SAWTRI BULLETIN

SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
OF THE CSIR

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SEASON'S GREETINGS

The Chief Director and staff extend Best Wishes and Cordial Greetings for 1985 to readers of the Bulletin.

INSTITUTE NEWS

Chief Director Appointed to University Position

SAWTRI's Chief Director, Dr D W F Turpie, has been appointed as Professor Extraordinary occupying the Phillip Frame Chair of Textile Science, and Head of the Department of Textile Science at the University of Port Elizabeth which offers facilities for postgraduate studies in textiles. In this capacity the Chief Director is a member of the Board of the Faculty of Science, a member of the University Senate and member of the Board of Studies for Physical Sciences.

Dr D W F Turpie, Chief Director at SAWTRI

Symposium on New Technology for Textiles

A Symposium on New Technologies for Textiles which is to take place in Port Elizabeth during July 1986, is being organised by SAWTRI in collaboration with the Eastern Cape Section of the Textile Institute and will be presented under the auspices of the South African Advisory Committee (SATAC) to the Textile Institute, Manchester. The inaugural meeting of the Organizing Committee was held on 14th September, 1984. Further announcements regarding the Symposium will be made in due course.

Research Programme for 1985/86

The annual meetings of the Steering Committees of the South African Wool Board and the Cotton Board were held at the Institute on the 1st November followed by the annual meeting of SAWTRI's Research Advisory Committee (RAC) on the 2nd November to approve proposals for the 1985/86 research programme.

Visitors to SAWTRI

Early in September, Dr W J van Biljon of the CSIR Liaison Office in Bonn, Germany, paid a visit to SAWTRI to familiarize himself with the facilities and objectives of the Institute.

On the 24th September, Dr Ray Howe, Head of the Textile Technology Department of the Natal Technikon, accompanied by Messrs A Mueck, I Lawson, A Ellis and D Taylor, who are all lecturers at the Technikon, visited SAWTRI to have in-depth discussions with Group Leaders and some Heads of Departments on a variety of topics.

The annual "Insight into Industry" visit organised by the Rotary Club of Algoa Bay took place on the 3rd October during which 25 students from all over the Eastern Cape were taken on a tour through the Institute.

A delegation of 20 German wool textile industrialists, hosted by the South African Wool Board during their stay in South Africa to study all aspects of the local wool industry, was received by SAWTRI on the 9th October. They were given a short over-view of the activities of the Institute in particular, and the CSIR in general, and were also shown a display of wool and wool blend fabrics developed by SAWTRI after which they were taken on a guided tour of the processing departments and laboratories.

Four representatives of Messrs Luckomen Enterprise Limited, a Taiwanese textile manufacturing firm in Taipei visited SAWTRI early in October. As importers of South African wool and mohair, the representatives were interested in gaining facts and information about SAWTRI publications relevant to their manufacturing operations.

Members of the German delegation being officially welcomed at the Institute.

On 23rd October and 30th October groups of mohair and wool farmers from Waterford and Laingsburg respectively, were shown around the processing departments at SAWTRI.

On the 31st October a French business delegation hosted by the South African Wool Board, paid a visit to the Institute to gain insight into the activities and facilities at SAWTRI. Mr K Kanki of Bisai Wool Yarn Spinning Co., and Mr M Kotsuki of Marubeni Corporation, Japan, visited the Institute during November while on a study tour of the South African wool industry.

Mr M Nobs of Alpha Tops in Switzerland visited the Institute early in November to have discussions on the measurement of mohair fibre diameter and the composition of blends containing mohair and wool.

Visits by SAWTRI Staff

Mr N J Vogt, represented SAWTRI at the second meeting of the Liaison Committee for Scientific Research in the Western Cape which was held in Cape Town on the 1st November, and gave a slide presentation on the research and activities of SAWTRI in general. This CSIR Committee meets annually with the Administrator of the Cape, members of the Executive Council, representatives of Universities in the Cape and senior City officials to report on CSIR activities of importance to the area.

Mr P. Horn, Head of Publications and Information, attended a Symposium on Publication Standards in Pretoria on the 1st and 2nd November presented by the State Library, the South African Bureau of Standards and the South African Institute for Librarianship and Information Science. He also visited the Institute for Information and Research Services (IRS) of the CSIR to meet and have discussions with IRS staff, and to familiarize himself with facilities and equipment available at this Institute.

Staff News

In the previous edition of the Bulletin, mention was made of 10 members of SAWTRI staff having passed a basic first-aid course with distinction. Nine members subsequently passed an advanced first-aid course, all with distinction, and a team was invited to take part in the Red Cross Industrial First Aid Competition held on the 31st October. We are proud to report that this team gained the highest number of points in their category and won the Chartered Institute of Industrial Safety Engineer's Award which is one of the most sought-after awards in industry.

Mr S Smuts, Head of the Textile Physics Department who has been with SAWTRI since 1964, has recently received high textile honours when Fellowship of the Textile Institute was awarded to him by the Council of the Textile Institute in Manchester.

Miss J Adams has recently been appointed as a member of the library staff.

SAWTRI PUBLICATIONS

Since the previous edition of the Bulletin, the following papers were published by SAWTRI:

Technical Reports

No. 556 Smuts, S., and Hunter, L., The Effect of Some Yarn and Fabric Structural Variables on Woven Wool Fabric Properties, Part II: Random Deformation Wrinkling Assessed by the SAWTRI Wrinklemeter. (September 1984).

No. 557 Galuszynski, S. and Robinson, G. A., Effect of Steaming and Commercial Drycleaning on Fabric Shrinkage and Bond Peel Strength (September 1984).

SAWTRI Special Publications

Bathie, L.A., The Reclamation and Reprocessing of Cotton Wastes Produced during Yarn Preparation (November 1984).

Papers by SAWTRI Authors appearing in other Journals:

Hunter, L., Gee, E. and Barkhuysen, F. A., Der Einfluss von Baumwoll-Fasereigenschaften auf bestimmte Eigenschaften eines Rechts/Links-Gestricks. *Wirkerei- und Strickerei-Technik* **34**, 998 (1984).

Van der Merwe, J. P., Hunter, L. and Brydon, A. G., Woollens in Wraps. *Textile Horizons,* **4** (11), 24 (1984).

CORE-SPUN AND WRAPPED CORE-SPUN WORSTED RING YARNS

by G.A. Robinson and S.G. Marsland

ABSTRACT

The spinning of core-spun and wrapped core-spun yarns on a conventional ring spinning machine is described and their properties compared with conventional all-wool worsted yarns. The former yarns appear to have considerable potential for both weaving and knitting because of improved physical properties.

INTRODUCTION

Blending wool with synthetic fibres can sometimes hold certain advantages, particularly for light-weight applications, and in this respect the use of continuous filaments instead of staple synthetic fibres may offer additional advantages. There are various ways of producing wool fibre/synthetic filament yarns such as Woolfil and core yarns[1—3], wrap spun yarns[4], Coverspun[5], ring spun core yarns[6—8], open-end core yarns[9] and Repco wrapped core spun yarns[10—27].

This report deals with an investigation into the production of various combinations of core and wrapper yarns on a ring frame using in most cases double rovings.

EXPERIMENTAL

Raw Materials

A 21,5 μm wool (Hauteur 77 mm) was used for these trials. The top was lubricated with 0,3% (o.m.f.) ® Bevaloid 4027 and converted into a double meché twistless roving of 2x350 tex.

Spinning

Spinning was carried out on a Rieter H2 spinning machine. The double meché rovings were separated by means of guides in the drafting zone (see Fig. 1). Nylon filament yarns were introduced from above and between the apron nose and the roller nip behind the front rollers and into the core of the wool strand. The traversing mechanism was centralised and fixed. Nominal 20 and 40 tex yarns were spun at a weaving tex twist factor of 34,8 and a knitting tex twist factor of 25,2. Schematic diagrams of the yarns are shown in Fig. 2. The following yarns were spun:

Double (roving) wrapped core spun
Double (roving) double core spun

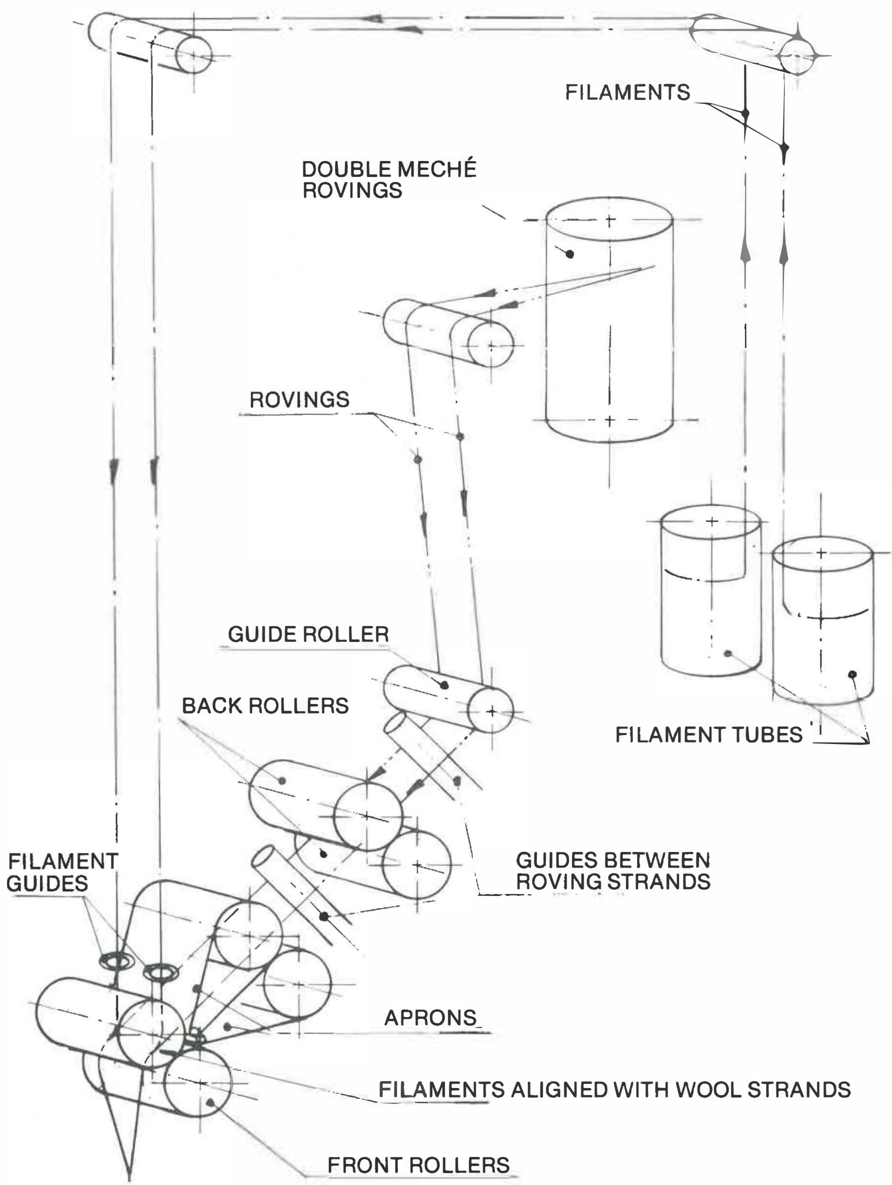

Fig. 1 — Schematic roving and filament arrangement on the ring spinning machine.

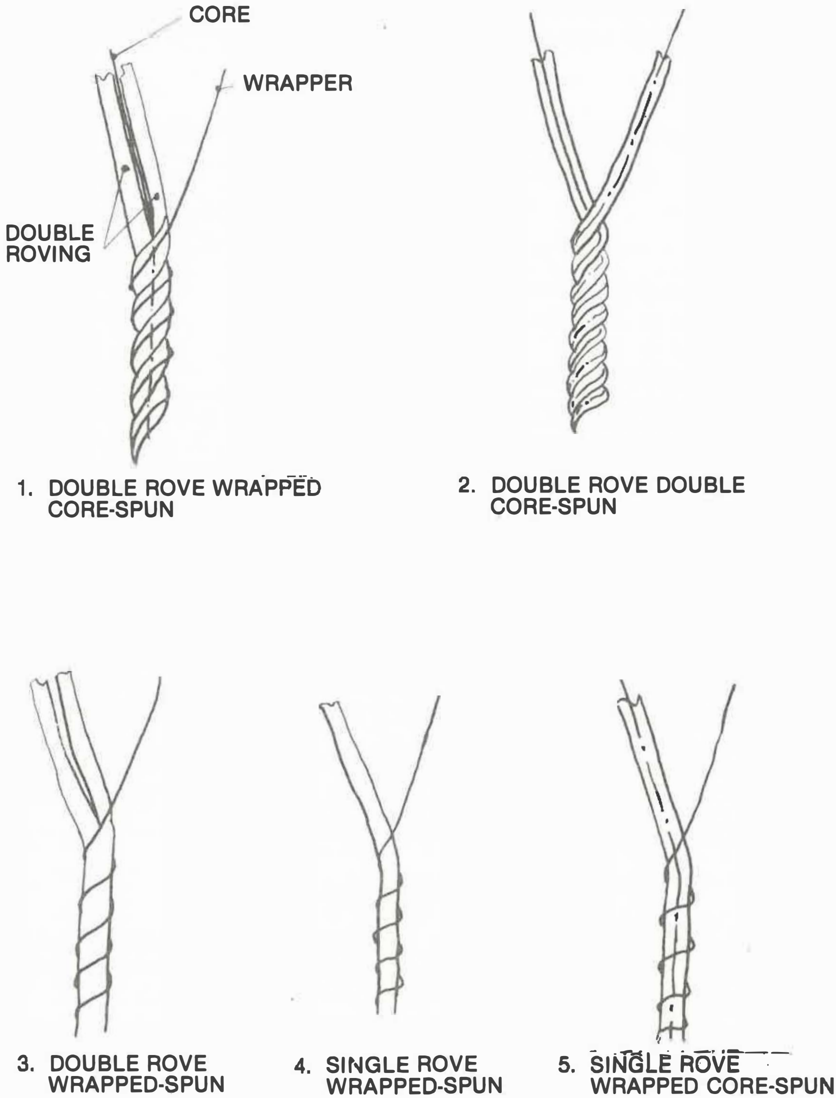

Fig. 2 — Schematic diagram of core and wrap yarns.

Double (roving) wrapped spun
Single (roving) wrapped core spun
Single (roving) wrapped spun

All are compared with conventional ring and double rove (two-strand) yarns.

TABLE 1(A)
DETAILS OF WEAVING YARN — (TEX TWIST FACTOR 34,8)

Description	Yarn Linear Density (tex)	No. of Roving Strands	Core (17 dtex f5 Nylon)	Wrapper (17 dtex f5 Nylon)	Twist (t/m)	Blend (% Wool/ Nylon)
Double rove wrapped core spun	42,5	2	1	1	Z540	92/8
Double rove double core spun	42,5	2	2	—	Z540	92/8
Double rove wrapped spun	42,0	2	—	1	Z540	96/4
Single rove wrapped core spun	21,8	1	1	1	Z760	84/16
Single rove wrapped spun	21,0	1	—	1	Z760	92/8

TABLE 1(B)
DETAILS OF KNITTING YARNS — (TEX TWIST FACTOR 25,2)

Description	Yarn Linear Density (tex)	No. of Roving Strands	Core (17 dtex f5 Nylon)	Wrapper (17 dtex f5 Nylon)	Twist (t/m)	Blend (% Wool/ Nylon)
Double rove wrapped core spun	42,2	2	1	1	Z400	92/8
Double rove double core spun	41,5	2	2	—	Z400	92/8
Double rove wrapped spun	42,7	2	—	1	Z400	96/4
Single rove wrapped core spun	22,7	1	1	1	Z560	85/15
Single rove wrapped spun	21,7	1	—	1	Z560	92/8

The yarns were steam set and tested for physical properties.

CONCLUSIONS

The results are compared (Tables 2(A) and 2(B)) with double rove yarn and singles and ply conventional yarns produced from the same rovings to similar linear densities.

As can be seen from Tables 2(A) and 2(B) the yarns had greatly improved tenacities, higher extensibility and were more regular, had less thick and thin places and were generally less hairy than either the equivalent conventional ring spun yarns or double rove yarns. These yarns show considerable potential for knitting and weaving and there is also the added advantage that finer yarns can be spun.

TABLE 2(A)
PHYSICAL PROPERTIES OF WEAVING YARNS

Type	Resultant Yarn Linear Density (tex)	Twist (turns/m)	Breaking Strength (cN)	Tenacity (cN/tex)	Extension (%)	Irregu-larity CV(%)	Thin Places (per 1000 m)	Thick Places (per 1000 m)	Neps (per 1000 m)	Hairs (per metre)
Ring (control) (two-ply)	R40/2	S560/2 Z760	329	8,2	27,1	13,8	2	0	8	6
Double rove (control)	41	Z550	326	7,9	28,0	15,8	18	32	16	6
Double rove wrapped core-spun	42,5	Z540	463	10,9	31,7	14,7	8	0	8	7
Double rove core-spun	42,5	Z540	469	11,0	32,9	15,0	8	4	8	12
Double rove wrapped spun	42,0	Z540	394	9,4	30,2	15,0	12	14	16	6
Ring (singles) (Commercial)	20,0	Z734	139	6,9	15,8	20,2	357	132	26	—
Single rove wrapped corespun	21,8	Z760	286	13,1	27,0	20,1	126	74	36	7
Single rove wrapped spun	21,0	Z760	203	9,7	23,5	20,3	230	78	38	9

TABLE 2(B)
PHYSICAL PROPERTIES OF KNITTING YARNS

Type	Resultant Yarn Linear Density (tex)	Twist (turns/m)	Breaking Strength (cN)	Tenacity (cN/tex)	Extension (%)	Irregu-larity CV(%)	Thin Places (per 1000 m)	Thick Places (per 1000 m)	Neps (per 1000 m)	Hairs (per metre)
Ring (control) (two-ply)	R40/2	S400/2 Z560	305	7,7	24,5	13,7	0	0	12	11
Double rove (control)	42,0	Z407	326	7,8	26,0	15,7	8	28	24	14
Double rove wrapped core-spun	42,3	Z400	458	10,8	39,0	14,6	6	8	14	8
Double rove core-spun	41,5	Z400	449	10,8	30,0	15,1	4	2	0	12
Double rove wrapped spun	42,8	Z400	405	9,5	29,9	14,9	4	4	6	8
Single rove wrapped core-spun	22,8	Z560	292	12,8	27,3	18,7	108	42	36	8
Single rove wrapped spun	21,5	Z560	214	10,0	24,4	19,0	142	32	30	8

ACKNOWLEDGEMENTS

The authors wish to thank Mr P W Goliath for assistance in spinning and the Department of Textile Physics for testing the yarns.

THE USE OF PROPRIETARY NAMES

The names of proprietary products where they appear in this report are mentioned for information only. This does not imply that SAWTRI recommends them to the exclusion of other similar products.

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A NOTE ON THE IMPROVEMENT OF THE SHORT FIBRE CONTENT OF UNDYED TOPS BY MEANS OF RECOMBING

by M. A. Strydom

ABSTRACT

Three undyed tops with mean fibre lengths from 52,7 mm to 60,3 mm having moderate to high short fibre contents (12 to 17% of fibres shorter than 25 mm) and low residual vegetable matter were recombed on a Schlumberger PB-26L comb at five different gauge settings between 30 mm and 40 mm . At the maximum setting the short fibre values were reduced to between 5,0% and 7,5%, while the corresponding percentages noil were between 4 and 5%. Improvements in the mean fibre length and CV's of fibre length, although statistically significant, were small. Composite graphs relating short fibre content and noil to comb gauge can be useful to assist the comber in balancing conflicting requirements, i.e. extracting as much as possible of the short fibre as noil without reducing the top to noil ratio to uneconomically low levels.

INTRODUCTION

Dyed tops are usually backwashed, gilled and then combed to remove neps and slubs and to re-align the fibres. Recombing is in fact regarded as essential in this respect and is virtually a standard operation in any vertical worsted mill in which dyed tops are processed. Without such an operation, dyed top sliver will not process satisfactorily. For the purpose of recombing, either the Noble or the rectilinear (French) comb can be used. The Noble comb has certain distinct advantages over the rectilinear comb, mainly as a result of its superior colour blending capability, a higher production rate and an improved fibre length distribution of the recombed product[1]. However, with the gradual worldwide decline in the number of Noble combs, one must conclude that most recombed material would today be rectilinear combed.

While the advantages of recombing in terms of *dyed* tops are well-known, its potential for improving the quality of *undyed* tops appears to have received very little attention as a subject in its own right. Walker[2] states that undyed tops required for spinning to very fine counts sometimes require a second combing operation and that the noils produced are highly desirable for the production of saxony woollens. Katz *et al*[3] made brief mention of recombing as an alternative to loose wool or sliver carbonising to reduce the vegetable particle count of tops but their paper does not provide processing data for the relative technical merits to be assessed in terms of fibre length distribution after recombing. Townend and Russell[4] also see the advantages of recombing mainly in terms of residual vegetable matter removal and not so much in terms of im-provements in length or short fibre contents.

Recent developments, however, suggest that recombing of undyed tops might be viewed more critically in future. For example, recognition of the im-portance of the short fibre contents of tops, and the availability today of rapid measures for their determination have prompted Grignet to propose that cer-tain levels (e.g. the percentage of fibres less than 15 mm) should be included in a list of length distribution parameters, which (together with the fibre diameter distribution) would provide a comprehensive quality control framework for a worsted spinning mill[5, 6]. This proposal was based upon results of research at SA WTRI and at Centexbel which was aimed at quantifying the relative impor-tance of the different physical properties of fibres in determining spinning per-formance and yarn properties. This work largely confirmed practical ex-perience and has shown that short fibre (particularly the percentage below 15 or 25 mm) is particularly deleterious to efficient spinning and the production of good quality yarns. It has been suggested that should the fibres shorter than 25 mm exceed 15%, recombing should be considered[7]. It is difficult to assess to what extent this recommendation is actually followed in industry and what maximum levels of short fibre are considered acceptable, although a value of 8% has been mentioned[7] Nevertheless, there is evidence that the number of faults in worsted cloth (of which as many as 70% can apparently be attributed to spinning faults) can be reduced considerably by incorporating a recombing operation in the processing sequence[8]. It can be argued, therefore, that the move towards the more stringent specification of tops in terms of their length distribution parameters will require the comber or the worsted spinner to resort to combing more frequently to upgrade tops which do not meet such specifications.

Very little documented information is available on the recombing process in general and on the relationship between comb settings, percentage noil and the improvements in the fibre length distribution of the top in particular. This paper describes some experiments with a rectilinear comb to establish these relationships, since assessing the benefits of recombing has to be considered in terms of the cost of an additional operation and the loss of material as noil on the one hand, and the improvement of the top fibre length distribution on the other.

MATERIALS AND METHODS

Wool

Three undyed tops with moderate to excessive short fibre levels were selected for this experiment. The specifications are given in Table 1. In addi-tion to the standard parameters for length, the symmetry of the length

TABLE 1
FIBRE LENGTH AND FIBRE DIAMETER DISTRIBUTION DATA

Parameter	Lot A	Lot B	Lot C
Hauteur (mm)	60,3	57,6	52,7
CV_H (%)	51,9	55,7	49,5
Fibres < 25 mm (%)	12,0	17,1	13,4
Skewness (P_S)*	0,62	0,57	0,34
Mean Fibre Diameter (μm)	21,9	22,7	20,7
CV_d (%)	22,9	20,7	22,2

*$P_S = \frac{300(H-L_{50})}{H.CV_H}$, where H = Mean fibre length and L_{50} = Median fibre length, obtained from the distribution curve.

distributions was estimated by calculation of the Pearsonian coefficient of skewness, as suggested by Freund[9]. The residual vegetable matter levels in all three cases were negligible.

Processing and Testing

Comb tests were run on a Schlumberger PB26L comb pinned for average merino qualities (i.e. 28 pins/cm in the top comb and fitted with Nitto unicomb models 0660 and 0943 HSF opener and finisher segments). The comb was can-fed by means of 12 x 24 ktex top sliver which gave an effective loading of 288 ktex. The comb gauge was increased from 30 mm to 34 mm in one step and thereafter by increments of 2 mm to the maximum setting obtainable (i.e. 40 mm). Up to a 36 mm gauge setting the gill feed was maintained at 5,0 mm per cycle, and this was increased to 5,2 mm and 5,8 mm per cycle at the two higher gauge settings of 38 mm and 40 mm, respectively. At each gauge setting the comb was run for 800 nips and the tear recorded. The comb sliver was finished by gilling twice and then tested for its fibre length distribution by means of the Almeter AL-100.

RESULTS AND DISCUSSION

Kruger and Aldrich[10] showed that the short fibre content of a comb sliver is negatively correlated with comb gauge (at a fixed feed) in the case of a first combing and Belin and Walls[11] showed that the noil/comb gauge relationship is usually curvilinear. Our results confirm these two conclusions and also show that there is a linear relationship between the short fibre and comb gauge, with high negative linear correlation coefficients (-0,88 for wool C, -0,96 for wool A and -0,99 for wool B). These relationships are illustrated in Fig. 1, which is a composite graph constructed to facilitate the assessment of the dual effect of comb gauge on short fibre content and on percentage noil. If one selects an arbitrary level of 8% short fibre, Fig. 1 shows that the gauge required to produce a recombed sliver with such a specification would have had to be increased from around 32 mm for the top with the lowest short fibre content (wool A, 12%) to just under 40 mm for the top with the highest short fibre content (wool B, 17,4%). The corresponding percentage noil values were about 1,5% for wool A and 5,0% for wool B. It is apparent from these results that the cost effectiveness of recombing would depend entirely on each individual case, i.e. whether the "cleaner" top with less short fibre would demand a sufficient premium to compensate for the loss of material as noil and the cost of the additional process. While recombing noil values of 1,5% to 4% are often quoted as typical for the UK[2, 12] certain continental spinners appear to aim for considerably lower levels. In this respect values of up to 1,0% have been published, which is stated to be equivalent to a reduction in short fibre content (in particular in the percentage of fibres < 30 mm) of approximately 2%[12]. It should be remembered, however, that these figures relate to *dyed* tops and that recombing *undyed* tops would most likely always result in considerably less fibre breakage, since the fibres would normally be in a much more aligned and parallel state. Therefore, lower values could be expected when comparing undyed tops with dyed tops in terms of typical or expected noil values.

It is generally stated that the mean fibre length and variation in fibre length are not affected to any marked degree when recombing dyed tops[1, 4, 12]. A similar observation appears to be valid in the case of undyed tops, as shown in Table 2. Table 2 compares the Hauteur values, CV_H data and skewness coefficients of the starting material with those of the recombed tops produced at the different gauge settings.

TABLE 2
HAUTEUR, CV OF HAUTEUR AND SKEWNESS VALUES FOR DIFFERENT GAUGE SETTINGS

Comb Gauge (mm)	Lot A			Lot B			Lot C		
	Hauteur (mm)	CV_H(%)	Coeff. of skewness	Hauteur (mm)	CV_H(%)	Coeff. of skewness	Hauteur (mm)	CV_H(%)	Coeff. of skewness
Control	60,3	51,9	0,62	57,6	55,7	0,57	52,7	49,5	0,34
30	62,5	51,9	0,59	59,4	53,3	0,56	*	*	*
34	63,2	49,8	0,65	60,3	51,3	0,55	55,0	44,2	0,26
36	63,6	48,5	0,63	60,2	50,0	0,59	55,0	44,1	0,30
38	64,6	47,4	0,58	62,9	49,2	0,48	55,6	42,3	0,33
40	64,4	46,4	0,63	63,6	47,6	0,48	55,4	42,8	0,30

*Effectively no noil removed.

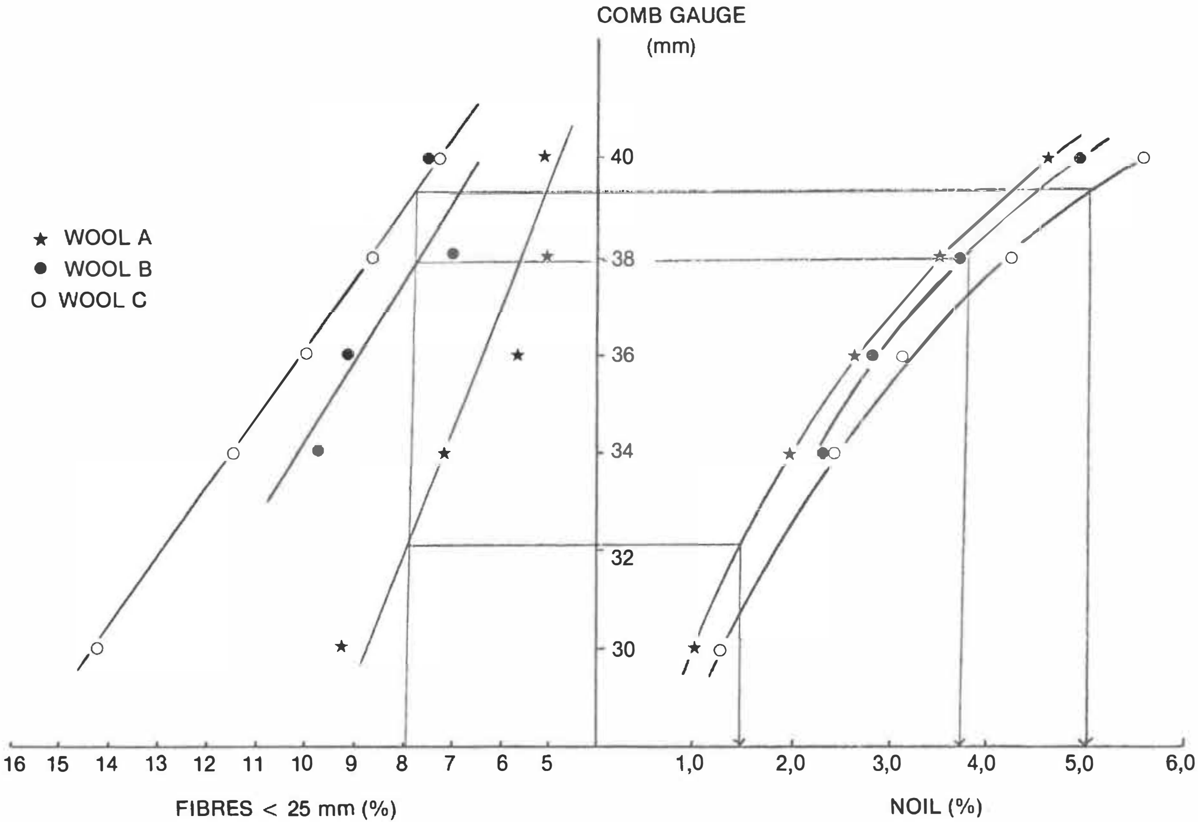

Fig. 1 — Relationship between Comb Gauge, Percentage Noil and Percentage Fibres shorter than 25 mm .

The data in Table 2 show that gains in the mean fibre length as a result of recombing varied between 3 and 6 mm at the maximum gauge setting of 40 mm . Based on work at SAWTRI this would be roughly equivalent to a half-micron reduction in average fibre diameter in terms of improvements in spinnability and yarn properties[14]. The equivalent reduction in fibre length variability (CV_H) was between 5% and 8% (absolute). In both cases simple regression analyses can be used to illustrate the highly significant linear association which existed between Hauteur and comb gauge and CV_H and comb gauge, the r^2 values being 60% and 92% respectively. Since recombing at maximum settings would most likely not be considered as a result of uneconomical noil extraction levels (see Fig. 1), it would appear as if improvements in terms of Hauteur and CV_H, which can be obtained by recombing, would at best be marginal. As far as the shape of fibre length distribution histograms after recombing was concerned, it appears that the effects were, again, for all practical purposes, negligible. The coefficients of skewness for all three tops before combing were between 0,3 and 0,6, and after recombing these were of the same order of magnitude, even at the highest gauge settings. This, however, was not unexpected in view of the fact that the coefficients were very small even before recombing. In other words, recombing did not appear to change the shape of the fibre length histogram to any marked degree.

Although length characteristics and residual VM levels were not determined, the noils were assessed subjectively and were considered to be of very good quality. This was not unexpected, since most of the short fibre and VM contamination is normally extracted during the topmaking process, i.e. during the first combing operation.

SUMMARY AND CONCLUSIONS

Recombing is generally an essential step in the further processing of dyed tops. However, undyed tops can also be recombed should the need arise, particularly if the quality of the top needs to be improved in terms of residual vegetable matter and fibre length distribution.

To study the latter aspect in somewhat more detail, three undyed tops varying in their quality in respect of length and percentage fibres less than 25 mm, were recombed at different comb gauge settings and the results plotted on a composite graph to illustrate how percentage noil and short fibre content depend upon the gauge setting. The higher the short fibre content of the starting material, the larger the comb gauge had to be set to reduce this value to below, say, 8%. This, in turn, affected the percentage noil in a curvilinear fashion (i.e. the higher the gauge required to obtain a particular short fibre level, the higher the rate of increase of the amount of noil extracted per unit increase in the gauge setting). The comber, therefore, has to select settings based upon a "trade-off" situation whereby he is required to optimise the quality of the top (in terms of short fibre) in relation to the maximum acceptable amount of noil which can be extracted during the recombing process, i.e. without the top to noil ratio reaching uneconomical levels.

Recombing to improve the quality of the tops in terms of Hauteur or CV of Hauteur would appear to be less readily justifiable. At the maximum settings (40 mm) improvements of only 3 to 6 mm and 5 to 8%, respectively, for the three tops investigated, could be obtained. The corresponding percentage noil values, however, were relatively high, varying between 4 and 5%. Further work is being planned to quantify these effects during subsequent spinning and in terms of their influence on yarn properties.

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USE OF TRADE NAMES

The names of proprietary products, where they appear in this report, are mentioned for information only. This does not imply that SAWTRI recommends them to the exclusion of other similar products.

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