SAWTRI
SPECIAL PUBLICATION

Some of SAWTRI'S Important Research Findings on Mohair

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P.O. BOX 1124
PORT ELIZABETH
REPUBLIC OF SOUTH AFRICA

WOL 69
ISBN 0 7988 3155 3
SAWTRI SPECIAL PUBLICATION
June 1985

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PREFACE

Until fairly recent times, very little published information was available on the processing performance and characteristics of the mohair fibre. What information there was, had been acquired the hard way over many decades by those very few organisations in the world which specialised in mohair, and much of this information was, quite naturally, regarded as private and confidential. Without the availability of sound scientific knowledge on the processing performance and characteristics of the mohair fibre, any industrialist wishing to enter the field for the first time was therefore placed at a significant disadvantage. Ultimately, therefore, so also was the mohair fibre producer. It follows that it was vitally important for the future of the mohair industry, and the fibre producer in particular, for research to be carried out on the mohair fibre and its processing. These considerations led SAWTRI to become involved in mohair research at the request of the Mohair Advisory Board, in the early '50's. Being situated in the heart of the South African mohair industry, SAWTRI was ideally placed to fulfil this task, although for many years, while it was still in its infancy only a small effort could be devoted to research on this exciting fibre.

At present the research effort which the Institute directs towards mohair comprises about 8% of its total research budget. In absolute terms, this is probably larger than that devoted to textile research on mohair by any other organisation in the world.

There is no doubt that mohair has many characteristics which make it highly desirable and valued by consumers all over the world. These include its lustre, durability, resilience and comfort, its ability to be dyed to bright colours, and its low felting propensity. However, it should be stressed that, in this modern high-technology age in which the technologies keep advancing and changing, it is essential that research on mohair and its processing is carried out on an on-going basis to enable the fibre to maintain its prestige, image and place in the textile world of tomorrow. It is appropriate to mention and give credit to the South African Mohair Board for their far-sightedness in this respect by sponsoring research at SAWTRI over a period of so many years.

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* Presented at the Annual Conference of the International Mohair Association held in Estoril, Portugal, June 1985.

TEXTILE PROCESSING PERFORMANCE:

A few years ago SAWTRI embarked on a wide ranging study aimed at systematically building up sound scientific knowledge and data in the very important field of textile processing. The eventual aim was to be able to predict the behaviour of fibres during textile processing in terms of the measured characteristics of the fibres.

In depth studies on mohair commenced in 1980, and a large number of lots, effectively spanning the mohair clip in terms of length and fineness, have since been processed on SAWTRI's full-scale worsted machinery. Processing followed the Continental or Dry-combed route, and the performance of each lot was carefully monitored at the various stages up to and including spinning. In addition, a wide range of yarns and woven and knitted fabrics was produced with a view to relating their physical properties to the properties of the fibres from which they were produced. This is a prerequisite in arriving at the stage where a fibre, most suited for a specific end-use can be pre-selected and ultimately at the stage where a yarn or fabric can be engineered to the required specifications and performance levels.

AVERAGE PROPERTIES:

An overall view of some of the average properties of the many different lots of hair that have been studied at SAWTRI since 1980, is given in Table I. It can be seen that mean fibre diameters ranged from 23 to 45 μm, staple lengths from 84 to 137 mm, and area medullation from 0,3 to 2,8%. The frequency of the staple curl varied from 2,8 per 10 cm for adult hair to as much as 6,6 per 10 cm for kids. Scoured yields varied from about 77% to 93%, the contaminants present in the greasy hair comprising mostly grease (from 2,9% to 8%), followed by suint (from 1,8% to 4,2%). Vegetable contamination was fairly low (from 0,1 to 1,7%), largely due to the superior style of the hair selected for the study. The suint was found to be acidic with pH values ranging from 3,3 to 6,2.

STAPLE LENGTH AND STRENGTH:

Traditionally, staple length is estimated by eye or measured by hand, while staple strength is rarely, if ever, measured. Recently, however, SAWTRI developed an instrument for the South African Wool Board for the automatic measurement of the length and strength of raw wool staples which now facilitates the task of length and strength measurement of wool staples on a routine basis. Recently* attempts were made to measure mohair staples on this instrument, and Fig 1 shows that a reasonably good correlation was obtained between hand and machine measured lengths using the SAWTRI instrument for

* Unpublished work by the Author and J Cizek.

TABLE I

AVERAGE VALUES AND RANGES OF THE VARIOUS MOHAIR PROPERTIES

	RANGE	AVERAGE VALUE
Diameter (μm)	23-45	33
CV (%)	20-33	25
Staple length (mm)	84-137	109
Medullation (%)	0,3-2,8	1,0
Curls per 10 cm	2,8-6,6	4,5
VM (%)	0,1-1,7	0,3
Grease (%)	2,9-8,0	4,6
Suint (%)	1,8-4,2	2,7
pH of Suint	3,3-6,2	5,3
Scoured Yield (%)	77-93	86
Compressibility (mm)	10-13	11

the latter. The instrument also records the profile of each staple and Fig 2 shows a typical example of a staple profile of kid mohair which is characterised by a certain waviness from the root (left hand side of figure) to the staple tip (right hand side of figure). Another example, being that of an Adult hair, is shown in Fig 3.

MEDULLATION IN MOHAIR:

Fibres which have a hollow or a partially-filled central canal running in either a continuous or fragmented form along their length are known as medullated fibres, and are usually present to a greater or lesser extent in the fleece of all animals. Some of these fibres have a chalky white appearance, and are often referred to as 'kemp'. While such fibres are occasionally acceptable, or even desirable for special effects, the presence of even a small amount in a high quality mohair may have a pronounced adverse effect on its value and end-use

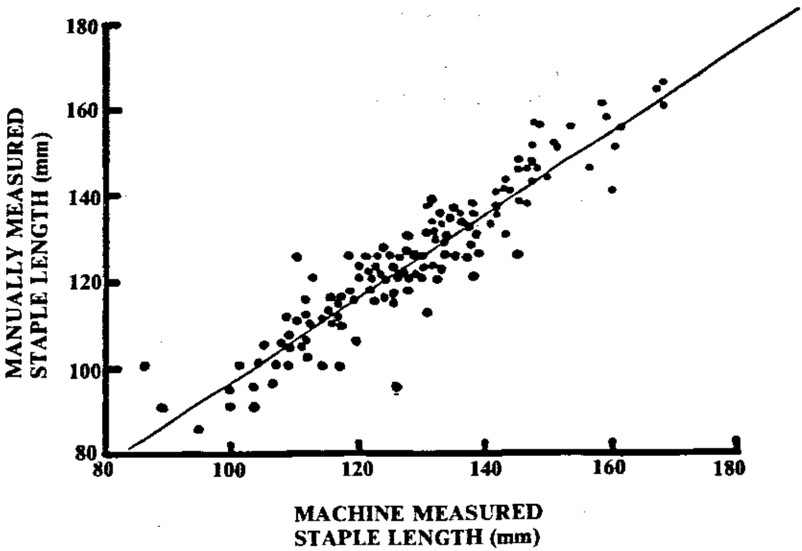

Fig. 1 – Manually measured versus machine measured staple length.

potential. Because medullated fibres, and particularly kemp, tend to lie on the surface of the yarn and fabric and are generally much thicker than the surrounding fibres, the visual and other effects they produce can be out of proportion to the actual quantity present. Furthermore, dyed kemp fibres generally appear much lighter than the surrounding dyed non-medullated fibres, and show up prominently in the fabric. From this it follows that it is important, not only to keep the number of kemp fibres to a minimum, but also to be able to accurately measure the proportion of kemp fibres so as to avoid using mohair with an unacceptable level of kemp in certain end-uses.

A photo-electric device, called a Medullameter, which provides a measure of the amount of light scattered at the fibre/medulla interface of medullated fibres in a sample, and therefore of the degree of medullation, was built at SAWTRI for the measurement of medullated fibres. This instrument was based on the design of an instrument developed at The Wool Research Institute of New Zealand. After suitable refinements, the Medullameter proved capable of the accurate and reproducible measurement of the degree of medullation in mohair, even at levels of medullation of well below 1%, and calibration and test methods have been developed for routine laboratory use. The relation between medullameter reading and percentage area medullation is shown in Fig 4.

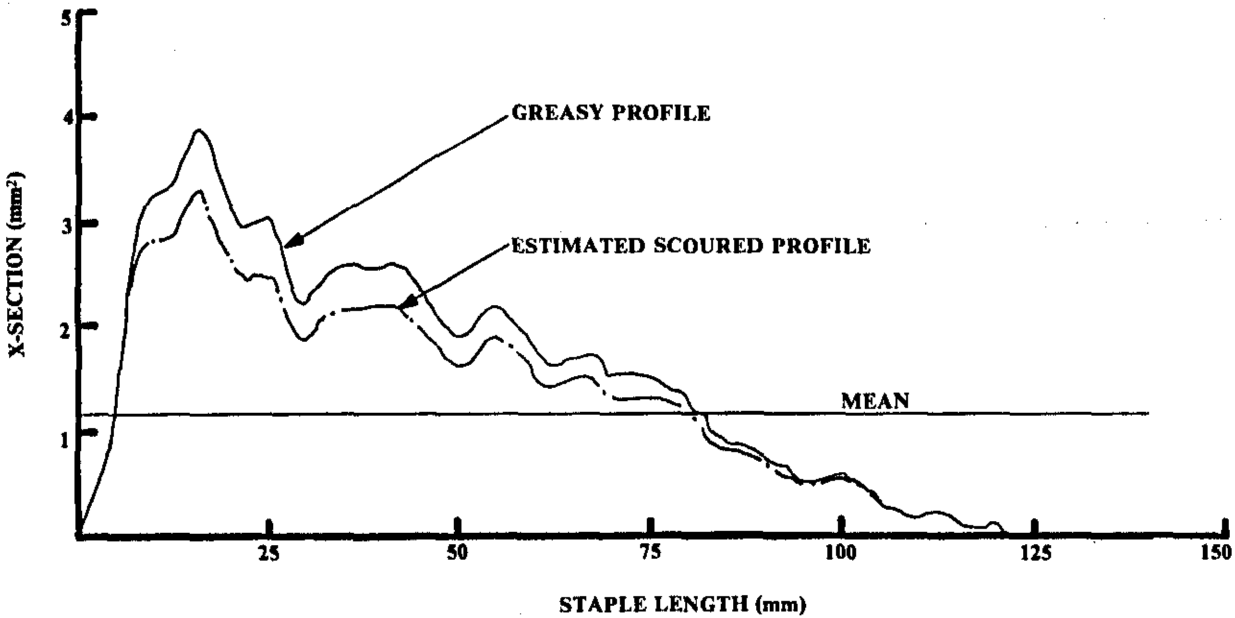

Fig. 2 – Example of a staple profile for Kid mohair.

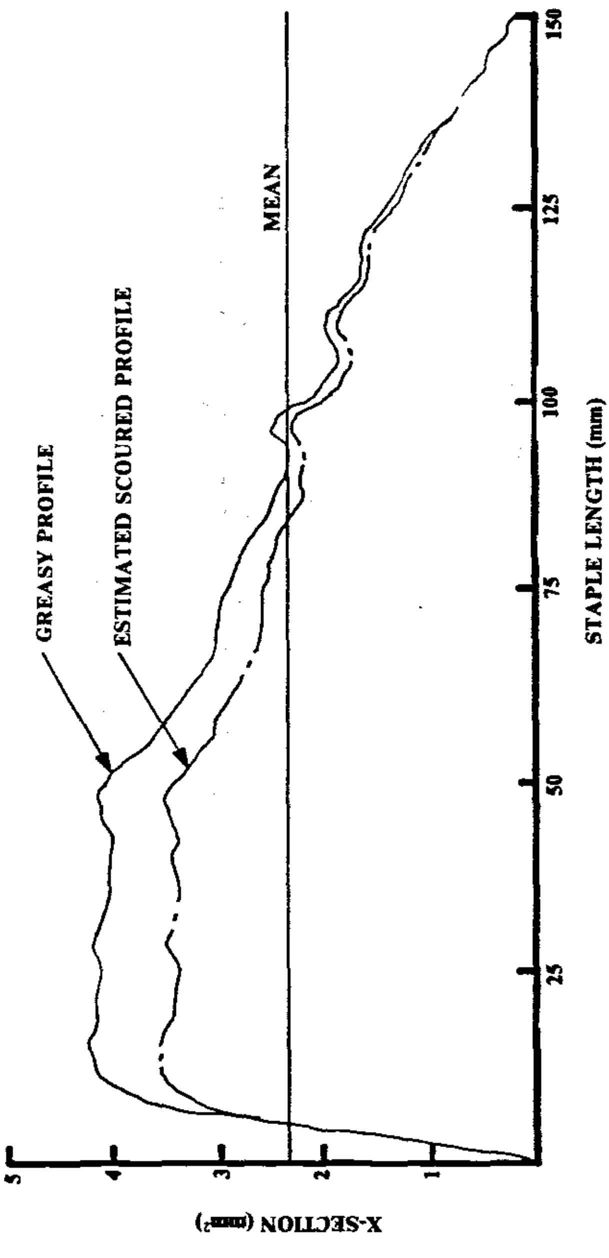

Fig. 3 – Example of a staple profile for Adult mohair.

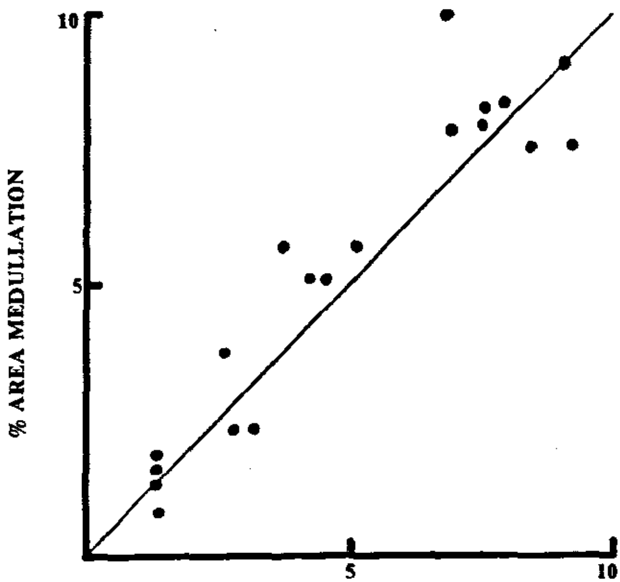

Fig. 4 – Percentage area medullation versus medullameter reading.

Present and future work is aimed at characterising those medullated fibres which show up differently after dyeing, giving the fabric an unacceptable appearance, and then standardising a method whereby the quantity of such fibres in a sample can be determined with the necessary speed and accuracy.

CV OF DIAMETER:

The variation in diameter (CV of diameter) between individual fibres in a mohair sample is sometimes regarded as important when assessing its quality. Because of the lack of information as to what constitutes a typical CV of diameter and how this changes with mean fibre diameter, a study was undertaken in which the diameters of over 1200 samples of raw mohair, scoured mohair and mohair tops were measured. It was found that, although the scatter was large, there was a tendency for the CV to decrease as the mean fibre diameter increased up to a mean fibre diameter of about 35 microns, after which the reverse tended to occur. The CV generally varied between 23% and 32% with the average being about 27%. (Fig 5).

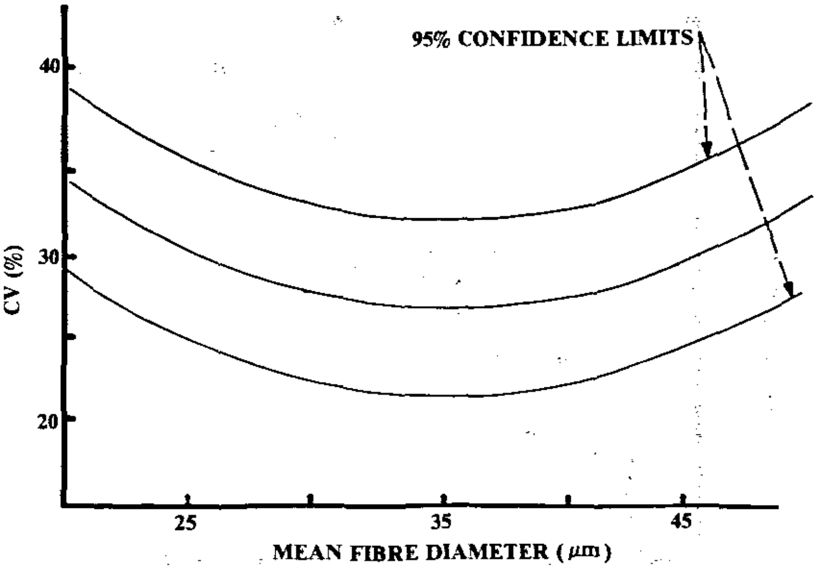

Fig. 5 – CV of fibre diameter vs mean fibre diameter.

AIRFLOW MEASUREMENT OF DIAMETER:

Fibre diameter is commercially one of the most important properties of mohair. This is mainly because it determines spinning performance, yarn and fabric properties and the end-use potential of the fibre. It is therefore important that mohair fibre diameter be measured accurately on a routine basis. Determination of fibre diameter by the airflow method is relatively quick, convenient and fairly accurate, and it is consequently widely accepted and used for obtaining fineness estimates of both mohair and wool. In this context, the Institute played a major role in standardising the airflow testing of mohair diameter.

Theoretically the degree of medullation and also the CV of diameter should affect the results obtained by the air-flow method. Because of such possible effects, and the important commercial implications should such effects exist, a study in this respect was recently undertaken. A total of 83 mohair samples were carefully selected in such a manner that the degree of medullation, the mean fibre diameter and the CV of diameter varied widely (Fig 6), but mostly independently of each other.

Contrary to expectations, the degree of medullation had no apparent effect on air-flow measured diameter within the fairly wide range of area

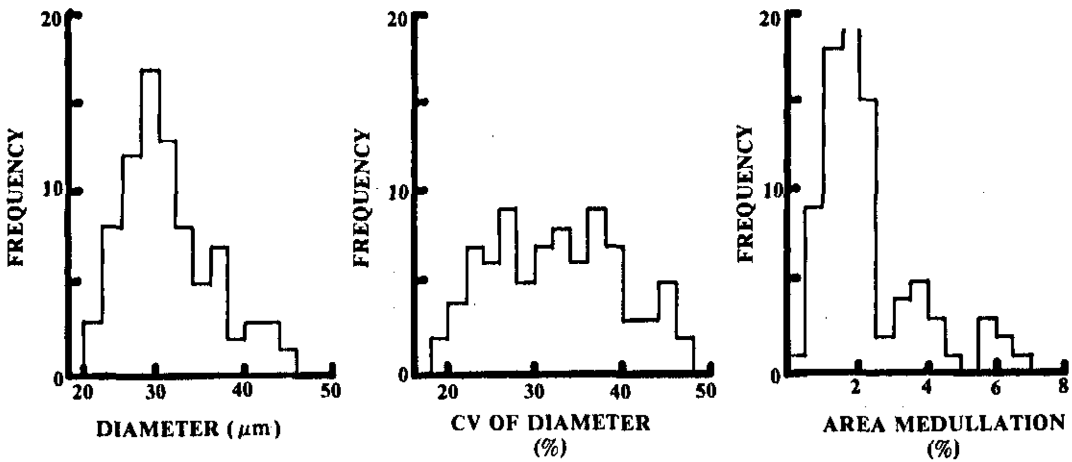

Fig. 6 – Ranges covered in airflow experiment.

medullation which was covered, namely 0,5% to 6,0%. CV of diameter, on the other hand, had a significant effect. Surprisingly, however, this was only about half that which had been predicted from theoretical considerations. A change in the CV of diameter of 6% absolute from that of the calibration sample produced a change of about 0,5 μm in the air-flow measured diameter. (Table II). The investigation has shown, therefore, that within the ranges covered, the air-flow measured diameter of mohair is a fairly good estimate of the projection microscope mean diameter.

TABLE II

THE EFFECT OF CV OF DIAMETER ON AIR-FLOW DIAMETER

PROJECTION MICROSCOPE (μm)	AIR-FLOW (μm)		
CV (%)	21	27	33
26	25,6	26	26,4
32	31,5	32	32,5
38	37,4	38	38,6
44	43,4	44	44,7

COMBING PERFORMANCE:

Reverting to the textile processing studies which were undertaken over the past few years, and which were referred to in Table 1, the long types of hair were combed on both the Noble and rectilinear combs, while the medium and short types were combed on the rectilinear comb only. As expected, more noil was produced on the Noble comb than on the rectilinear comb. (Fig 7). The noil ranged from as little as 1% to about 5% during rectilinear combing and from about 4% to 8% during Noble combing. An interesting fact emerged, namely that the amount of noil was dependent upon the diameter of the hair, but was independent of length. Comb settings were, of course, adjusted according to length in keeping with commercial practice. The increase in noil with decreasing fibre diameter was probably due to more breakage being suffered by the finer fibres during processing. The tops were generally nep-free and ranged in mean fibre length from 60 to 105 mm . These lengths represented conversion ratios from the staple to the top ranging from about 1,1 : 1 to 1,4 : 1.

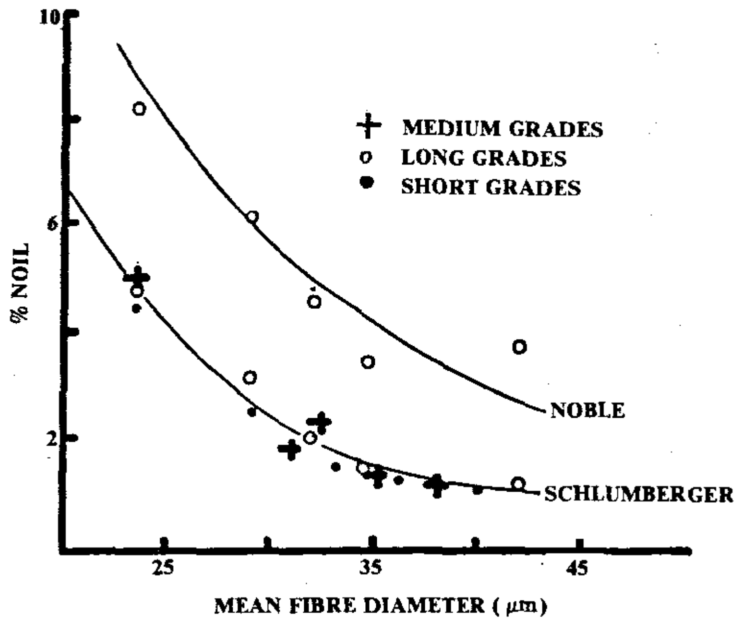

Fig. 7 – Percentage noil versus mean fibre diameter

RING SPINNING PERFORMANCE:

From the results on spinning performance, the overriding importance of mean fibre diameter clearly emerged, and this was followed in importance by mean fibre length. Variability of diameter and length within a lot had very little effect.

It is widely accepted that spinning performance is largely determined by the average number of fibres in the yarn, and for a given yarn count this is largely dependent on the diameter of the fibres. In the present study it was found, however, that even for the same number of fibres in the yarn cross-section, an increase in mean fibre diameter caused a deterioration in spinning performance. Fig 8 shows regression curves of the Mean Spindle Speed at break (which is a measure of spinning potential) against mean fibre diameter for yarns having a constant 40 fibres in the yarn cross-section, and having mean fibre lengths of 85 mm and 105 mm . It can be seen that spinnability covered a wide range, from 5 000 to 12 000 rev/min. The effect is a marked one, and could be due to changes in fibre surface characteristics with changing fibre diameter resulting in changes in fibre cohesion. It is also possible that fibre flexural rigidity palyed a role.

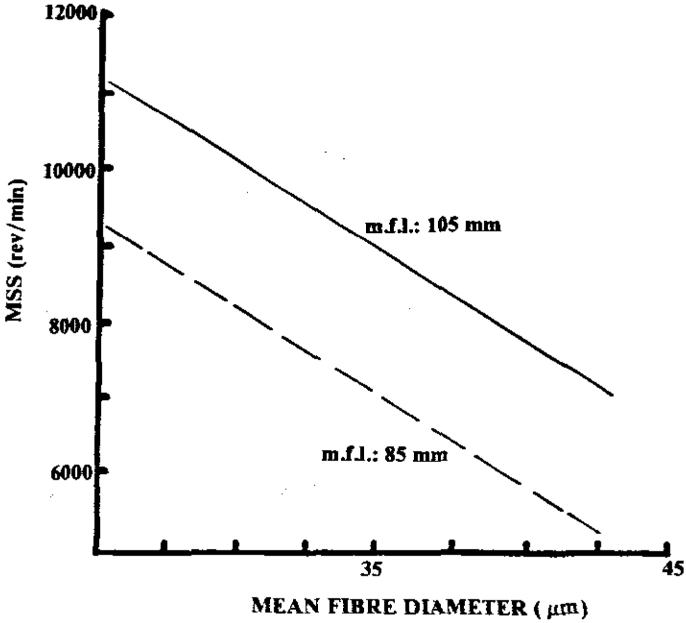

Fig. 8 – Spinning potential (MSS) versus mean fibre diameter.

YARN PROPERTIES:

A major study on the relationship between yarn and fibre properties is now nearing completion, the aim being to establish the relative importance of the many different fibre properties in determining yarn properties and to quantify the effects in terms of regression equations. This, as well as earlier studies, have indicated that fibre diameter has, by far, the main effect on yarn quality. For a given yarn count, the various yarn properties deteriorate with an increase in mean fibre diameter. It can be seen from Fig 9, for example, that hairiness increased, tenacity decreased and irregularity increased as fibre diameter increased.

The hairiness of mohair yarns is an interesting property. For some end uses, such as hand-knitted ladies cardigans, shawls and blankets, hairiness is an asset, enhancing the appearance of the fabric. For this purpose, brushing of mohair yarns and fabrics is commonplace in the industry. In other end uses, however, such as in men's worsted suits, hairiness is a disadvantage, and has to be minimised. Mohair is inclined to produce a hairy yarn, and if hairiness is to be minimised various precautions are necessary. Results of studies involving a hairiness meter showed that the hairiness of mohair yarns increased linearly with

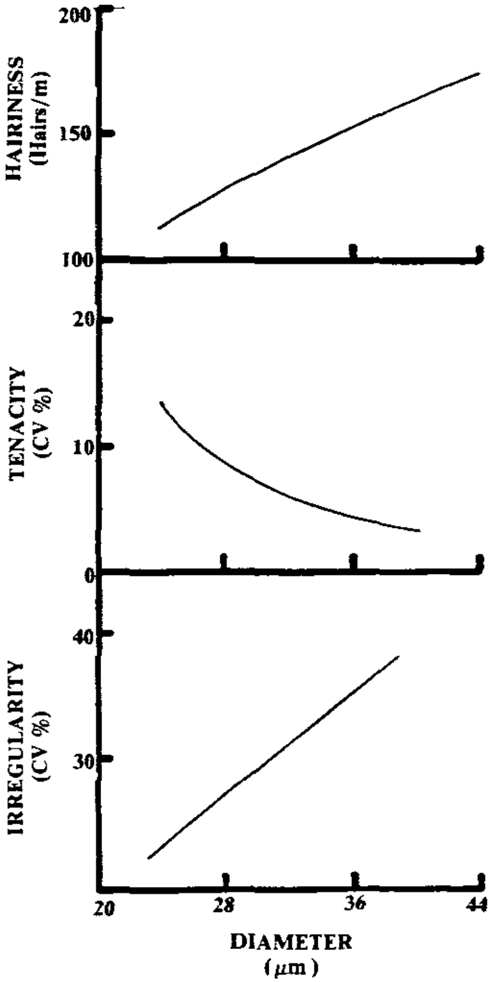

Fig. 9 – Effect of fibre diameter on yarn properties.

increasing fibre diameter, and that re-winding increased the hairiness of singles yarns and two-ply yarns by 40% and 20%, respectively. Hairiness was considerably reduced by plying, although the differences between singles and two-ply yarns decreased as the yarn count increased.

Friction is another very important property of yarns destined for machine knitting. Its importance in determining knitting efficiency and yarn breakages and also in determining stitch length when knitting takes place without positive feed, is well established for various fibres, but the Institute has undertaken some very important work, specific to mohair, in this respect. These studies have shown that paraffin wax represents an effective means of reducing yarn friction, but that its effectiveness can be adversely affected by the presence of excessive amounts of processing oils and additives.

FABRIC PROPERTIES:

As in the case of yarns, a major study on fabrics is now in progress. Initial studies have shown that, of the various fibre properties, mean fibre diameter is again of overwhelming importance in determining fabric properties. It can be seen from Fig 10 that flexural rigidity (stiffness), air permeability and drape coefficient, shown here for two different fabric states, all increase with an increase in mean fibre diameter.

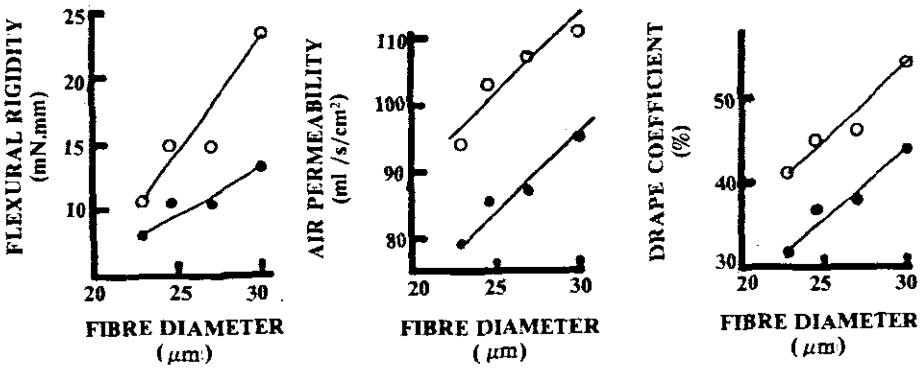

Fig. 10 — *Effect of fibre diameter on fabric properties*
(o = *Dry-relaxed* • = *Wet-relaxed)*

Good wrinkle resistance and recovery are commonly associated with mohair, and some studies in this field have been carried out using an instrument developed at the Institute, called the SAWTRI Wrinklemeter. This instrument has been used to quantify the severity of wrinkles inserted by the AKU random deformation method. These, together with some very recent studies, have indicated (Fig 11) that the percentage wrinkle recovery deteriorated as mean fibre diameter increased from the Kids through the Young Goats to the Adults. Fig. 12 shows this expressed in another way, namely that the severity of wrinkling increased as mean fibre diameter increased. In end-uses where good wrinkle recovery is of paramount importance, it therefore appears advisable to select the finer grades of hair.

MOHAIR LUBRICATION:

Because of the low cohesive properties of mohair, proper lubrication is of utmost importance. The correct lubricants must be selected and applied at the appropriate stages, to allow sufficient control of the fibres during carding, combing and spinning, and the Institute is, in fact, about to embark on a project, aimed at studying, and comparing, the performance of various commercial formulations during mohair topmaking. This will provide valuable information to the local processing industry.

Some years ago, a study was carried out on the spinning performance of twistless mohair rovings which had been sprayed at the top stage with a number of different formulations, and this revealed an interesting relationship between the withdrawal force of the tops and the end breakage rate during spinning. From the graph shown in Fig 13, it is apparent that an optimum value exists for the withdrawal force. In other words, a certain minimum level of cohesion between the fibres is necessary to produce a good spin, but excessive cohesion is as undesirable as insufficient cohesion.

REDUCTION OF MEDULLATED FIBRES, AND PARTICULARLY KEMP:

Proper breeding and selection is probably the most effective way of reducing medullated fibres, but there are also ways of reducing them during textile processing. During carding, some of the kemp fibres become embedded in the card clothing and fettling at regular intervals can reduce overall kempiness significantly. Another source of kemp removal is the burr beater of the carding machine since much of the fibre ejected along with the vegetable matter is actually kemp. At certain other points on such machines such as between the swift and doffer kemp fibres are only loosely attached to the web and often drop out. Attention to machine design, setting and handling can therefore increase the removal of kemp at the carding stage. Further kemp removal can be

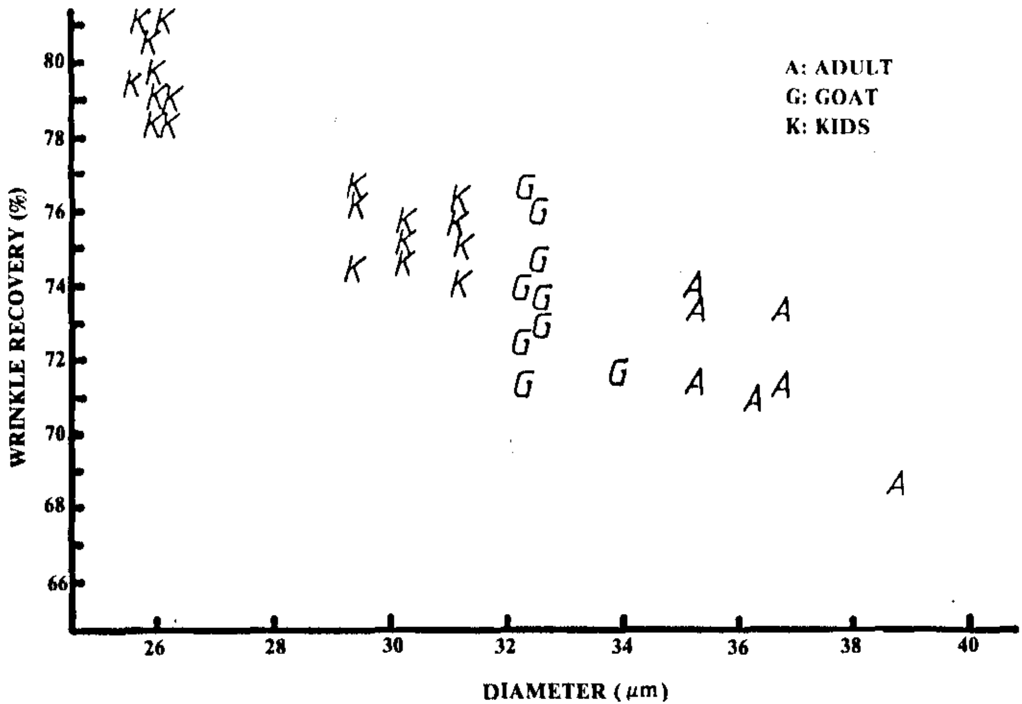

*Fig. 11 – Wrinkle recovery versus fibre diameter**

*Unpublished work by L. Hunter, S. Smuts & E. Gee

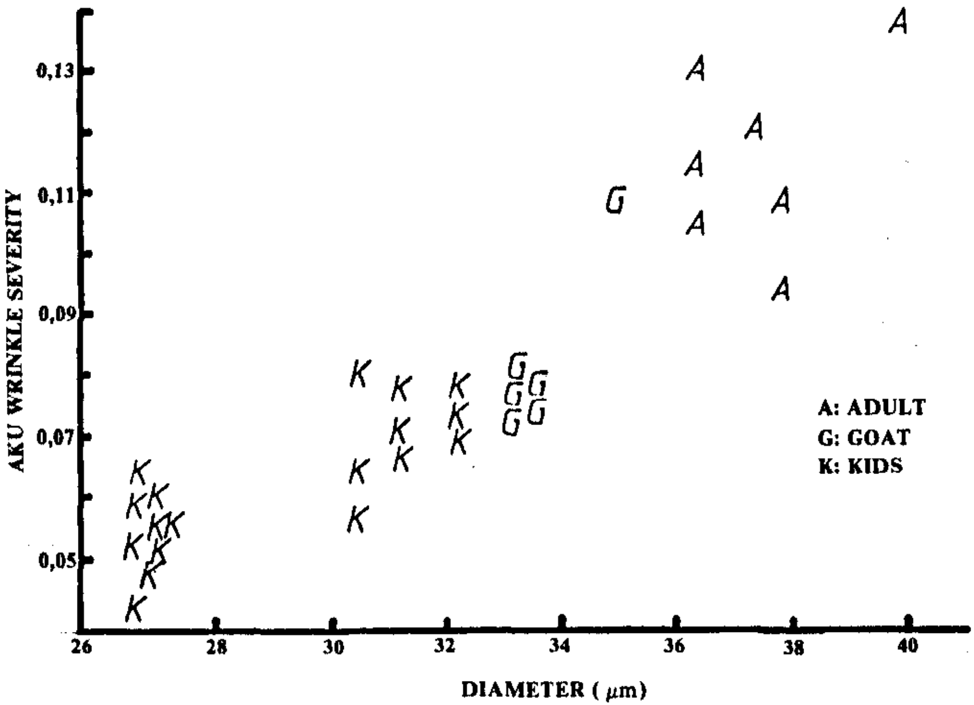

*Fig. 12 – Wrinkle severity versus fibre diameter**

*** Unpublished work by L. Hunter, S. Smuts & E. Gee.**

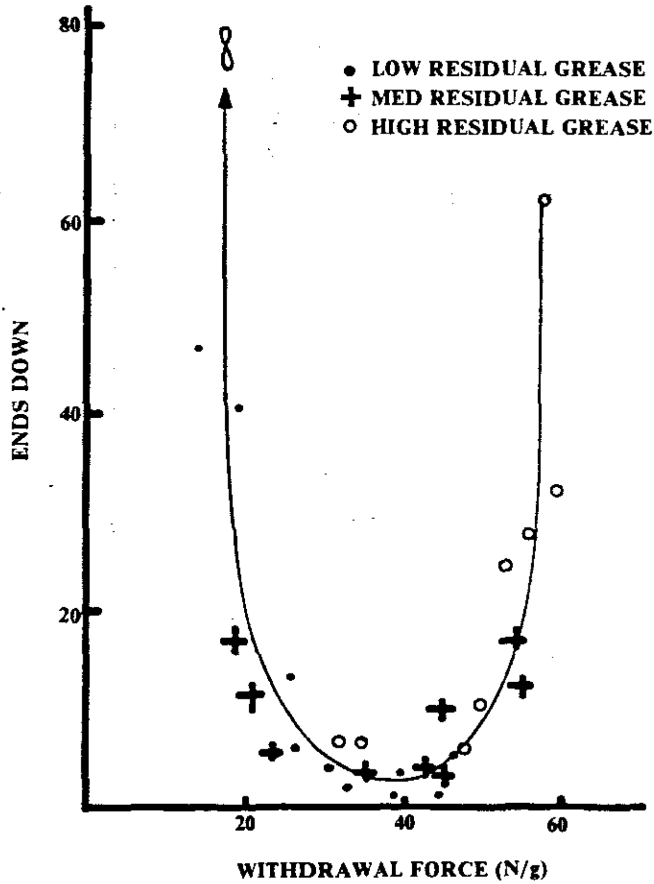

Fig. 13 – Ends down during spinning versus withdrawal force

accomplished by combing on a Noble Comb using a suitable selection of the pin densities and temperatures of the large and small circles and a suitable selection of the settings of the drawing-off rollers.

FRICTION SPINNING:

Friction spinning represents a relatively new development and an interesting feature of this spinning system is that the radial distribution of fibres in the yarn cross-section can, to a large extent, be pre-determined. Thus a luxury or speciality fibre, with particular aesthetic appeal, such as mohair, can be made to predominate on the yarn surface, while cheaper materials can be used to make up the body, or core of the yarn. Such a technique has been used to produce a ladies coating fabric, having Noble combed kid mohair noils on its surface. A Lincoln wool of 34 μm was used as a carrier and short carbonised wool locks were used as a filler, the slivers from each component being so positioned on the spinning machine that the Lincoln wool was eventually situated in the centre or core of the yarn, while the locks covered the Lincoln wool in an intermediate position and the mohair ended up on the surface of the yarn as a sheath. Finally, it was found that adding a nylon multifilament yarn as an extra core improved the yarn strength as well as the spinning and weaving performance.

Any spun yarn can, in fact, be fed directly to the friction rollers to form a core and recently this facility has been used to produce a cockle-free mohair yarn, having an outer sheath of mohair and a yarn spun from wool on the woollen system as core. This particular yarn was knitted on a 5 gg flat bed machine into both plain single jersey and fancy structures, and not only was excellent definition and regularity of the stitches obtained, but the fabrics were also entirely free from loop distortion.* Furthermore, no knitting problems were experienced.

REPCO SPINNING:

The spinning technique developed by the Institute some years ago, and known as the Repco Wrapped Core-spun (RWCS) technique, is probably one of the best ways of producing very fine yarns for lightweight fabrics from mohair. The technique involves feeding eight multifilament yarns (usually nylon) and four mohair rovings into a Repco self-twist machine to produce four mohair yarns, each having a filament core and a filament binder. For this purpose the Repco machine requires very little modification and it is possible to spin very fine yarns at speeds approaching 200 m/min. A diagramatic representation of the RWCS system is given in Fig 14. It can be seen that the filaments are fed in at a point in front of the drafting aprons, one filament in the same position as one of

* Unpublished work by G A Robinson.

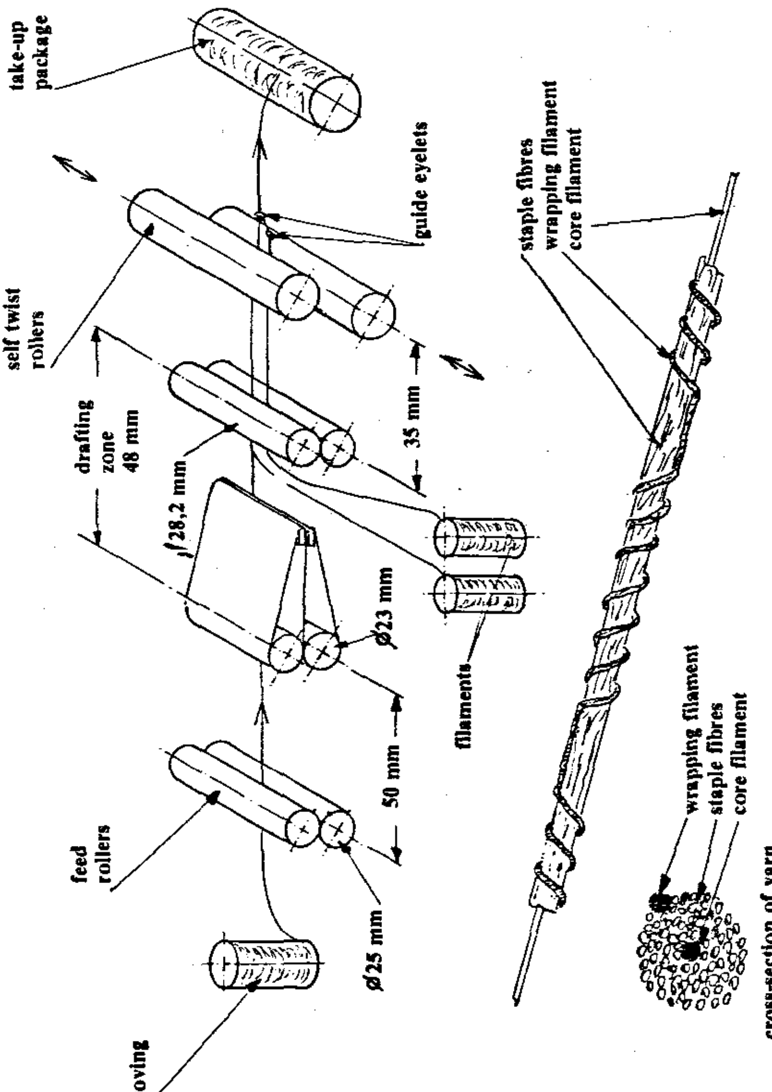

Fig. 14 – RWCS system.

the mohair strands, and the second filament in an adjacent position on its own. When these emerge from the self twist rollers, they are guided to the take-up package, and the yarn so produced is as depicted on the lower half of the figure. It has a filament core and a filament wrapper. The presence of the filament affords stronger, more extensible and less hairy yarns than equivalent 100% mohair ring yarns. An added benefit is that the yarns need only be uptwisted to a relatively low twist factor, and thus the lustre of the yarns is excellent. They perform better in preparation and weaving, and can be used in the construction of very light-weight fabrics. Furthermore, in view of the fine yarns which can be produced, it now becomes possible to produce lightweight twill constructions, suitable for men's and ladies suiting fabrics, which have advantages in terms of drape and lustre, and possibly wrinkling.

YARN BRUSHING:

Mohair is very popular in brushed end-uses where its attractive features are fully exploited. Some limited work has been carried out at the Institute to extend our knowledge in this highly specialised field, and this has involved the spinning, brushing and weaving of mohair loop yarns from mohair of 25 to 40 microns in diameter. The brushed yarns were woven into a blanket construction having a polyester/cotton back and a mohair pile face, the latter being raised after finishing. It was found that as fibre diameter increased, the number of malformed loops in the yarns decreased. Generally, the coarser fibres also resulted in better brushing performance, although the number of times the yarn was wrapped around the wire cylinder of the brushing machine was also of considerable importance. The amount of fibre lost during brushing was dependent both on fibre diameter and the number of wraps, increasing with an increase in either of these parameters. Fibre loss during yarn brushing ranged from 0,3 to 3,6%, and a further loss of some 4% of fibre occurred during fabric raising.

RADIO FREQUENCY DYEING:

In recent years, many attempts have been made to improve various aspects of dyeing, and new technologies have been, and are being developed to reduce fibre damage, decrease energy consumption and increase productivity. It is well known that mohair tends to lose its lustre when dyed for prolonged periods at the boil, and to preserve its lustre it is generally necessary to use short dyeing cycles and low dyeing temperatures. One of the latest technologies which appears to hold considerable promise in this field is radio frequency (RF) dyeing. A few years ago the Institute acquired a radio frequency continuous top dyeing machine and much pioneering research, particularly on wool and synthetics has been done in this field. Some of the work has been conducted in close collaboration with a number of South African firms who are therefore already familiar with the technology.

In recent studies on mohair it was found (Table III) that dyeing time could be drastically reduced from the conventional 90 minutes to 35 minutes using the radio frequency technique, only 5 minutes of the 35 minutes representing actual exposure to the radio frequency field. An estimated saving of some 80% in dyeing energy costs could be achieved. Furthermore, dye fixation improved slightly from 93% to 96%. Alkali and urea bisulphite solubilities were marginally lower for the RF dyed lots possibly indicating less fibre damage had occurred. The lustre of a 36,7 μm sample taken from the tops was measured on a Goniophotometer and the higher value shown in the table for the RF dyed lot indicates that a better lustre was recorded. Spinning was carried out without re-combing, and spinning performance then measured using the MSS technique. The spinning results appeared to be more favourable for the RF dyed hair. Of particular interest to small mills or businesses is the fact that RF dyeing lends itself to quick changes and small runs, which is of particular advantage for mohair.

TABLE III

CONVENTIONAL VERSUS RADIO FREQUENCY DYEING*

	Aqueous (100° C)	**RF (100° C)**
Treatment Time (min)	90	35 (only 5 mins exposure to RF)
Dye fixation (%)	93	96
Alkali Solubility (%)	14,5	13,8
Urea Bisul. Solubility (%)	51	48
Lustre Value	68,8	96,9
Spinning Potential (MSS, r/min)		
92 tex Z320	9400	9900
44 tex Z460	6300	8400

* Unpublished work by F.A. Barkhuysen & A.P.B. Maasdorp

CHLORINATION OF MOHAIR:

Although one of mohair's most attractive features is its high lustre, there are certain grades and qualities which do not have such a high lustre and sheen, and a new research development at the Institute could herald a process whereby the lustre of such mohair types could be greatly increased. This work, however, is still at a very early stage. The process involves treating mohair slivers with chlorine gas dissolved in water, and is based upon a SAWTRI invention patented by the South African Inventions Development Corporation. The process is primarily aimed at rounding the scales of keratin fibres to prevent their subsequent interlocking and felting during laundering. This makes the fibre smoother, which results in increased specular, as opposed to diffused, reflection of light, thereby increasing lustre. Over-treatment, however, can also produce longitudinal striations on the fibre surface and other evidence of damage, and lustre can decrease as a result.

In the past, little thought has been given to the need to shrink-resist treat mohair, since mohair articles are usually either drycleaned or carefully hand-washed. In addition mohair has a relatively low felting potential. It has been shown, however, that if one subjects a mohair knitted fabric to a very severe aqueous washing treatment, it can shrink considerably.* Some work is being directed towards developing a process for shrink-resist treating mohair in both sliver and loose stock form without, in any way, adversely affecting or detracting from the many desirable features of the fibre.

MOHAIR CONTENT OF MOHAIR/WOOL BLENDS:

One of the most frequent queries that the Institute receives in the context of fibre composition, is that relating to the content of mohair in mohair/wool blends. Mohair is frequently blended with wool in various proportions and for various reasons.

Generally the blending of "lustre" wools are often preferred to other wools, especially since these often match the mohair in terms of length. It is extremely difficult, if not impossible, for even an expert to detect, with the naked eye, the presence of certain of these lustre wool fibres in an intimate blend with mohair. For the purpose of checking a blend composition, however, it is important to be able to identify the fibres quantitatively. The Institute has done considerable work in this field and established a method some time ago which was based upon the differences in the anti-scale frictional properties of wool and mohair fibres. The method, however, was time consuming and tedious, and not infallible, and it has now been superseded by a quicker and more reliable method developed in Germany in which the height or thickness of the scales of the fibres

* Unpublished work by N J J van Rensburg

are measured on a scanning electron microscope. The heights of the scales are clearly lower for mohair than for wool.

The Institute is at present looking at the effects of chlorination on scale heights to determine whether or not a chlorination treatment, now used, not only for shrinkproofing wool, but also, in some instances, for increasing its lustre, will adversely affect the accuracy of the determination of the blend composition using the scale height method.

In this context work is also in progress, in which the scale height distribution for various types and origins of both mohair and wool is being studied.

STAPLE PROFILE AND ITS FUTURE ROLE:*

Returning to the subject of the length and profile of mohair staples, some very interesting work is in progress. Fig. 15 is another example of a staple profile, measured on the SAWTRI length/strength tester, this example being Young Goats of 33 μm. Two profiles are shown in the figure. The profile shown below the greasy profile is the profile after the contaminants have been removed from the fibres by scouring them, and this is referred to as the estimated scoured profile. It can be seen that the two profiles merge at the tip end of the staple which is relatively free from contaminants, whereas the two profiles are quite far apart at the root end of the staple which is normally contaminated the most. In order to arrive at the estimated scoured profile, a sliding correction factor is therefore applied to the greasy profile.

Fig. 16 shows how this correction was arrived at, and is the result of a study involving a number of different staples ranging from fine to coarse in quality and embracing Kids, Young Goats and Adults. It can be seen from the curve that the ratio between the cross-sectional area of the scoured staple to that of the raw staple was practically 1:1 at the tip end and this gradually decreased to about 0,85:1 a few millimetres from the root.

Suppose one has several of these profiles from a number of staples representing one lot of mohair. If each of them were normalised to the same mean thickness and corrected for contaminants, and the scoured profiles assembled in such a way that the root ends were on the left and the tip-ends on the right, a grand mean profile such as that shown in Fig. 17 would be produced. This profile was obtained from 10 staples examined from a lot of Kid mohair. Quite understandably, most of the waviness seen on individual staples has now disappeared. Next, by averaging progressive clusters of points the smoothed grand mean profile shown in Fig. 18 was produced. The initial steep positive slope of these curves is due to the progressive widening of the distance between

* Unpublished work by the Author and J Cizek

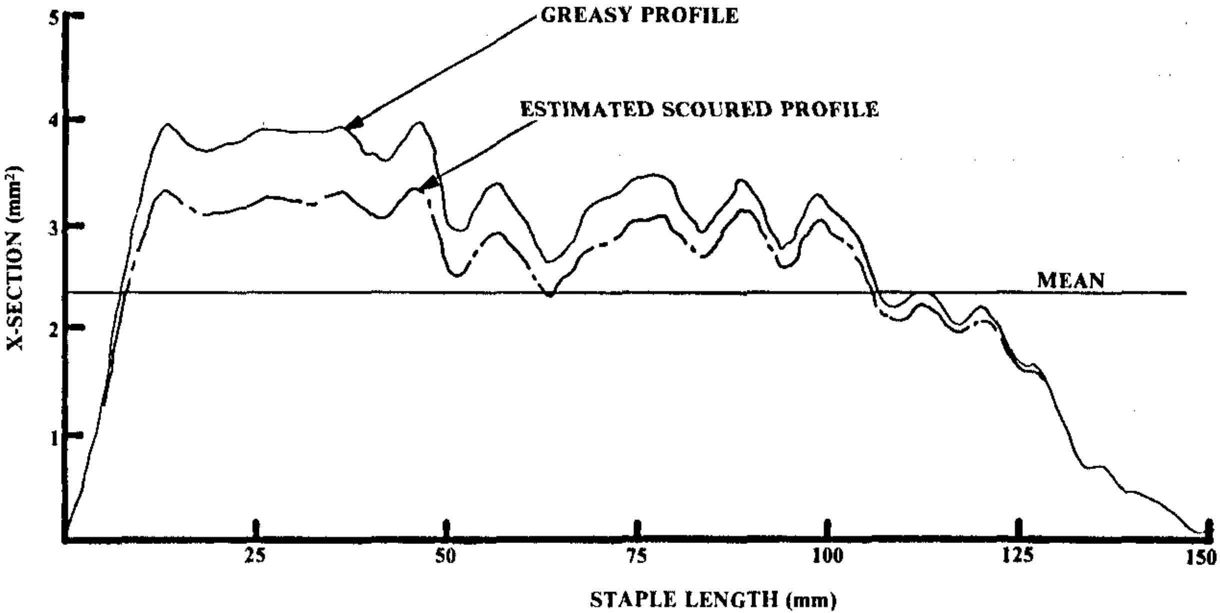

Fig. 15 – Example of a staple profile of Young Goats.

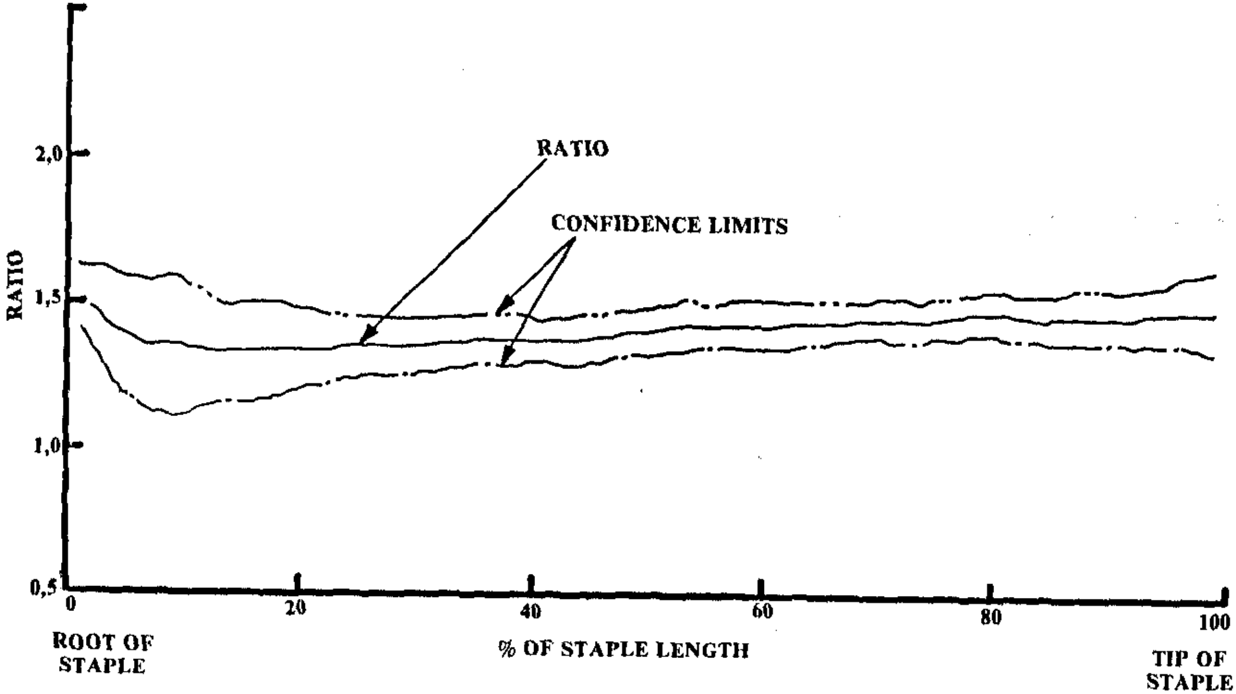

Fig. 16 – Variation in the ratio of the cross-sectional area of scoured staple to raw staple along its length.

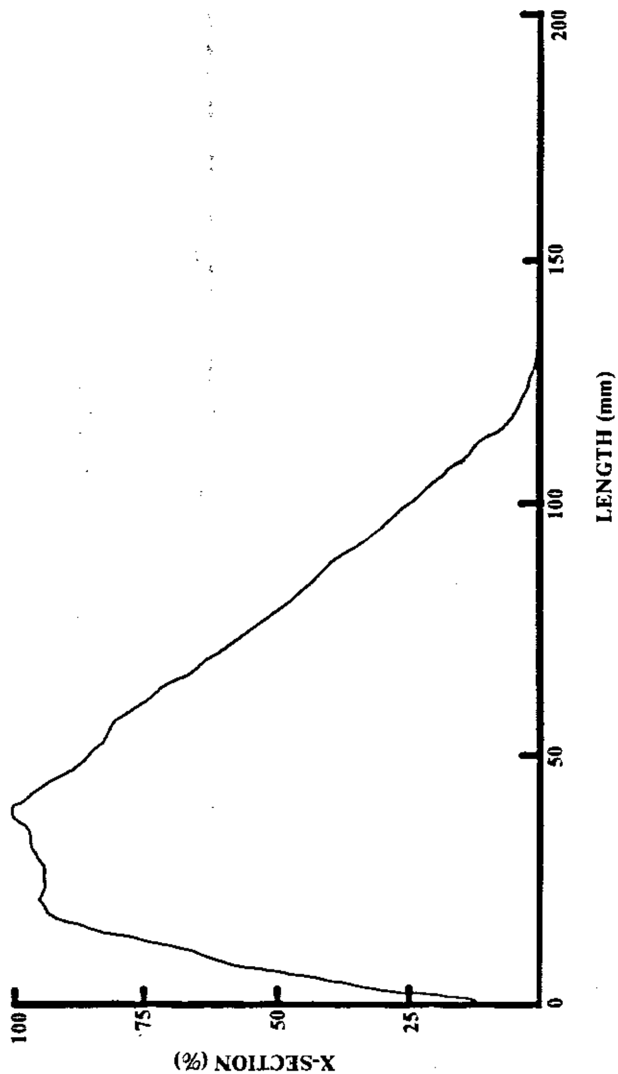

Fig. 17 – Grand mean profile for a lot of Kid mohair.

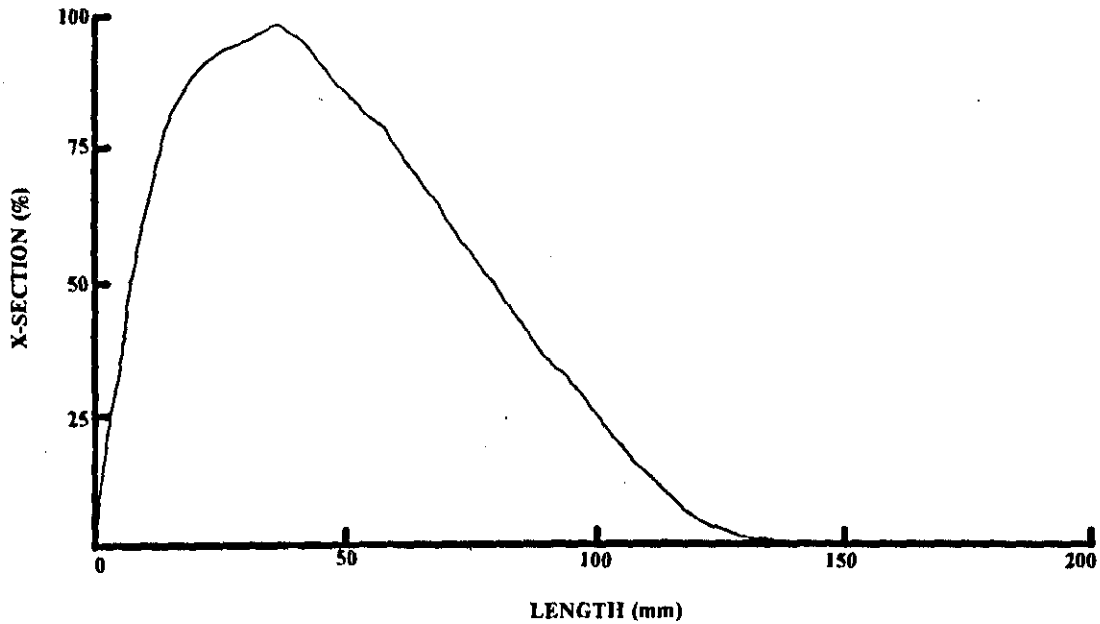

Fig. 18 – Smoothed grand mean profile for a lot of Kid mohair.

the measuring wheels as the staple enters the machine, and also to the initial slight distortion of the root ends. If one now re-draws the curve in such a manner that the position of the points used to construct it, and which were derived from information on the root ends, are each moved to co-incide with the vertical axis, then a profile, termed the "Standardised" Grand Mean Profile is obtained, as seen in Fig 19. This is believed to be a good representation of the fibre length distribution in the raw mohair lot.

If few fibres were broken or lost during processing and few fibres removed during combing, the fibre length distribution diagram shown in Fig. 19, would not be expected to change much up to the top stage. The actual (Almeter Hauteur) fibre length distribution curve obtained for the top has been superimposed on the standardised grand mean profile curve in Fig 19. It is interesting to note how closely the two curves agree in this case.

This technique appears to be most promising and could have important application in the development of a mathematical model for the prediction of top characteristics from raw mohair staple data obtained on the SAWTRI machine.

Using only 10 staples from each of 15 lots, the degree of association between the mean length of the raw hair obtained from the standardised grand mean profile, and the mean fibre length of the top produced from the raw hair was good ($r = 0{,}80$). (Fig. 20). Similarly, the degree of association between the tail lengths was also good ($r = 0{,}76$). (Fig. 21).

Another potentially interesting area which needs an in-depth study is that relating to profile measurements of different styles of mohair. In a limited experiment involving a single staple from 60 different sources, but covering four differences in subjective appearance for Kids, Young Goats and Adults, some interesting information has been obtained.

The standardised grand mean profile curves obtained for the various styles of Adult mohair, after normalising the individual lengths of each staple to a length of 100%, are shown in Fig 22 by way of an example. The grand mean profile for the Adults of 'stylish' appearance appeared to be a little better (i.e. more uniform) than that pertaining to the Adults of 'open' appearance, and the profiles for the Adults having 'character' or having 'style and character' appeared better still. Such information tended to suggest that as the style improved, so also did the length uniformity.

USE OF PROPRIETARY NAMES

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

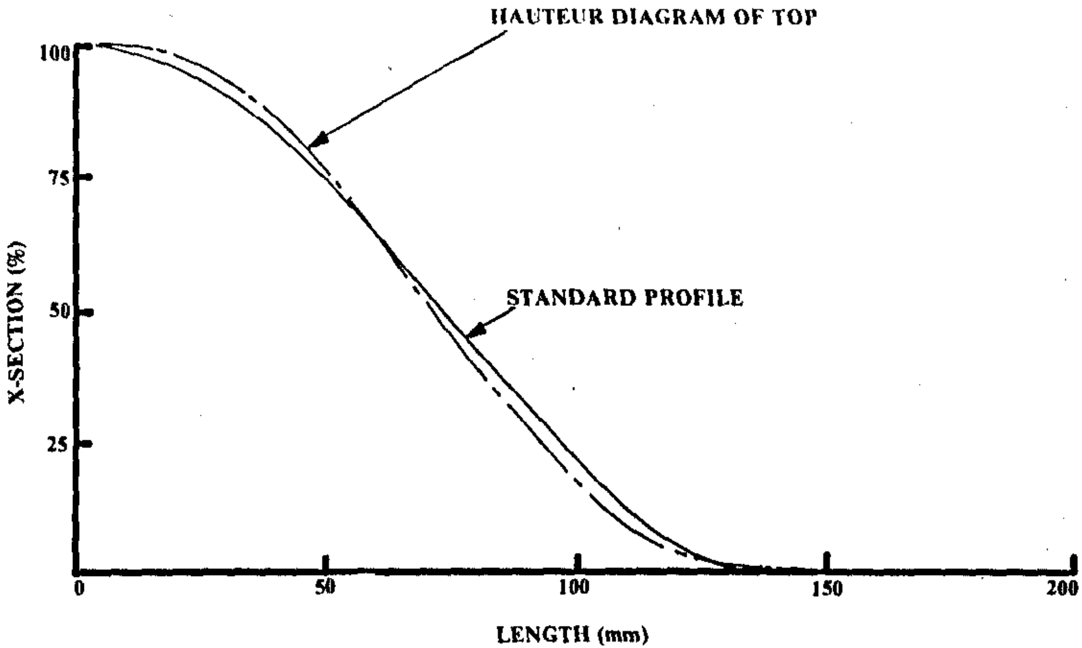

Fig. 19 – "Standardised" grand mean profile for a lot of Kid mohair with Hauteur diagram of the top produced from it superimposed.

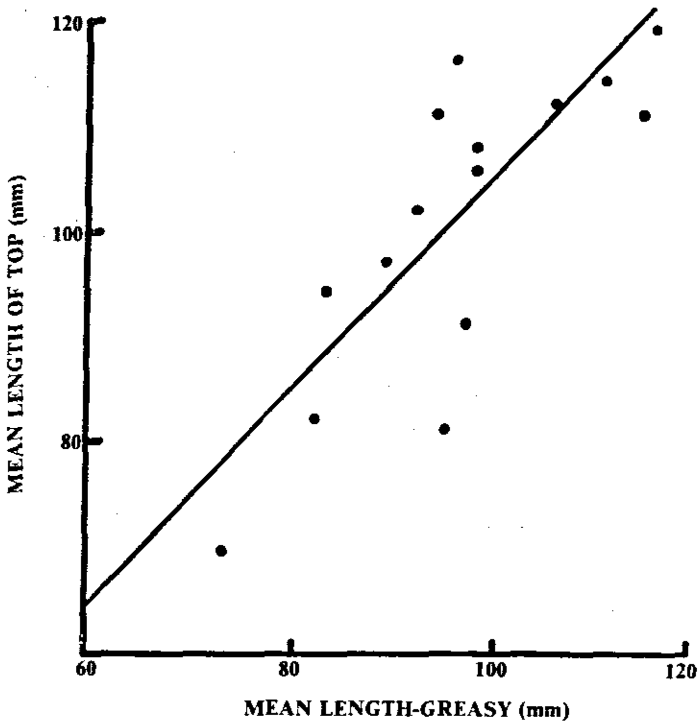

Fig. 20 – Mean length of top versus mean length derived from greasy staple diagram.

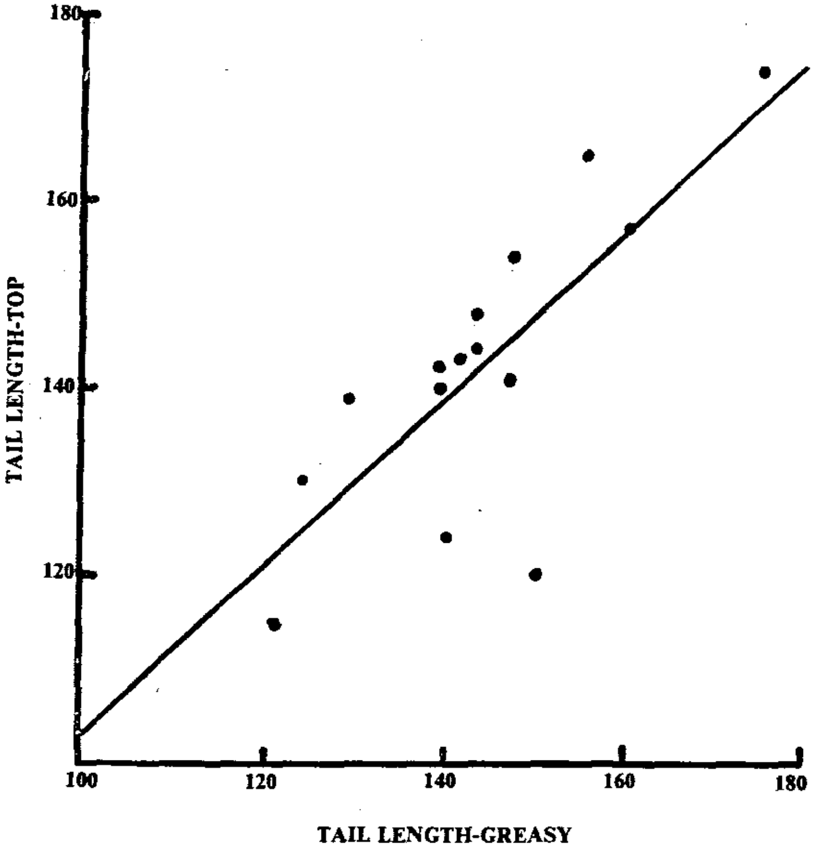

Fig. 21 – Tail length of top versus tail length derived from greasy staple diagram.

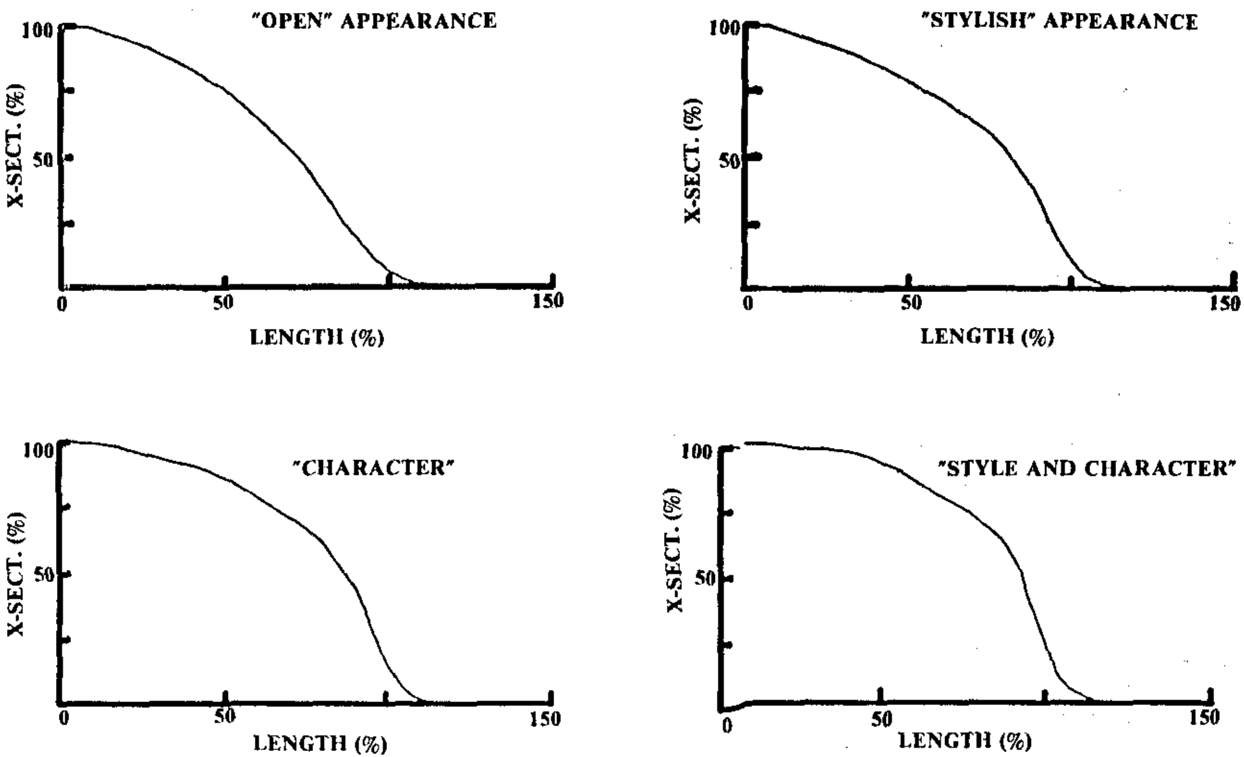

Fig. 22 – "Standardised" grand mean profiles obtained from various styles of Adult mohair.

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WOL 69

ISBN 0 7988 3155 3

SAWTRI SPECIAL PUBLICATION

June 1985

Published by
The South African Wool and Textile Research Institute,
P.O. Box 1124, Port Elizabeth, South Africa,
and printed in the Republic of South Africa
by P U D Repro (Pty) Ltd., 48 Main Street, Despatch.