SAWTRI BULLETIN

SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
OF THE CSIR

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PORT ELIZABETH

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SAWTRI BULLETIN

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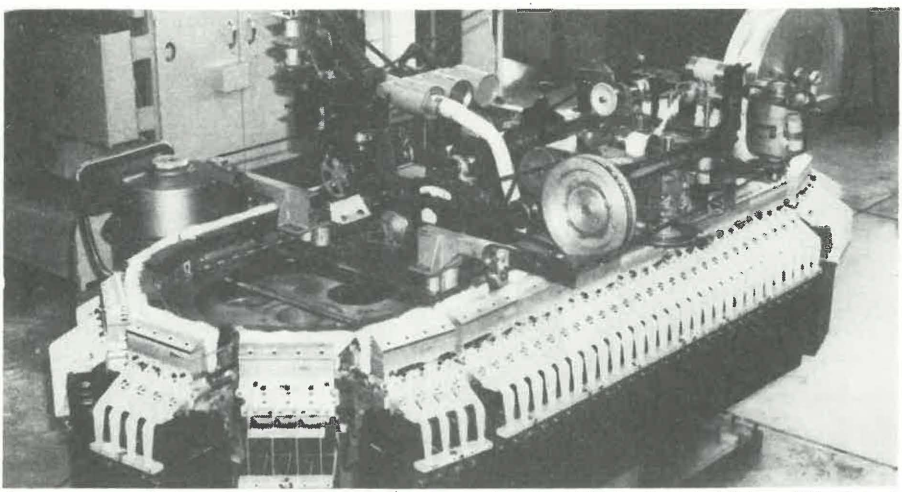
INSTITUTE NEWS

SAWTRI Comb

At the Sixth Quinquennial International Wool Textile Research Conference held in Pretoria in 1980, SAWTRI released for the first time information about a revolutionary combing machine which had been under development at the time. An important milestone has now been reached in this development since a collaboration and licensing agreement recently has been concluded successfully between SAIDCOR (South African Inventions Development Corporation) and a leading overseas textile machine manufacturer.

The combing machine is considered to represent the first serious challenge to conventional combs for wool and other long staple fibres in more than a century and could also be a first step towards the automation of this important textile process. Novel features of the comb include its modular design, continuous linear action, low noise level and the fact that it lends itself to automation. The modular design reduces manufacturing costs and allows a customer to select the size of comb to suit his particular requirements. The linear combing action permits very high production rates. The low noise level of the machine is particularly important in today's ecologically conscious society. The fact that it can be automated fits in well with the need to combat ever-increasing labour costs.

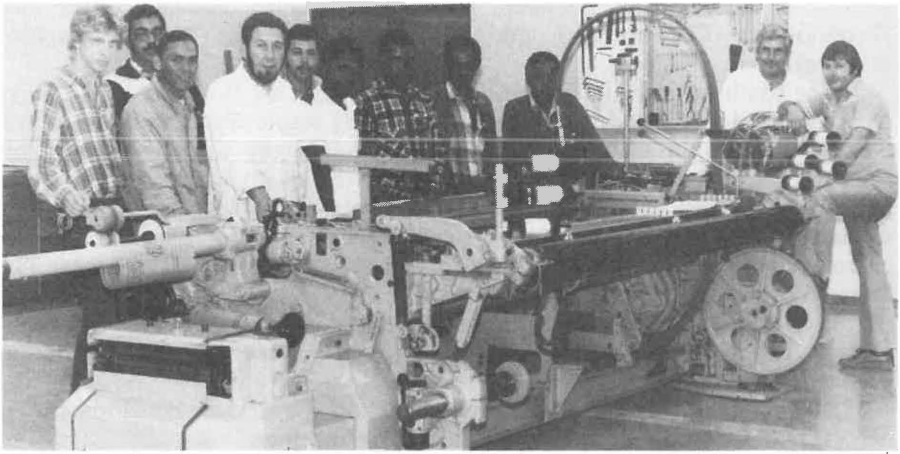
Although the comb is already functional, further development is necessary before full commercialisation of the machine.



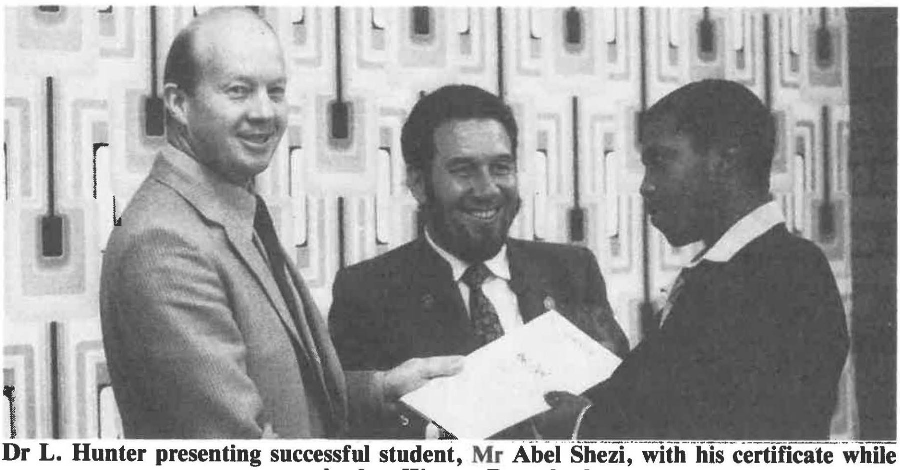
A prototype of the new textile comb developed by the CSIR's South African Wool and Textile Research Institute

Another Dornier Weaving Course

Mr Werner Brust of the Dornier Organisation in Lindau, West Germany, conducted a three-weeks course on the Dornier Rapier weaving machine here at SAWTRI from 19th April to 7th May. The course was attended by ten technicians from a number of mills. At the conclusion of the course, Dr L. Hunter, Assistant Director of SAWTRI, presented certificates of attendance and competence to the successful candidates.



Mr Werner Brust (in white dust coat) surrounded by Course participants at SAWTRI's Dornier Rapier loom



Dr L. Hunter presenting successful student, Mr Abel Shezi, with his certificate while course leader, Werner Brust looks on.

SAWTRI takes part in Wool Festival

The Graaff-Reinet Farmers' Association organised a Wool Festival in the town during May. Dr D. W. F. Turpie, Director of the Institute, was invited to address the farmers and others present on the work at SAWTRI and the Institute's role in the South African Textile Industry, and he made the first public announcement of the news, which was enthusiastically received, regarding the SAWTRI Comb referred to above. In the course of his talk Dr Turpie demonstrated the SAWTRI Defribber and also mounted a display of wool fibre in various stages of processing from the raw state to the finished cloth. An audio-visual presentation by Mr de Wet Olivier of SAWTRI and its activities was screened as a part of the Institute's contribution to the Graaff-Reinet Wool Festival.

Dr Turpie delivering his paper at the Farmers' gathering during the Graaff-Reinet Wool Festival

Completion of Extensions

Extensive building operations which have been in progress since March, 1981 are now rapidly drawing to a close. The bulk of work has been completed and the staff concerned are rapidly settling in the new premises for knitting and weaving, woollen processing, machine development, raw fibre scouring and short staple processing. The new compression room is fully functional, the larger boiler room is receiving its second large boiler and extensions to the maintenance workshop have virtually been completed. All this activity has made it possible for the Institute to spread its wings and broaden the research front. Management is extremely grateful to the research and other workers who have borne the many inconveniences with such fortitude and for their efforts to continue under extremely difficult conditions.

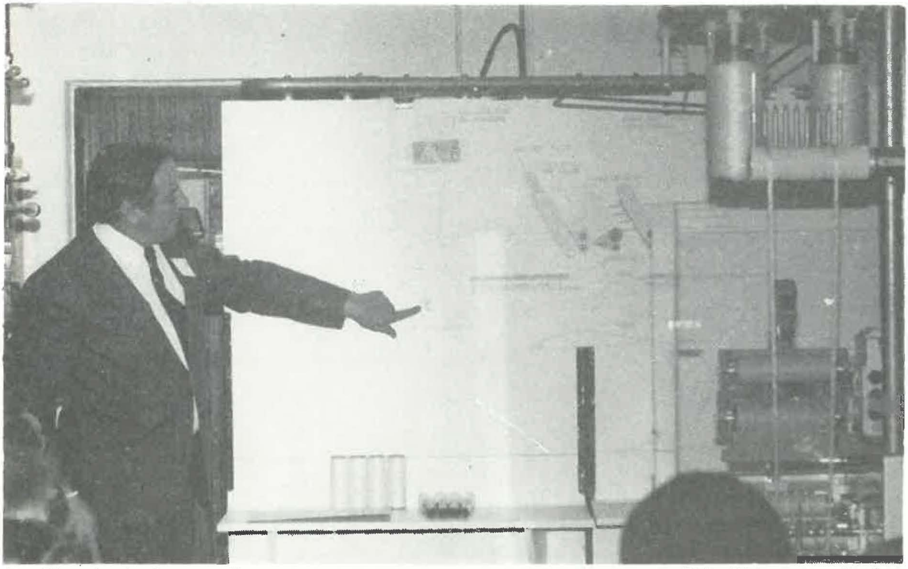
The Cotton Symposium

The CSIR Regional office under the able guidance of Mr N. J. Vogt has now reached the stage where final arrangements for the forthcoming Cotton Symposium are being rounded off. The SAWTRI Publications Department is in the process of preparing the Symposium Transactions which will be available to the delegates when they register for the Symposium, which, it will be recalled, is being held at the University of Port Elizabeth on 26 and 27 July. The social programme has been finalised, the sessions timetable completed and it is anticipated that some 300 delegates will attend.

International Mohair Association Congress

The International Mohair Association's Congress which was held in Port Elizabeth, on June 21, provided a golden opportunity for SAWTRI to introduce the Institute to those overseas delegates as well as local delegates who have thus far been inadequately informed about research activities here. A special tour of the Institute was organised on June 22 during which approximately 120 delegates were shown the facilities. At various points in this itinerary the Director and senior staff gave explanatory talks thereby giving the visitors a clear picture of the Institute and its extensive activities.

Three lady delegates to the IMA Congress examining mohair fabrics during a tour of SAWTRI.
Left to right: Mrs Sue Darvall, from Victoria, Mrs Mavis Handyside and Mrs Marjorie Johnston from Western Australia



Dr Turpie during a talk on spinning, explaining details of the modified Repco spinning system developed at SAWTRI, on the occasion of the IMA delegates' tour of the Institute.

Dr Nic van Rensburg, Group Leader of Wet Processing and Textile chemistry explaining lustre of mohair to a section of the touring group of IMA congress delegates.

Mr Tony Hobson, President of the International Mohair Association giving a word of thanks after the congress delegates' tour of the Institute with Dr D. W. F. Turpie, Director of SAWTRI seated.

VISITS AND VISITORS

Visits by SAWTRI Staff

The Director, Dr D. W. F. Turpie, accompanied by Mr N. J. Vogt, Regional Representative of the CSIR in the Eastern Cape Province, departed for Zimbabwe on May 3rd for a five-day visit to various factories of the cotton industry. Dr L. Hunter, the Assistant Director, who was to have been a member of the party was unfortunate to have to withdraw on account of illness. Dr Turpie and Mr Vogt attended a meeting of the SAWTRI/CCGA Steering Committee in Harare (formerly known as Salisbury).

On the 15th May, Dr Turpie left for the United Kingdom, where, on May 20, at Ilkley, Yorkshire, he attended the Research and Development Meetings of the International Wool Secretariat. At Galashiels in Scotland, Dr Turpie had discussions with Dr T. Harwood, Dr J. G. Martindale and Mr J. P. van der Merwe who is a SAWTRI staff member, about the research being undertaken at the Scottish School of Textiles on Woollen Processing by Mr van der Merwe.

Dr Turpie (left) and Mr Vogt during a factory visit in Zimbabwe.

Mrs Eric Quaile, Promotion Executive of the Cotton Promotion Council of Zimbabwe holding a bunch of opened cotton bolls at the Cotton Research Institute at Gatooma.

Dr Turpie and Mr Vogt examining cotton bolls in a cotton field of the Cotton Research Institute at Gatooma, Zimbabwe.

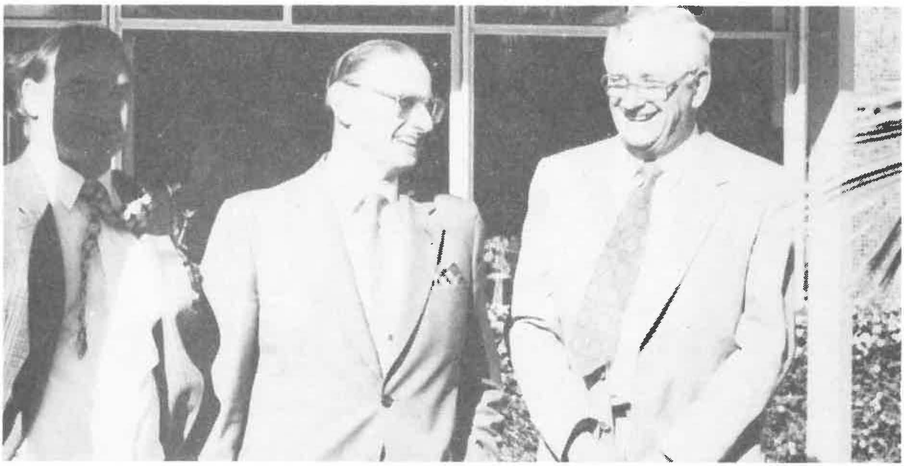
In Switzerland, Dr Turpie paid visits to Messrs Rieter, Testex and Rüti after which he travelled to Italy and visited Cognotex, Imola and Savio. He also attended various meetings of the International Wool and Textile Organisation in Venice and presented a paper on recent work carried out by SAWTRI on processing losses. Dr Turpie returned home on June 13.

Mr M. A. Strydom, who is Head of Long Staple Processing at SAWTRI, left the Republic on May 28 on an extended visit which took him to Switzerland, France, Italy, Belgium and the United Kingdom visiting various textile factories and laboratories. He joined Dr Turpie in Venice for the IWTO meetings and presented a paper on a joint research project by the CSIRO, SAWTRI and the IWS on processing trials.

Visitors to SAWTRI

During March, Dr G. H. Crawshaw, IWS Product Development Manager — Carpets and Special Products, at the IWS Technical Centre in Ilkley, Yorkshire, visited SAWTRI where he held discussions with the Assistant Director, Dr L. Hunter and Dr N. J. J. van Rensburg who is responsible for Textile Chemistry and Wet Processing. This visit was followed by one from Mr E. Schwartz, Managing Director of Textest in Zürich, Switzerland.

Mr A. Kitahara, Manager: Economics and Market Research of the IWS in Japan visited SAWTRI on April 21st for discussions with Dr Turpie. Mr Kitahara had been on a visit to South Africa, where, in Port Elizabeth, he was guest speaker at the Congress of the National Wool Growers Association's Cape Province Branch which was held from 20 to 22 April.



Dr Arthur Farnworth (centre) with Messrs Ferreira (left) and Allen during their visit to SAWTRI.

Dr Arthur Farnworth, Managing Director of the Australian Wool Corporation, accompanied by Mr Jan Allen, Deputy Director of Wool Marketing of the SA Wool Board and Mr Eric Ferreira, Chief Technical Officer of the Division of Technical Services of the Wool Board paid a visit to SAWTRI on May 25th. Dr Farnworth visited South Africa to acquaint himself with developments in wool marketing and research in South Africa.

Mr Albert-Bruno Prouvost of the well known French wool firm Peignage-Amedee SA and Director of Combing of this firm in France, paid a brief visit to SAWTRI in the company of Mr Michel Droulez of Cape Wool Combers in Uitenhage. Mr Prouvost was shown around the Institute by Mr Neville Vogt and had discussions with the Assistant Director of SAWTRI, Dr L. Hunter, on 21st May.

Mr N. Vogt, second from left, in conversation with Mr Prouvost with Mr Droulez (left) and Dr Hunter (right).

First World Merino Conference

A paper written by Dr L. Hunter, Dr Turpie and Mr Gee: "The Effect of Wool Fibre Properties on Worsted Processing Performance and on Yarn and Fabric Properties" will be presented by Dr Hunter at the first World Merino Conference to be held in Melbourne, Australia from 14 to 17 July. SAWTRI is playing a leading role in world textile research in this particular field.

Staff News

Mrs Emmie Kritzinger who has been a technician in the Textile Physics department for a number of years has obtained a B.A. degree majoring in Education and Psychology from the University of South Africa and was capped at a graduation ceremony in Cape Town in May this year.

SAWTRI PUBLICATIONS

Since the March issue of the "Bulletin" the following Technical Reports have been published:

No. 495 : Weideman, E. and van Rensburg, N. J. J., *Electroflotation of Dye Liquors Containing Wool Grease using Aluminium Electrodes.*

No. 467 : Turpie, D. W. F., Strydom, M. A. and Gee, E., *Processing losses during Topmaking. Part II: The Effect of Certain Fibre Properties and the Degree of Fribbiness of the Raw Wool.*

No. 498 : Ball, G. H. and van der Walt, G. H. J., *The Simultaneous Dyeing, Crease Resist and Flame Retardant Treatment of All-Cotton Fabrics: Part I: The Effect of Different Levels of n-Methylol Dimethyl Phosphonoproprioamide as Flame Retardant.*

No. 499 : Robinson, G. A., Gee, E. and Cawood, M. P., *The Dimensional Changes of Outer Fabrics and Interlinings during Fusing. Part IV: Effect of the Presence of Glue and Directions of Alignment and Feed.*

No. 500 : Hunter, L. and Gee, E., *The Correlation Between Cotton Fibre Properties and Ring and Rotor Yarn Properties.*

FOAM SIZING
PART I: A PRELIMINARY STUDY

*by G. H. J. VAN DER WALT and R. A. LEIGH**

ABSTRACT

The foam properties of different commercial sizes were evaluated and their application to cotton warps on a Gaston County FFT machine studied. It was found that foams with half-lives ranging from about 30 minutes to more than 80 minutes could be obtained when a suitable surfactant was added to the size liquor. Furthermore, it was found that an acrylic-based size could be applied to cotton warp yarns on the FFT machine at wet pick-up values varying from 10 to 40%. Due to the high viscosity of concentrated size liquors, however, only liquors containing relative low concentrations of size could be used on the machine. This resulted in low levels of size add-on, but despite the fact that the size add-on level was fairly low a significant improvement in yarn breaking strength was obtained.

INTRODUCTION

Warp sizing of cotton and cotton blends is an essential part of modern textile processing. Sizing is a prerequisite for satisfactory weaving performance of single yarns, since unsized yarns cannot stand up to the stresses and strains imposed during weaving, without frequent rupture. Application of a suitable starch or synthetic polymer size to the yarn improves its single breaking strength and elastic elongation and imparts better abrasion resistance. As a consequence the yarn can withstand the high tension, abrasion and friction in the loom better[1].

Traditionally size is applied at wet pick-up values of 80% to 150%, followed by drying. The evaporation of the water during the drying process requires a substantial amount of energy[2,3]. Furthermore, some sizes have to be "cooked" during preparation and this also contributes significantly to the cost of the sizing process[4]. As a result of the continuous increase in energy costs, it is important therefore, that various methods of reducing the cost of the sizing process be found. Some of the methods already in use are solvent sizing[5], recover of the sizing material[6], low temperature polymeric sizes[4,5], hot-melt sizing[7,8], and high pressure squeezing in sizing[7,9]. Energy savings of about 40% and 20% have been obtained with solvent sizing and high pressure squeezing, respectively. It has been claimed that the latter also contributes to more uniform sizing[9].

One of the latest developments in sizing is the application of a size to warp

* Bevaloid (SA) (Pty) Ltd, Durban

yarns by means of foam[2,3,10-12]. In the foam sizing process a relatively low volume of a very concentrated solution can be applied to the warp yarns[3]. The actual amount of size added to the yarns is the same as that used in conventional sizing, but the wet pick-up is significantly lower, because the foam contains water as well as air bubbles.

The principal advantage of foam sizing is the reduced water requirements and it has been claimed that the drying energy cost can be reduced by as much as 50%[2,3,13]. Furthermore, it has been claimed that chemical cost can be reduced[3,10] and that the size can be removed easier because of lower penetration of size into the yarn[3].

There are various systems available for the application of the foamed size, e.g. a horizontal padder, a knife-over-roller coater, and a roller coater where the foam is collapsed by squeezing or other mechanical means[3,11]. In view of the growing importance of foam treatments it was decided to carry out some studies on foam sizing, using a Gaston County Foam Finishing (FFT) machine. In the FFT system relatively unstable foam, which can be collapsed at a predetermined rate, is used. The FFT machine is used mainly for treating textile fabrics, and relatively little is known about its use in the application of size to yarns. It was decided, therefore, to study the effect of different sizing solutions applied at different add-on levels on an FFT machine on some properties of cotton yarns.

EXPERIMENTAL

Material

Greige cotton yarn (30 tex), was made up into a warp 9,0cm wide and containing 150 ends.

Sizes used for Laboratory Studies on Foams

Size liquors containing 20% solids were prepared from:

1. A PVA/starch blend
2. A Starch-based, PVA free material
3. A PVA-based, starch free material
4. A Styrene-acrylic polymer

The sizes, which contained 1,0% of a Bevaloid surfactant (®Bevaloid 104/T1), were foamed in a Kenwood mixer at a maximum speed for 5 minutes.

Pilot Scale Foaming Trials

PVA based size solutions containing 30%, 20%, 15% and 12,5% solids and 0,5% (or 1,0%) ®Synperonic NP8 and 1,0% of ®Bevaloid 104/T1 as well as acrylic size liquors containing 6% and 9% solids and 1,0% ®Dobanol 91-8 and 1,0% ®Tergitol TMN-6 were foamed on the FFT machine.

Pilot Scale Foam Sizing of Yarns

A Gaston County laboratory Foam Finishing (FFT) machine with a dual application system was used. The sizing liquors were foamed in the machine at a liquor flow of 100 mℓ/min or 150 mℓ/min with air flow rates varying from 0,6 to 3,0 ℓ/min to give foam densities of 0,20 to 0,047 g/cm^3 (blow ratios of 5:1 to 21:1).

The beam of warp yarns was run on the FFT machine at speeds of 23 to 46 m/min to give wet pick-up values varying from 40% to 10%. At the point of traverse over the foam delivery slots (bottom and top applicators) the warp width was reduced to 2,6 cm and a grid bar was placed across the warp to prevent the yarns from moving apart. The slots were partly sealed and a length of only 2,6cm was left open for the application of the foam to the warp. Additional guide bars and tension rollers were installed to guide the warp over the applicator slots.

Testing

The abrasion resistance of the sized yarns was determined on a Bevaloid abrasion tester[14], the yarn-to-metal friction on a Bevaloid friction tester[15], and the yarn breaking strength on a Goodbrand single thread tester. All tests were carried out at 23°C and 70% RH.

Foam Properties

The viscosity of the foams and size liquors were measured with a Rion viscotester with spindle, models VT-01 and VT-02 and a Haake viscotester. The blow ratio, density and the half-life of the foam were measured using a separating funnel.

RESULTS AND DISCUSSION

Laboratory Studies

Sizes are normally relatively viscous products and some contain a small amount of defoaming agent in the formulation to prevent foam generation in the size application trough during the conventional sizing process. This may be detrimental to foam stability in the case of foam treatments. A number of sizes, varying in viscosity and containing *no* added deformer, were therefore specially prepared, and their foaming properties evaluated. The blow ratio and density of the sizes having different viscosities are given in Table I. This investigation showed that it is possible to foam very viscous sizes. The results in Table I show that the blow ratio decreased with an increase in the viscosity of the sizes.

Generally, the blow ratio was more or less in the same range as those obtained elsewhere on the foaming of size solutions[3]. Blow ratios required for the FFT machine are normally in the range of 50:1 to 5:1 (0,02 to 0,2 g/cm^3)[16]. On the other hand, the foam half-lives of the different sizes were higher than 80 minutes, while it has been recommended that foams with half-lives of up to 45 minutes should be used on the FFT machine[16].

TABLE I

THE EFFECT OF VISCOSITY OF DIFFERENT SIZE LIQUORS ON BLOW RATIO AND DENSITY OF THE FOAM

Size (20% solids)	Size Bases	Viscosity of Size Liquor (80°C)(mPa.s)	Blow Ratio*	Density (g/cm^3)
Bevaloid 61/3257MF	PVA/Starch	700	4,0:1	0,25
Bevaloid 4183F4V	Starch-based, PVA free	280	4,6:1	0,22
Bevaloid 104/5	PVA-based, Starch free	30	7,8:1	0,13
Bevaloid 4167B	Acrylic polymer	1	8,2:1	0,12

$$\text{*Blow ratio} = \frac{\text{mass of specific volume of liquid}}{\text{mass of same volume of foam}}$$

Pilot Scale Application

A 30% solid solution of a PVA-based size (Bevaloid 104/1) containing 1,0% surfactant (Bevaloid 104/T1) was foamed on the FFT machine. This size liqour was considered too viscous, however, causing the foam generator to overheat. This was still apparent even when the size liquor was diluted to 20% solid solution. Furthermore, these foams generally had a very high foam half-life (60 min) which is considerably higher than that required for the FFT machine, namely 3 to 45 min.

It was decided, therefore, to substitute the Bevaloid surfactant by Synperonic NP8 (0,5%), and to dilute the size liquor to 12,5% solids. The results obtained are given in Table II, which shows the effect of air flow rate on some of the foaming properties at a constant liquor flow rate of 150 mℓ/min. The viscosity of the size liquor prior to foaming was 60 mPa.s. The density of the foam decreased from 0,16 to 0,07 g/cm³ when the air flow rate was increased from 0,6 to 2,0 ℓ/min. At an air flow of 3,0 ℓ/min the concentration of the surfactant had to be increased to 1,0% to achieve a lower density foam. It appeared that the minimum density of the size liquor was about 0,05 g/cm³. Furthermore, Table II shows that foam viscosity increased when the air flow rate was increased. On the other hand, the half-life of the foam did not change significantly, but nevertheless, it was lower than that obtained previously.

TABLE II

THE EFFECT OF AIR FLOW RATE ON SOME FOAMING PROPERTIES OF A PVA BASED SIZE CONTAINING 12,5% SOLIDS

AIR FLOW RATE (ℓ/min)	DENSITY (g/cm³)	BLOW RATIO	VISCOSITY (mPa.s)	HALF-LIFE (min)
0,6	0,16	6:1	2700	29
1,2	0,10	10:1	3500	28
2,0	0,07	14:1	3800	29
3,0*	0,05	20:1	4500	29

*1,0% Synperonic NP8

In some further studies the behaviour of an acrylic size (Bevaloid 104/12) on the FFT machine was investigated. Size liquors containing 6% and 9% solids were used. It was found that the viscosity of the 9% size liquor was too high (160 mPa.s) causing the foam generator to overheat. The 6% size liqour (65 mPa.s), containing 1% Dobanol 91-8 surfactant, produced blow ratios of 5:1 to 21:7 (densities of 0,20 to 0,046 g/cm³) with foam half-lives of 34 to 39 minutes. During the actual sizing trials, however, Tergitol TMN-6 was substituted for Dobanol 91-8 because the foam appeared to be more uniform when Tergitol TMN-6 was used. The half-life of this foam was 36 minutes.

The results given in Table III indicate that cotton yarns can be sized on the FFT machine at low wet pick-up values (10-40%). Unfortunately the actual size add-on levels obtained with a 6% size liquor at these low wet pick-up values (0,9 to 1,6% solids) are too low to effect significant improvements in abrasion resistance or yarn-to- metal frictional properties. However, even at very low add-on levels the acrylic size produced some improvement in tensile strength, increasing breaking strength by between 6% and 28%.

The only way in which an increase in size add-on levels could be obtained at these very low wet pick-up values will be the foaming of size liquors with higher solids contents. Such size liquors, however, have very high viscosities and the present flowmeter used in the laboratory FFT machine is not suitable

TABLE III

INFLUENCE OF FOAM SIZING ON SOME PHYSICAL PROPERTIES OF COTTON YARN

Application System	Blow Ratio	Speed (m/min)	Wet Pick-Up (%)	Size Add-on (%)	Abrasion Resistance of Yarns (Revolutions)			Yarn-to-Metal Friction (cycles)			Yarn Breaking Strength (cN)	Yarn Elongation (%)
					To Fray	To Bead	To Break	To Bead	To Cling	To Break		
Single	13:1	46	29	1,6	2	5	40	1	5	24	389	6,0
Single	13:1	35	10	0,9	3	6	46	2	5	25	346	8,0
Dual	12:1	37	20	0,9	3	6	47	2	7	35	323	7,8
Dual	8:1	23	40	1,5	2	5	45	2	7	25	199	6,0
Unsized control		—	—	—	Immed	2	32	2	9	19	305	8,2

Note: Liquid flow 100 mℓ/min

for high viscosity solutions. The replacement of this flowmeter with a meter which could handle high viscosity solutions should eliminate this problem. Alternatively, lower viscosity sizes will have to be developed. Furthermore, it is essential that the foam half-life be reduced to lower levels which will result in a rapid break-down of the foam when it comes in contact with the yarns on the FFT machine.

SUMMARY AND CONCLUSIONS

Foam sizing trials were carried out on a Gaston County laboratory Foam Finishing (FFT) machine. There was no difficulty in producing foams from PVA-based and acrylic-based sizes, provided suitable surfactants were added to the sizing solutions. It was found, however, that the FFT machine performed satisfactorily only when low viscosity size liquors (below 100 mPa.s) were used.

Size liquors having high solids contents are very viscous and attempts to foam size a small warp made from cotton warp yarns on the FFT machine was limited by the viscosity constraint. It was possible, however, to reduce the wet pick-up to values as low as 10-40%. Despite the fact that the add-on level of size was fairly low, some improvements were noticed in certain yarn properties when an acrylic-based size was used. Furthermore, it was found that a significant improvement in yarn breaking strength was obtained by foam sizing.

ACKNOWLEDGEMENTS

The authors are indebted to Mrs J. White, Miss P. Kerchhoff and Mrs A. Erskine for technical assistance, Mr L. Layton for preparing the beams, Dr N. J. J. van Rensburg and Mr K. M. Priestman for valuable technical discussions during this investigation, and Messrs Bevaloid (SA) (Pty) Ltd. for supplying the sizes and yarns.

THE USE OF PROPRIETARY NAMES

Products marked with ® denote registered trade names, namely Dobanol 91-8 of Messrs Shell, Synperonic NP8 of Messrs ICI, Tergitol TMN-6 of Messrs Union Carbide and Bevaloid surfacant 104/T1 of Messrs Bevaloid (SA). The fact that these chemicals have been used in no way implies that they are recommended or that there are not others of equal or greater merit.

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SIZING OF SINGLES WOOL-WORSTED YARNS PART III: THE EFFECT OF VARIOUS SIZES ON WEAVABILITY

by G. A. ROBINSON and L. LAYTON

Parts I and II of this series were published as Technical Reports, No's 337 and 413 in Nov. 1977 and May, 1978 respectively

ABSTRACT

Twenty-two different size formulations were applied to fine worsted singles yarns to assess their effect on weavability during the weaving of a lightweight all-wool gaberdine fabric. Some of the formulations performed satisfactorily while others did not.

INTRODUCTION

The sizing of wool yarns is not very common since in most cases two-ply yarns are used as warp and these perform adequately without sizing. Nevertheless, the worldwide movement towards lightweight fabrics caused SAWTRI to embark upon a project aimed at determining the requirements, including sizing, for weaving singles wool worsted yarns. Various studies have been carried out by SAWTRI in an attempt to find a suitable size formulation for all-wool *singles* yarns so that good weavability can be achieved. Initial work involved the modification of a Hergeth Sample Sizing machine[1,2]. Since this machine was originally intended to be used with cold water sizes, modifications were necessary so that wool yarns could be sized with hot aqueous solutions.

A study on the sizing and weaving of wool blend yarns[4] showed that the yarns suffered losses in tensile strength during the preparation processes but subsequent sizing increased the tensile strength. Application of selected commercial size formulations resulted in better weaving performance when used on wool/cotton and wool/polyester blends than on all-wool singles yarns indicating that a better sizing agent for the wool component was necessary.

This report deals with an investigation into the weaving performance of all-wool singles yarns which had been sized with various size formulations with a view to indentifying sizes which could be used with consistently good results for the sizing of fine singles wool worsted yarns.

EXPERIMENTAL

Spinning

A 400g batch of South African merino combed tops (20,6 μm, 57 mm) having an initial dichloromethane extractable matter content of 0,51% was prepared for spinning by lubricating with 0,3% of ®Bevaloid 4027. The tops were drawn and finally converted into rovings on a Schlumberger NSC FM1 high draft draw frame. A 27 tex Z733 worsted yarn was subsequently spun on a Rieter H6 spinning frame from these rovings. The physical properties of this yarn before and after sizing appear in Table I.

Preparation

The yarns were wound and cleared on a Schlafhorst IKN cone winder fitted with Uster electronic authomatic yarn clearers and Classimat recorder. Warping was carried out on a Hergeth Sample Warping machine to give 22 warp beams suitable for sizing.

Sizing

The 22 warps were sized on a modified Hergeth sample sizing unit described in an earlier report[2].

All size mixtures used in these trials were commercial products and, in most cases, were intended for use with cotton or synthetics or both and were not specifically designed for wool with the exception of size lots 18, 19 and 22 which had been recommended for wool. Details of the various size formulations are given in Table I.

The percentage of total solids was 10% (except where stated otherwise in Table I). The method of size preparation was to run about one-third of the required volume of water into a storage kettle and to add the size ingredients while stirring. Except in certain cases the solutions were heated to 96°C and kept at this temperature for 30 minutes and then made up to a volume of 45ℓ. The yarn was sized at a temperature of between 70°C and 90°C except for Tylose, MH 1000, which was a cold water size in which case a temperature of 40-45°C was employed. The same size bath temperature and level were maintained throughout to ensure uniform size application. The quetsch pressure was 2,25kN over a 200 cm width and infra-red heaters dried the warp yarn at between 75°C to 85°C. The yarns were split by means of lease rods and comb and finally transferred onto the weavers beam.

Physical properties of the yarns

The tensile properties of the yarns (sized and unsized) were measured on a Goodbrand single thread tester. The abrasion resistance was determined on a Bevaloid abrasion tester[5], the number of rubbings (emery 400, ®Carborundum) which caused the yarn to break being recorded.

A sample of the unsized yarn (control) was also tested for comparison. All tests were carried out at 20°C and 70%RH.

TABLE I

PROPERTIES OF WOOL (27 tex) WARP YARNS BEFORE AND AFTER SIZING

Size Lot No	Size	Description	Supplier	Amount of Size Add-on (%)*	Goodbrand Single Thread Breaking Strength (cN)	Tenacity (cN/tex)	Extension at Break (%)	Abrasion Resistance (Cycles to Break)	Weavability: (End Breaks/1 000 ends/100 000 Picks***	Weavability: Ranking
Blank	CONTROL (unsized)	—	—	1,2	103	3,8	17,3	66	-do-	—
1	®Solvitose WS60	a carboxymethylated starch	Scholten	8,2	200	7,4	21,9	52	5,9	3
2	®Solvicol B9380	a starch based adhesive	Scholten	7,2	174	6,4	22,8	60	7,9	8
3	®Tuboflex TP 1 (5% mix)**	a combination of water soluble polygelactomannans and synthetic polymers	Beitlich	4,4	166	6,2	16,4	62	7,3	5
4	®Elvanol	a polyvinyl alcohol	Du Pont	7,2	177	7,7	24,6	90	10,2	9
5	®Bevaloid 2782	polyvinyl alcohol plus starch, wetting agent and defoamer	Bevaloid	7,8	194	7,2	21,9	82	5,7	2
6	®Bevaloid 4124	a blend of water soluble vinyl polymers, modified starch and lubricants	Bevaloid	5,4	163	6,0	23,1	81	4,5	1
7	®Vicol R	a water soluble acrylic polymer	Allied Colloids	7,8	161	6,0	15,1	80	23,8	16
8	®Vicol N40	an acrylic bases synthetic polymer	-do-	8,8	184	6,8	22,1	99	11,8	11
9	®Solvitose XI + Nopcotex 668T (50/50)**	a softener plus starch ether	Scholten and Diamond Shamrock	4,6	147	5,4	20,7	63	33,6	19
10	®Colvinyl 226 + CMC	a water soluble vinyl polymer and carboxymethyl cellulose	Allied Colloids + Corn Products	6,8	163	6,0	20,9	74	23,9	17
11	®Fibropur P68	a blend of water soluble sizing agents free from starch	Henkel	6,6	142	5,3	21,9	54	21,3	15
12	®Solvitose XI + size CB (50/50)**	a 25% aqueous solution of an acrylic copolymer plus a starch ether	Scholten and BASF	3,2	160	5,9	23,0	59	41,6	21
13	®Bevaloid 4032	a polyvinyl alcohol plus modified starch	Bevaloid	7,5	171	6,3	16,5	75	16,1	12
14	®Solvitose XI	a starch ether	Scholten	8,0	146	5,4	15,3	68	18,1	14
15	®Bevaloid 4163	a blend of water soluble vinyl polymers and modified starch, lubricants and defoamer	Bevaloid	7,6	140	5,2	17,4	83	11,1	10
16	®Plystran	a combination of polymers	Seydel	7,9	166	6,2	15,6	81	7,5	6
17	®Bevaloid RD61/419/F764	a research product	Bevaloid	7,5	199	7,4	19,7	90	6,4	4
18	®Gelatin T40	a protein sizing agent	Davis Gelatin Ind	7,7	172	6,4	19,7	50	7,8	7
19	Tylose ®MH 1000 (5% mix)**	a methyl cellulose (cold size) product	Hoechst SA	4,0	144	5,3	13,7	59	34,3	20
20	®Bevaloid 2798 (France)	a blend of polyvinyl acetate and polyvinyl alcohol	Bevaloid	7,7	200	7,4	16,3	99	31,8	18
21	®Bevaloid 120 (France)	a vinyl copolymer	-do-	8,0	142	5,3	14,0	112	17,4	13
22	®Hyalcol	a casein based product	Allied Colloids	10,0	120	4,4	13,2	65	would not weave	22

*Size add-on corrected for residual foreign matter **Recommended by Supplier ***See Weavability index: 0 = excellent
0 – 2,5 = very good
2,5 – 5,0 = good
5,0 – 7,5 = fairly good
7,5 – 10,0 = poor
10,00 and over = very poor

Measurement of size pick-up on warp yarn

Approximately 10g of a sized yarn was dried at 102°C for two hours and then weighed. The same yarn was then scoured for 30 mins in 1% Na_2CO_3 (m/v) at 70°C, filtered, dried and re-weighed and the percentage material removed determined[6].

An *unsized* sample of yarn was desized in the same manner to determine the soluble fractions and waxes on the fibre and the difference between the values obtained for the sized and unsized samples was taken as a measure of the size add-on. The results of tests carried out on the warp yarns appear in Table I.

Weaving

The fabrics were woven on a 190 cm Saurer 100W weaving machine running at 165 picks/min, the cloth construction being a 2/2 twill gaberdine to finish 40,15 x 30,70 ends and picks/cm, respectively. This fabric construction was chosen because it was known to be a difficult fabric to weave and previous studies on the weaving of this yarn had shown that it was very weak and a high number of yarn breakages were recorded and in general the weaving efficiencies obtained were low.

Warp yarn breakages were recorded during each weaving trial which lasted for approximately 60 000 picks and the number of warp yarn breakages per 1 000 ends per 100 000 picks woven was then calculated. These results are given in Table I.

The alkali solubility of the sized yarns was measured using Test Method IWTO 4 — 60(E) and the alkali solubility values (ASV) are shown in Table II.

TABLE II

ALKALI SOLUBILITY TEST RESULTS ON DESIZED WOOL YARNS

Size Lot No	Size	Amount of Size Removed (%)	Alkali Solubility (%)
1	Solvitose WS60	8,1	11,1
2	Solvicol B9380	7,3	8,1
3	Tubaflex TP1 (5% mix)	3,7	8,4
4	Elvanol	6,6	10,4
7	Vicol R	8,3	9,3
8	Vicol N40	9,2	9,3
9	Solvitex XI + Nopcotex 668T	4,1	7,9
10	Colvinol 226 x CMC	6,7	8,1
—	Control (unsized)	—	10,6

*Size add-on corrected for residual foreign matter

RESULTS AND DISCUSSION

Table I shows that all the sized wool yarns were stronger than the unsized control. In some cases sizing also increased the extension at break of the yarns. The abrasion resistance of the yarns, as measured on the Bevaloid abrasion tester, did not correlate with weavability trials. In nearly half the trials the abrasion of the sized yarns was no better than that of the unsized yarns.

The actual size pick-up varied, but in general a 10% mix resulted in an add-on of about 7,5-8%. Several size mixtures yielded good or fairly good results, i.e. less than 7,5 end breaks/1 000 ends/100 000 picks. Size Bevaloid 4124 gave the best results. Solvitose WS60, Bevaloid 2782 and RD 61/419/F 764, Tubaflex TP1 and Plystran also performed fairly well. A protein size (Gelatine T40) performed fairly well although the warp was rather tacky and it is possible that in combination with a starch this could perform well. Other mixtures were not considered to perform well enough to be used under mill conditions with such fine all-wool singles yarns.

The alkali solubility results in general indicated that there was no marked chemical damage to the wool yarns.

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USE OF PROPRIETARY NAMES

The fact, that chemicals with proprietary names have been used in this investigation does not in any way imply that SAWTRI recommends them or that there are not others which are as good or better.

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