SOME FACTORS AFFECTING THE CLEAN PRICE OF GREASY WOOL

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Using data from two representative wool-selling seasons, this paper presents an analysis of the influence of various wool characteristics on the clean price of greasy wool. The crimp frequency of staples is shown to be over three times more important than either staple length or colour; other characteristics, relative to these three, appear to be of no importance.

Wool Characteristics and Textile Processing

The raw wool producer has no specifications defining the desirable range of each fleece trait appropriate to the manufacture of the best final textile product, whatever that product may be. To a large extent this imperfect liaison between producer and manufacturer results not only from the lack of objective test methods for measuring many raw wool characteristics and fabric properties, so making it difficult to relate the two, but also from the fact that wool bulks with widely differing characteristics are frequently suitable for the manufacture of the same product.

In a general sense, the importance of the two most conspicuous fleece properties, fibre length and fineness, is demonstrated by the way in which the yarn spinning industry is divided into two main sectors: worsted and woollen. Respectively, these sectors have evolved to handle long and short stapled wool. These different wools cannot be processed economically by the same sets of machinery, nor their fibres successfully manipulated without the use of clearly different operations. Within the sectors the fineness of the fibres is important because it largely determines the count to which the yarn will be spun. While these observations are true in a general sense they only hint at the relative importance of each property and give only a slight suggestion of how a change in dimension of either one will affect the properties of the end-products.

The important question of how the variation in length and fineness, and the variation of those other characteristics which constitute wool quality in the wider sense, affects the properties of textile end-products can only be answered by conducting a series of processing trials. This approach is necessarily expensive and long-term. Some such processing trials have been carried out in a number of countries.[1] From these one

* The author is indebted to the Sydney wool selling brokers for their co-operation in allowing appraisals to be made and to the Wool Statistical Service of the Australian Wool Board for providing seasonal prices. The author's current address is: Australian Embassy, The Hague.

[1] W. Von Bergen and J. H. Wakelin, Apparel wools: Properties. 1. Preliminary report on worsted processing trials. *Text Res. J.* 22 (2): 123-37, 1952; T. F. Evans and D. J. Montgomery, Properties of Apparel Wools. 5. Physical properties of single fibres. *Text. Res. J.* 23: 689-701, 1953; G. R. Stanbury and J. Byerley, The relation between the strength, count and twist of single worsted yarns. *J. Text. Instit.* 25: T295-310, 1934; W. Von Bergen and H. R. Mauersberger, *American Wool Handbook.* Barnes, N.Y., 2nd edn., 1947; J. G. Martindale, Worsted slivers and yarns: Irregularity. *J. Text. Instit.* 36: T35-47, 1945; Progress in worsted spinning research. *J. Text. Instit.* 37: 350-70, 1946; A. D. Bastawisy, W. J. Onions and P. P. Townend, Some relationships between the properties of fibres and their behaviour in spinning. *J. Text. Instit.* 51 (7): T1-20, 1961.

can safely conclude that in normal circumstances the mean fibre diameter of wool bulks is the most important single property governing processing performance.

More particularly these studies demonstrate that the mean fibre diameter closely governs the spinning capacity, strength, and regularity of yarns. In the worsted sector, mean fibre length is shown to be quite important in affecting yarn regularity and to a lesser extent the fineness to which a yarn may be spun. In this last respect, although spinning limit is thought to be impaired by extreme variability in fibre length, there is so much fibre breakage in processing at present that even a variation of 1·5 inches between staples in a fleece will probably be unimportant.[2]

Some work on the importance of crimp in processing has been carried out, but in this field of investigation the problem is confused by the finding that even in merino staples showing well-defined regular crimp, the crimp frequency of constituent fibres may show a wide variation about the staple mean. Staple crimp frequency governs the commercial appraisal of quality number, but it is unreliable as an indication of mean fibre diameter and hence of spinning capacity, commercial appraisers frequently making inaccurate assessments in this regard when valuing individual lots. Investigations have generally revealed that slight processing advantages exist for wools with more highly crimped staples.[3] On the other hand one study showed that low crimped wools spin slightly finer, with fewer end-breakages, giving more uniform and slightly stronger yarns.[4]

Wool merchants give emphasis to many other characteristics when valuing lots of greasy wool, but there is little objective evidence available to indicate the relative importance of the characteristics in processing. For example, "character" which relates to the possession of strongly marked distinct "qualities" of breed and type and is an indication that the staple crimp formation is regular and pronounced, has been investigated for its effect on the subsequent product only once.[5] Although there was a suggestion in the evidence that wools of better character comb to better advantage, the experiment was hardly sensitive enough to be conclusive. Another study showed that wools with anomalous crimp (i.e. exhibiting poor "character") showed no disadvantage in spinning, nor were the fabrics produced in any way inferior to those made from normal wools.[6]

Although no discriminative tests have been carried out, it is widely

[2] N. F. Roberts, The textile consequences of fleece characteristics. *Wool Technology and Sheep Breeding* 4 (2): 68, 1957.

[3] J. Menkart and B. Joseph, The significance of wool fibre crimp. 2. A study on the woollen system. *Text. Res. J.* 28: 940-5, 1958; J. H. Dusenbury and C. J. Dansizer, Effects of fibre diameter and crimp on properties of wool fabrics and other fibre assemblies. 2. Properties of top, roving, yarn and fabric. *J. Text. Instit.* 51 (12): T1443-61, 1960.

[4] A. D. Bastawisy, W. J. Onions and P. P. Townend, Some relationships between the properties of fibres and their behaviour in spinning. *J. Text. Instit.* 51 (1): T1-20, 1961.

[5] W. D. McFadden, P. E. Neale and M. D. Finkner, *Influence of Crimp on Production and Combing Characters.* New Mexico College of Agric. and Mech. Arts Bul. 382, 1953.

[6] W. R. Lang and R. B. Sweeten, Anomalous staple crimp: its significance in worsted processing. *J. Text. Instit.* 51 (12): T922-34, 1960.

acknowledged that the colour of greasy wool is important to the manufacturer because any off-white colouration may remain in the wool after scouring and so defeat his objective in producing a white top. Off-whites tend to make dye colours dull and lacking in pure tone.

The importance placed on softness of handle of raw wool depends to some extent upon the section of the trade valuing the wool and the end-use of the intended product. Fabric "hand" is the result of a multiplicity of interacting factors, of which the inherent softness of the fibres is important to a varying degree. The influence of softness of handle of raw wool on processing is inextricably associated with the influence of fibre diameter, since softer wools tend to be finer, but the main difficulty in isolating the role of softness is that there is as yet no objective means of measuring this characteristic.

"Sound" wools are those without a weak (or "tender") region in the fibres. "Tenderness" in wools causes increased card waste and excessive noil during combing and so is discriminated against. Vegetable fault in wool interferes with efficient processing in many ways. Other characteristics such as the degree of weathering (by moisture, heat, and ultraviolet radiation) experienced by wool fibres while on the sheep's back, and freedom of fibre growth (e.g. fibres not felted together) are important in processing for obvious reasons and constitute a source of variation in price. "Bulkiness" or "density" can be important because thinly grown fleeces usually suffer some form of degradation by the environment. Excessive lustre in a wool, although sometimes sought after for special effects, is usually discriminated against because of the belief that uneven dyeing will result.

All the characteristics mentioned above play some part in determining the monetary value of a lot to a manufacturer. Although some have been examined objectively to assess their importance, it is obvious that the state of knowledge in this field is quite incomplete. Until the quantitative data on wool fibre and fabric properties are complete and scientific specifications for processing and end-product application are available, the attention given by the wool producer to the various fleece characteristics may well be disproportionate to their actual usefulness. The only alternative is to relate the market price of wool to the degree of development of the greasy wool characteristics. This is the approach used here. Clearly, it is not known whether the trade is paying for wool features in correct proportion to their usefulness. On the other hand, the experience gained by processors over a long period of time cannot be totally inaccurate. Moreover, information on the relative economic value of alternative characteristics will enable the breeder to concentrate on those characteristics *held to be important*, until the long-term processing trial conclusions are drawn. Even then, the breeder would be unwise to change his breeding plan until this technological knowledge is reflected by market prices.

Measuring Wool Characteristics

When greasy wool is auctioned, every lot is classified by "type", the "type number" revealing immediately to anyone familiar with the Australian Wool Board (A.W.B.) type system, the "style" of the wool (e.g. Spinner's, Topmaking, etc.), the trade length (e.g. warp, half-warp, etc.), the quality number (e.g. 70^s, 64^s, etc.), and the degree of

vegetable fault (e.g. free, B, C, or D grades). The average clean price paid for each type during the season is calculated by the A.W.B. and is available on a confidential basis. Since there is available in each season a list of prices corresponding to a range of types, the relative economic value of style, trade length, quality number, and vegetable matter can be measured by coding each type for these four and relating the coded values to relevant price.

It is well known, however, that woolbuyers consider more characteristics than just these four when valuing a lot. Accordingly, preliminary work was carried out to establish grades of excellence or subjective scores for these characteristics. For example, six grades were required to represent the various degrees of *soundness* inherent in a lot, five grades were needed for *handle, density, freedom of growth, character, colour, weathering, definition of crimp* and *regularity of crimp*, but only four grades were needed for *lustre*. A numerical score for each grade of any characteristic allows an appraiser's estimate of the degree of development of that characteristic to be compared statistically with another's and also enables a repeatability check on any one appraiser to be carried out.

Trade length is too insensitive a measure of staple length so this classification was abandoned in favour of measurements made with a rule graduated in inches and tenths, and "style", which is wholly determined by the ten characteristics mentioned previously, was not considered *per se* because it is represented by its component characteristics.

Having chosen the major classification of the wool to be included in this investigation (merino combing) and having established scores to represent the various degrees of development of each characteristic known to affect the value of greasy wool, one has only to establish sets of scores for a range of types and relate these values to the clean price obtained for the types at auction. The danger in this approach is that the prices at any particular part of the season are likely to be far from representative. It is better to choose at random ten lots of each type during the season, score them, calculate the average score of each characteristic, and relate this set of averages to the annual average clean price of the type. This procedure was repeated for as many types as possible.

The same method was applied in the measurement of staple length. Using staple length as an example, the procedure was as follows. To simplify matters initially, consider only one type, the very common type 56. During the whole season, ten lots of type 56 were selected at random from those available on the show floor, the selection taking place at different sales throughout the year to account for any variation in type 56 due to district influences. On selecting a sale lot of type 56, five staples were drawn at random from the shown bales, measured, and the lot mean recorded. At the end of the season, after recording the mean staple length for 10 lots, a grand mean staple length for type 56 was calculated, and this grand mean was the value used as the independent variable in the regression of staple length on price, the price being the average seasonal price for *all* type 56's sold in any particular year. A similar procedure was adopted for all the other characteristics listed previously, so that at the end of the season, 72 types as listed in Table 1 were available with a set of grand means for each characteristic, these

72 sets of variables being used as independent variables in the multiple regression analyses.

TABLE 1

A.W.B. Types scored in relative Economic Value Analysis

	Warp	Warp and half	Half warp	French combing
Super spinners	19	26 27		
Good spinners	37 39 40 41 41A	44 45 46 47 47A 48	49 50 51 52 53	
Average spinners	55 56 56A 57 58 59	60P 60 61 62 62A 63 64 64A	65P 65 66 67 67A 68	
Good topmaking	71 72 72A 73 74 75	76 77 78 78A 79 80 81	82 83 84 84A 85	
Average topmaking	88 88A 89 90	93 93A 94		
Good				121P 121 122 123 123A
Wefty				124 125 125A

Although the measured degree of excellence of the characteristics of the 72 types was obtained in one season only, in the analyses which follow, these measurements have been related to the price data of the seasons 1946-47 to 1958-59, excluding the 1952-53 season for which records are unavailable. Appropriate price details in the form of Australian annual average clean-on-floor (C.O.F.) prices (in pence) for the ten years were made available by the Wool Statistical Service of the A.W.B. To relate measurement data collected in one season with the price (of the same types) in another season presumes that the mean score for the various characteristics is relatively constant from year to

year for each type. The assumption is reasonably justified, as care was taken to ensure that types were selected from a range of districts over the whole season. If the appraisals were repeated in another season, one would expect the second set of mean scores for the characteristics of each type to be nearly similar to the first set.

Before the analyses were carried out, the observer's ability to repeat his scores was tested by presenting him with the opportunity of re-appraising 228 lots, ranging from sub-types 18 to 125 AB, his repeatability being measured by the intra-class correlation statistic. With the possible exception of lustre, the intra-class correlation coefficients listed in Table 2 indicate that the appraiser was able to repeat his score satisfactorily when presented with the same lot a second time. Since the types included in this preliminary trial cover the range encountered in the major data and since the appraiser was found in preliminary work to give appraisals which did not differ significantly from other experienced appraisers, one may expect that the results are indicative of the degree of development of the characteristics of the lots. Because the observer was relatively unsuccessful in repeating his appraisals for lustre, this characteristic has not been considered in the analyses which follow.

TABLE 2

Intra-class Correlations of Repeated Appraisal

Characteristic	Intra-class correlation coefficient
Staple length	0·86
Crimps per inch	0·79
Character	0·77
Colour	0·82
Handle	0·74
Crimp definition	0·76
Crimp regularity	0·73
Density	0·74
Freedom of growth	0·80
Weathering	0·70
Lustre	0·66

Analysis of the Seasonal Price Records

It seemed desirable to select that season or seasons in which the relative order of the prices for various types was similar to and representative of other seasons. The most convenient way of comparing the seasons is to compute the product-moment correlation coefficients of the prices of the corresponding types in all possible pairs of seasons. This procedure was adopted and the results are shown in Table 3.

Any season with a high frequency of low correlations with other seasons is one in which relatively irregular prices have prevailed. On this basis the four seasons which have prices in an order similar to most of the other seasons are 1953-54, 1954-55, 1955-56, 1956-57. Of these, 1953-54 has been selected as the most representative season for examination of relative economic value.

Relative economic values were determined by using the statistical model of linear and curvilinear multiple regression of price (Y) on the average scores for the "n" characteristics (X). The independent

TABLE 3

Product Moment Correlation Coefficients of Subtype Prices between all possible Pairs of Seasons

	1947–48	1948–49	1949–50	1950–51	1951–52	1953–54	1954–55	1955–56	1956–57	1957–58
1946–47	0·91	0·92	0·91	0·86	0·82	0·82	0·81	0·82	0·88	0·70
1947–48		0·95	0·91	0·89	0·87	0·81	0·80	0·81	0·85	0·79
1948–49			0·89	0·89	0·90	0·89	0·89	0·86	0·91	0·86
1949–50				0·89	0·81	0·75	0·72	0·77	0·83	0·66
1950–51					0·78	0·72	0·74	0·73	0·80	0·66
1951–52						0·90	0·87	0·88	0·91	0·81
1953–54							0·98	0·96	0·97	0·81
1954–55								0·93	0·96	0·83
1955–56									0·96	0·76
1956–57										0·80

variables were assumed to be fixed. The linear model may be symbolized as follows:

$$Y = a + \Sigma b_r X_r + e, \qquad r = 1, 2, \ldots . n.$$

Soundness was not considered in the analyses that follow, since there was insufficient variation in the characteristic to warrant its inclusion.

Regression of Price on Greasy Wool Characteristics

The results of simple and multiple regressions of the 1953-54 price on greasy wool characteristics are given in Table 4.

TABLE 4

Results of Multiple Regression of 1953-54 Price on Eleven Wool Characteristics

Characteristic	Simple regression coefficient	Partial regression coefficient	Standard partial regression coefficient
Staple length	—7·37	10·43***	0·26
Crimps per inch	6·11***	5·94***	0·85
Handle	25·23***	—0·28	—0·01
Density	0·06	—3·99	—0·13
Growth	12·44***	—0·08	—0·03
Character	14·84***	—3·54	—0·11
Colour	23·45***	10·71**	0·30
Vegetable matter	—10·28***	2·81	0·14
Weathering	16·01***	0·54	0·16
Crimp definition	9·41*	4·30	0·12
Crimp regularity	25·07***	1·13	0·03

*** denotes $P < 0{\cdot}001$; ** denotes $P < 0{\cdot}01$; * denotes $P < 0{\cdot}05$.

All the simple coefficients are statistically significant except those of staple length and density. The negative sign of staple length, which indicates that an increase in staple length causes a decrease in price in the simple analysis, is explained by the high correlation between staple length and crimps per inch. As expected, the only other negative sign is that for vegetable matter.

Of the partial regression coefficients, only crimps per inch, staple length and colour are significant. The size of the latter two coefficients is about twice that of crimps per inch, yet in the standard partial form the coefficient of crimp frequency is about three times greater than colour and staple length. The partial coefficient of vegetable matter is positive but not statistically significant. Handle, density, character and freedom of growth are negative but not significant. Of the variation in price, 91·9 per cent is accounted for by the eleven variables.

The data were re-analysed deleting all the variables except staple length, crimp frequency and colour. The results are shown in Table 5. Compared with the full analysis, all the partial coefficients are slightly larger. All are significant at the 0·1 per cent level. The importance of colour and staple length in affecting price levels is about equal, as

gauged by the standard partial coefficients, but about 3·5 times less than crimps per inch. Control of price variations is 89·8 per cent which is not significantly different from the control with eleven variables. As one might expect, the inclusion of weathering as a variable (although not significant, it ranks next after staple length and colour in the size of its partial coefficient) gives no increase at all in control.

TABLE 5

Results of Multiple Regression of 1953-54 Price on Staple Length, Crimp Frequency, and Colour

Characteristic	Partial regression coefficient	Standard partial regression coefficient
Staple length	10·19***	0·25
Crimps per inch	6·22***	0·89
Colour	8·75***	0·25

*** denotes $P < 0·001$.

Further estimates of relative importance may be obtained by comparing the reduction in the control of price variation which occurs when each variable is deleted in turn. In the presence of the full set of variables, deletion of crimps per inch causes a reduction in control of 9·1 per cent, colour 4·6 per cent, and staple length 2·1 per cent. By deleting one of the three in the presence of the other two only, control is reduced by the following amounts: crimps per inch 40 per cent, colour 4·2 per cent, staple length 3·9 per cent. The overwhelming importance of crimp frequency is again demonstrated.

As an arbitrary test for curvilinearity a quadratic equation was fitted. The multiple regression analysis of price on the three previous variables with various combinations of their squares was adopted. The combination of variables is shown in Table 6. There is a significant 4·1 per cent increase in control by the introduction of the second degree terms (set 1) compared with the three first-order variables alone (Table 5). In sets 2 to 7, only the deletion of the second-order colour term (set 2) causes a reduction in control which is not significant compared with all six variables (set 1). Of the remainder, those sets in which the second-order staple length terms are deleted give the largest reductions in control, emphasizing the importance of staple length in the curvilinear relationship.

As comparison of the standard partial regression coefficients at the non-linear level provides no information, the importance of each term may be gauged by deleting similar pairs (sets 8, 9, 10) and comparing the consequent reduction in the percentage of price variability explained by the regression. When the crimp frequency terms are deleted, there is a reduction in control of 38 per cent, compared with 6·0 per cent for staple length and 4·1 per cent for colour. The influence of staple length in the non-linear relationship has placed it before colour in order of importance.

TABLE 6

Second-order Regressions Examined of C.O.F. Price (1953-54) on Staple Length (SL), Crimps per inch (CPI) and Colour (COL)

Set	SL	SL^2	CPI	CPI^2	COL	COL^2	R^2 (%)
1	+	+	+	+	+	+	93·9
2	+	+	+	+	+		93·6
3	+	+	+		+	+	93·1
4	+		+	+	+	+	91·2
5	+	+	+		+		92·7
6	+		+	+	+		90·2
7	+		+		+	+	90·9
8			+	+	+	+	87·9
9	+	+			+	+	55·9
10	+	+	+	+			89·8

Repetition of the above analyses using 1954-55 prices gave results closely similar to those for 1953-54 prices, as would be expected from the similar price patterns in these two seasons as evidenced by their correlation coefficient of 0·98 in Table 3.

Conclusions

The results show that of the variation in price, between 80 to 90 per cent is controlled by three variables: crimps per inch, colour, and staple length. No other characteristic consistently revealed itself as being important in affecting price. From the comparison of the standard partial regression coefficients presented previously, crimps per inch is over three times more important in affecting price levels than either staple length or colour, which are approximately equal in this respect. The results confirm the conclusions drawn in an earlier analysis[7] which showed that the price paid for merino wools is overwhelmingly dependent on crimp frequency (or quality number) and that staple length and colour have real, though very much smaller, effects in determining prices paid; and that soundness, handle and character give no additional information concerning price. These conclusions were based on prices paid for various types in the 1946-47, 1948-49, 1951-52, and 1953-54 seasons, the price used for each type being the average price over these four seasons.

It has been demonstrated also that the relationship between price and the important variables is more aptly described by a curvilinear model. Use of a quadratic equation results in a slightly greater emphasis on staple length. However, the general conclusions are unaltered when the non-linear model is used.

The other important fact brought to light by the study is that character, which relates to the regularity and distinction of the crimp, is relatively insignificant in affecting the price of greasy wool bulks. It is well known that character is considered by breeders to be a highly desirable property of a fleece, but it seems their breeding plans will need

[7] A. A. Dunlop and S. S. Y. Young, Selection of merino sheep: An analysis of the relative economic weights applicable to some wool traits. *Empire J. Exp. Agric.* 28: 201-10, 1960.

re-orientation in view of this finding. The result again confirms a similar conclusion drawn in the other study of relative economic value.[8]

With these facts in hand, what should the wool producer aim at in his production? In terms of quantity, it has been found that greasy fleece weight is generally three times more important than crimp frequency in determining the monetary return of the wool clip to the grower.[9] Thus it is apparent that within the limitations imposed by the breed and strain of sheep best suited for a particular environment, any breeding plan should concentrate on the production of increased wool weights. In terms of overall quality it seems that the highest gross returns will be obtained for wool which is highly crimped, as white as possible, and possesses staples which are as long as possible, within the limits defined by the machine settings for wools of different crimp frequency. To what extent wool producers should divide their wool improvement efforts between crimp frequency, colour, and staple length will depend on the relative costs of altering these characteristics. If costs were about equal in terms of standard deviation units, it would seem advisable to concentrate about two or three times more attention on improving staple crimp frequency than colour and staple length. Specified wool defects should obviously be avoided, but the tendency to concentrate on improving those characteristics of style (other than colour) such as regularity and distinctness of staple crimping, density, staple definition and handle, will not be sufficiently rewarding in cash return. There are some wools possessing extreme development of "stylish" characteristics which are required and paid dearly for by manufacturers but, in most instances, style should be regarded by breeders as a minor point of selection in any breeding plan.

There is no doubt that wool producers are paying too much attention to stylish characteristics and this is clearly evidenced by the fleece judging systems currently being used in Australia. For instance, in the system devised by the National Council of Wool Selling Brokers of Australia,[10] 20 per cent of points are awarded for regularity and distinctness of staple crimping, and 28 per cent of points to other style characteristics such as "trueness to type", regularity of length, density and handle. Only 40 per cent of points are awarded for yield and fleece weight, and a mere 6 per cent for colour.

Because they receive no other form of guidance, wool buyers pay higher prices for the more highly crimped wools irrespective of their mean fibre thickness. Consequently one can only advise the producer to do all he can to increase the crimp frequency of his wool in spite of the fact that crimps are relatively unimportant in manufacture. This only serves to emphasize the need to introduce objective measurement in wool marketing.

At present all the greasy wool characteristics are subjectively assessed by the buyers, who use hand and eye methods. Staple crimps are quite unreliable as an indicator of the mean fibre thickness of the constituent fibres. It has been shown also that measurement of fibre thickness

[8] *Ibid.*

[9] E. M. Roberts, Relationship between fleece weight and quality number. Unpublished Ph.D. thesis, Univ. of N.S.W., 1957.

[10] *Instructions to Judges and Stewards and Scale of Points for Fleece Judging.* Natl. Council of Wool Selling Brokers of Aust., Sydney, 1959, p. 13.

provides more reliable and less variable information than expert subjective appraisal. The same remarks apply to yield. It becomes obvious that, before the auction, buyers ought to be provided with the results of fibre thickness and yield measurements made on the greasy wool lots for sale. This could be accomplished by testing samples in the laboratory and printing the test results in the catalogue prior to sale. Buyers would be able to examine the lots in the usual manner but concentrate on those features for which no objective measurements are available (e.g. colour, handle, weathering, etc.). The display of the scoured laboratory samples with the lot would allow the buyer to predict what the colour of the scoured product would be like, and should reduce the emphasis placed on colour in greasy wool, for part of its importance is probably the result of the woolbuyers' caution in assessing the extent that the degree of yellowness in the greasy state will remain after scouring.

Pre-sale testing has many advantages and if introduced would make up some of the deficiencies of the wool auction system without destroying its traditional character, and may well lead to a form of price stabilization which the industry sorely needs and at present so completely lacks. To introduce a pre-sale testing scheme on an efficient basis, estimates are required of the variance of greasy wool properties, especially fibre fineness and fibre yield. Some studies have been made which report such estimates.[11]

It has also become apparent during this study that the classification of greasy wool by the A.W.B. type scheme could be easily improved. Instead of the consecutive number system of classification, each style could be coded from one to seven, each trade length group coded by a letter, and each quality number group coded by reference to the average number of crimps per inch per quality number, the vegetable matter code remaining as it is. This would enable the complete classification of any wool in any section of the type scheme simply by memorizing four sets of code values.

[11] J. N. Skinner, Variation in some properties of Australian greasy-wool lots. *J. Text. Instit.* 56 (1): T1-13, 1965; Estimates of variance of fibre diameter and fibre yield in Australian greasy wool. *Proc. Fourth Intl. Wool Text. Res. Conf.* (Paris, July 1965), (in press); S. A. S. Douglas, Variability estimates of some measurable characters in Australian greasy merino-wool lots. *J. Text. Instit.* 56 (1): T14-23, 1965.