre thickness than the crimps indicate, and 8·9 per cent. are finer. These facts are of significance to the sheep breeder and to the woolman, in that it is shown that ram's wool in three cases out of four is coarser in fibre thickness than the crimps indicate. In other words, when quality estimation is based on crimps, an allowance should be made for a coarser fibre thickness in three cases out of four.



C.—Variability.

The mean fibre thickness of a sample forms a basis for classifying a wool into its quality number, but the mean does not indicate the degree of fibre variability which is influenced by the number of thickness classes, the range of these and the frequency distribution.

The statistical treatment of fibre measurements has received the attention of various research workers. Henseler (1926), Probst (1926), Roberts (1930). S. G. Barker (1931) states that: "It is not only the average fineness of a sample and its frequency distribution, but also its coefficient of variation, expressing as it does the variation within the staple, that is of supreme importance." The degree of fibre variability of wool is a factor of significance from the wool manufacturer's point of view. To what extent fibre variability of stud rams is of importance from a genetic aspect is still being investigated. Expressions of variability, namely Standard Deviation and Coefficient of Variability, are useful when fibre uniformity are studied.

The Standard Deviation bears a close relationship to the form or shape of the distribution curve. It expresses in absolute terms the degree of scatter or dispersion of the variates. It also gives an indication of fibre purity of any one sample and roughly three times the Standard Deviation on either side of the mean will include all the variates.

Examples of thickness distribution curves of rams' wools are given in Figures 2, 3 and 4.

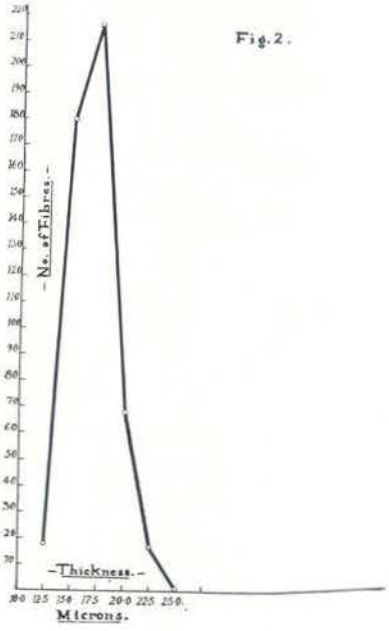


Fig. 2 is the curve of sample 39/11 and shows a uniform distribution with a low standard deviation of 0·863. The Mode is 17·5μ with a frequency of 216, so that 43 per cent. of the fibres measure 17·5μ. The thickness ranges from 12·5μ to 25μ with 6 class intervals, and a mean of 16·96μ, a 90's wool.

Fig. 3 is the curve of sample 2/1. The standard deviation is 1·277. The fibre thickness ranges from 12·5μ to 30μ with 8 class intervals, and the Mode at 20·0μ with a frequency of 180 or 26 per cent. of fibres measuring 20·0μ. The mean is 20·03μ, a 64's wool.

Fig. 4 is the curve of sample 18/1, which shows a more variable distribution with a standard deviation of 1·827, and a range from 12·5μ to 42·5μ. The Mode is at 25·0μ with a frequency of 127 or 25 per cent. of fibres of 25·0μ. The mean is at 24·51μ, a 58's wool.

The standard deviation of the rams' wool ranges from 0·863 to 2·094. Although a useful constant for variability, its utility for comparative purposes is restricted and wools of differing mean thicknesses such as in Table 1 are also compared on a relative basis by the coefficient of variability, as the latter expresses the Standard Deviation as a percentage of the mean. The coefficients of variability of rams' wool ranges from 5·1 per cent. to 8·7 per cent. An analysis of the frequencies of the coefficients of variability is given in Table 4.

TABLE 4.

Range of Coefficient of Variability as Percent.	Frequency.	Percentage Frequency.
5·1–5·5	6	4·9
5·6–6·0	24	19·5
6·1–6·5	29	23·6
6·6–7·0	24	19·5
7·1–7·5	25	20·3
7·6–8·0	12	9·8
8·1–8·7	3	2·4

The largest portion of the South African Merino stud sires, namely, 82·9 per cent. have wool which ranges from 5·6 per cent. to 7·5 per cent. as regards coefficient of variability, 4·9 per cent. have a lower coefficient of variability, namely, from 5·1 per cent. to 5·5 per cent. and are relatively more uniform; while 12·2 per cent. are higher in this respect, namely, from 7·6 per cent. to 8·7 per cent. and are more variable.

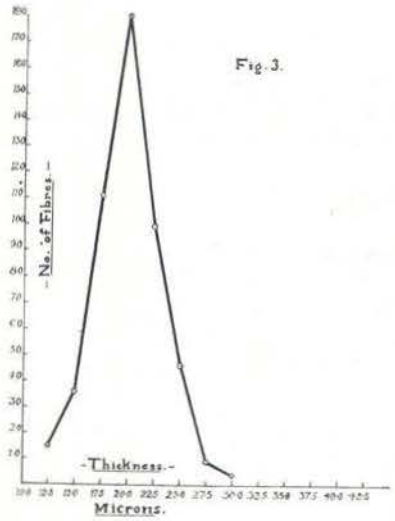


Fig. 3.

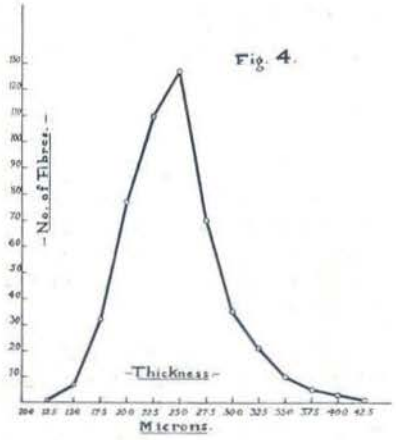


Fig. 4.

D.—Correlation.

Correlations between wool attributes are useful to the practical man as conclusions can often be formed by assuming relationships between characteristics. The coefficients of correlation in the present study are given in Table 5.

Table 5.

	Fibre Thickness.	Crimps per Inch.	Stand. Dev.	Coeff. of Var.
Fibre Thickness	—	− ·426 ± ·0498 Def. Neg. Corr.	+ ·677 ± ·0327 Def. Pos. Corr.	+ ·020 ± ·0608 No. Corr.
Crimps per Inch	− ·426 ± ·0498 Def. Neg. Corr.	—	− ·2596 ± ·0567 No. Corr.	− ·0218 ± ·061 No. Corr.
Stand. Dev....	+ ·677 ± ·0327 Def. Pos. Corr.	− ·2596 ± ·0567 No. Corr.	—	+ ·0659 ± ·0671 No. Corr.
Coeff. of Var...	+ ·020 ± ·0608 No. Corr.	− ·0218 ± ·061 No. Corr.	+ ·0659 ± ·0671 No. Corr.	—

Between fibre thickness and crimps per inch the value of $-0{\cdot}426 \div 0{\cdot}0498$ indicates a definite negative correlation, although not a high one. This means that in general the more crimps per inch there are the finer is the wool.

As regards fibre thickness and standard deviation, the coefficient of correlation of $+0{\cdot}677 \pm {\cdot}0327$ shows a definite positive correlation or, the coarser the wool, the higher the standard deviation.

There is no definite correlation between fibre thickness and coefficient of variability as the coefficient of correlation of $+{\cdot}020 \pm {\cdot}0608$ indicates.

Likewise the coefficient of correlation $-0{\cdot}2596 \pm 0{\cdot}0567$ between crimps per inch and standard deviation indicates no definite correlation. Between the standard deviation and coefficient of variability the value $+0{\cdot}0659 \pm 0{\cdot}0671$ shows no definite correlation.

DISCUSSION.

A 1931 survey of wool from stud rams in the Union demonstrated the existence of a dominant type. On crimping, 67·5 per cent. of the wools are 64/66's, or a medium quality, and from a show and sale ring point of view this percentage would be regarded as medium wool. On fibre thickness 64·2 per cent. of the rams have a 58/60's wool or a strong quality.

It is also shown that in three cases out of four ram's wool is coarser in fibre thickness than the crimps indicate. This fact is sufficient reason for advising the wool farmer to separate stud ram wool from his general fleece lines. It is also evident that wool from

stud rams requires different standards of crimping and fibre thickness from those established for commercial flock wools. From the manufacturer's point of view fibre thickness plays a more important rôle in spinning that do crimps as such; the wool buyer's valuation in respect of fineness being based more on fibre thickness than on crimping.

The stud rams concerned in the study are valuable animals from the owners' point of view and are consequently better cared for than flock sheep. It was suggested that the fact could have influenced their wool characteristics, but a comparison with certain well-fed experimental sheep at Grootfontein showed that this was not the case as the latter wools agreed with the standards of commercial flock wool.

As regards correlation between fibre thickness and crimps per inch, the coefficient of correlation of $-0{\cdot}426 \pm 0{\cdot}0498$ although definite is not a high one. This relationship is established on wools well-grown and from shoulder regions away from skin folds. The correlation does not appear so definite when sampling includes wools on skin folds (Reimers and Swart, 1929), Bosman, 1933) (1) or droughty wools (Duerden, 1929; Duerden and Bosman, :1929).

Hultz and Paschal (1930) in "Wool studies with Rambouillet Sheep," found an insufficient correlation between crimp and fibre thickness to warrant reliability being placed on crimp as an indication to fibre thickness.

Duerden and Bosman (1929) found a sufficient agreement between crimp and thickness of commercial wools well-grown taken away from skin folds to warrant estimations for quality number being based on crimps. From the foregoing study it appears that ram wools constitute an anomaly.

The South African wool clip which includes droughty wools, fold wool, ram wools and other types will only show agreement on crimps and fibre thickness to a limited degree, and the quality number of the limitations will be treated on the merits of fibre thickness. Quality number based on fibre thickness by hand and eye methods is more difficult to estimate than that based on crimps especially in the finer qualities, 80's and above, and there are instances where wool buying firms have resorted to laboratory methods for estimating fibre thickness for the finer qualities.

The variability or uniformity of fibre distribution is also a factor influencing the spinning of wool. The standard deviation is a useful expression for variability. Where the analysis of all the ram's wool is based on 500 fibres, the distribution curve is valuable for indicating the fibre scatter within the staple. The standard deviations range from the lowest to the highest in harmony with an increase in fibre thickness from the finest to the coarsest wool.

The largest number of fibres of one thickness in any one sample was 218 out of 500 or 44 per cent. The least was 100 or 20 per cent. The largest portion of the samples, namely 65·8 per cent. have a fibre uniformity of 26·30 per cent. The average for fibre uniformity of stud rams is approximately 30 per cent. It is also of interest that about 15 per cent. of stud rams in the Union have a fibre uniformity of 40 per cent.

The coefficient of correlation of $+0{\cdot}677 \pm {\cdot}0327$ between thickness and standard deviation shows a definite correlation, indicating that fine wools have greater fibre uniformity within the staple than coarse wools. This fact is also evident in the fibre thickness standards of Duerden (1929) and of Dantzer and Roehrich (1928), where the thickness limits for the coarser qualities are wider than those for the finer wools.

In an analysis of " Fibre Lengths, Thickness and Qualities in a Single Wool Staple," (Duerden and Bosman, 1931), it was shown that " a wool very variable in length will also be very variable in thickness, or a wool uniform in length will be uniform in thickness. In striving for the uniformity of the one, the breeder will tend to attain uniformity of the other."

From the foregoing it also follows that fine wool will have a higher percentage fibre uniformity within the staple than coarse wool, both as regards fibre thickness and fibre length. Comparisons based on standard deviation should be limited to within the different grades; fine wools with fine and coarse wools with coarse.

The coefficient of variability expresses the standard deviation as a percentage of the mean thickness and is shown to vary from 5·1 per cent. to 9·0 per cent. This constant is limited in its usefulness for Merino wool as in itself it does not indicate the degree of scatter or the degree of fibre uniformity within the staple. It is, therefore, suggested to use both the standard deviation and coefficient of variability as measures of variability in wool studies.

It will be of interest to wool producers to know how far facts established for stud rams are showing themselves in the Union's wool clips, as it is the stud rams that breed flock rams and these in turn influence the commercial clips. The stud rams of 1931 will have lambs suitable for use in 1933 and the progeny of these when used for flock improvement purposes can only reflect their characteristics in the Union's wool clip from 1934.

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SUMMARY AND CONCLUSIONS.

1. The wool characteristics of Merino stud rams are of significance to the wool industry of the Union since the progeny of these rams influence the commercial wool clips.

2. The mean fibre thickness of wools from stud rams ranges from 16·96μ to 27·62μ, which includes all the Merino qualities from 90's to 60's, as well as the coarser ones of 58's and 56's.

3. The frequencies of the qualities based on fibre thickness indicate that 0·8 per cent. are of 90's quality; 5·7 per cent. are 70's; 5·7 per cent. are 66's; 14·6 per cent. are 64's; 24·4 per cent. are 60's; 39·8 per cent. are 58's; 8·9 per cent. are 56's. Thus on fibre thickness, 64·2 per cent. of the stud rams are of 58's to 60's, which would be regarded commercially as strong wool.

4. The crimps range from 21 per inch to 6 per inch, which likewise includes all the Merino qualities and coarser ones of 58's to 56's. The frequencies show that: 0·8 per cent. are of 90's; 1·8 per cent. are 80's; 8·1 per cent. are 70's; 30·9 per cent. are 66's; 36·6 per cent. are 64's; 13 per cent. are 60's; 8·1 per cent. are 58's and 0·8 per cent. are 56's. On crimping, therefore, 67·5 per cent. produce qualities 64's to 66's, commercially regarded as a medium wool.

5. Rams' wool in three cases out of four is coarser in fibre thickness than the crimps indicate. This result is compared with that obtained in the establishment of standards from commercial flock wool where a 75 per cent. agreement between standards of crimps and thickness was obtained.

6. Between fibre thickness and crimping there is a coefficient of correlation of $-0·426 \pm ·0498$, which is a definite one, though not high. In general the more crimps per inch there are the finer is the wool.

7. The standard deviation of fibre thickness ranges from 0·863 to 2·094. In the most uniform sample 44 per cent. of the fibres are of one thickness. The standard deviation is 0·863. The least uniform sample has 20 per cent. fibre uniformity, and a standard deviation of 2·09.

8. The average fibre uniformity for stud rams is approximately 30 per cent. 15 per cent. of stud rams in the Union have a fibre uniformity of 40 per cent., and are relatively very uniform.

9. Fine wools have a higher fibre uniformity than coarse wools. The coefficient of correlation between mean thickness and standard deviation is $+0·677 \pm 0·0329$.

10. The coefficient of variability varies from 5·1 to 8·7 per cent. 82·9 per cent. of the samples have this value from 5·6 per cent. to 7·5 per cent., 12·2 per cent. have a range from 7·6 per cent. to 8·7 per cent., and 4·9 per cent. are relatively very uniform with a value of 5·1 per cent. to 5·5 per cent.

11. There is no coefficient of correlation between coefficient of variability and fibre thickness as is shown by the value $0·020 \pm 0·0608$.

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