# SAWTRI BULLETIN

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SOUTH AFRICAN
WOOL TEXTILE RESEARCH INSTITUTE
OF THE CSIR

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# SAWTRI BULLETIN

*Editor: P. de W. Olivier, B.Sc.*

Vol. 8 SEPTEMBER, 1974 No. 3


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SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
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P.O. Box 1124,
Port Elizabeth

## PUBLICATIONS COMMITTEE

# EDITORIAL

In an age of changing standards – and, in some cases – little or no standards at all – the Symposium on Quality Assurance in Modern Textiles, held in Pretoria in August, provided the South African textile industry with an ideal forum for stating its approach to quality standards.

Nineteen speakers, three of them from overseas, presented papers to an audience of just under two hundred delegates and officials. Starting with the principles of quality assurance, the papers covered specific industries, products and processes and finally, various quality assurance schemes.

The theme of the Symposium was well maintained throughout and it was refreshing to note the readiness with which speakers shared their knowledge and experience with the audience – a far cry indeed from the outmoded traditional caution and secrecy which has been characteristic of the textile industry for far too long and perhaps even a stumbling block on the road to progress.

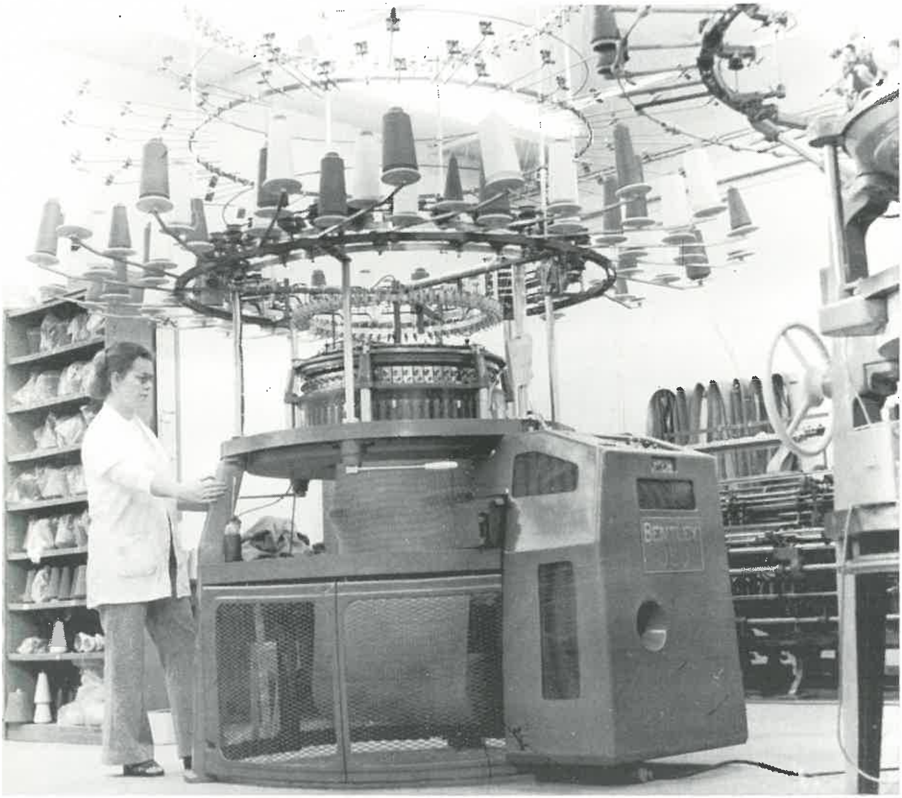
That the textile industry is fully aware of the importance of quality control at every stage of processing is undoubted. It is to be hoped that through the knowledge gained during the Symposium the application of quality control will be facilitated in many ways which can only redound to the benefit of both the manufacturer and the consumer.

We at the Institute will continue our long established policy of trying to give a lead, wherever possible and through our contact with industry as on occasions such as this, we become aware of industry's problems and can work on them.

# INSTITUTE NEWS

## Research Team for Effluent Purification in the Textile Industry

The department of Chemical Engineering of the University of Natal in Durban is at present accommodating a research team under the able guidance of Dr. de Wilde who has been seconded from Messrs. A. E. & C.I. for the purpose of conducting research into problems relating to effluent purification in the textile industry. Projects entered upon by this research unit will be financed by the Water Affairs Commission. SAWTRI's director, Dr. D. P. Veldsman has been requested to serve on the group's Steering Committee and while in Durban during the first week of July he had useful discussions with members of the group.



**The Bentley JSJ recently installed at SAWTRI, is a revolving cylinder machine designed for circular knitting of fine gauge single jersey fabric by the yard. The gauge is 28 n.p.i. with 60 feeds and two multistop patterning mechanisms. The machine provides freehand patterning facilities in a design width of 24 wales or 48 wales when reflex patterning is used. The design depth is 30 courses for two-colour patterns, 20 courses for three-colour and 15 courses for four-colour patterns**

**Director's Visits**

Accompanied by the CSIR Regional Liaison Officer for the Eastern Cape, Mr. Neville Vogt, the Director visited member firms in Durban, Johannesburg and Standerton at the beginning of July and on July 29th and 30th, through the kind offices of the Xhosa Development Corporation, they visited the Transkei and Ciskei Textile Industries.

**Quinquennial Wool Conference**

SAWTRI researchers will present three papers at the Quinquennial Wool Conference which will be held in Aachen, West Germany from September 2nd to 11th, 1975. The final programme for this conference embodies some 250 papers. SAWTRI's contribution to the proceedings will be: "Recent Developments at SAWTRI on the Solvent Dyeing of Wool", by Dr. D. P. Veldsman; "The Relationship between Certain Yarn and Fibre Properties for Wool Worsted Yarns", by Dr. L. Hunter; and "The Unconventional Scouring of Grease Wool in Concentrated Wool Grease Emulsions", by Dr. D. W. F. Turpie. The planning Committee of the Conference, of which SAWTRI's Director is a member, has decided to invite applications from young wool scientists below the age of 40, who wish to attend the Conference and visit textile mills in Germany. The cost of their visit will be financed from a fund raised for this purpose. SAWTRI has submitted the names of two of its young scientists. Upon being accepted, their names will be announced.

**Textile Institute to organise National Conference**

The South African Advisory Committee of the Textile Institute met on July 1st in Pretoria and it was decided to organize a National Conference on Textile Training for 1975. Further details will be provided in a future edition of "SAWTRI BULLETIN".

**New Tariff Schedule**

A new tariff schedule is being prepared and will be distributed shortly. New tariffs take effect on November 1st.

**Textile Institute Awards**

Dr. Derek Turpie, Chairman of the Eastern Cape Branch of the Textile Institute and a Group Leader at SAWTRI has been made an associate of the Textile Institute.

Mr. Salvatore Musmeci, Chief Technician in Scouring at SAWTRI has been awarded Licentiate Membership of the Textile Institute.

**New Members**

SAWTRI wishes to welcome two new subscribers: They are Messrs Diamond Shamrock (Africa) (Pty) Ltd. and Messrs Kangol (S.A.) (Pty) Ltd. We sincerely trust that this newly established association will be of mutual benefit as well as of benefit to the entire South African Textile Industry.

## SYMPOSIUM ON QUALITY ASSURANCE

The Symposium on Quality Assurance in Modern Textiles jointly organised by the Textile Institute, CSIR and the S.A. Bureau of Standards at the conference hall of the University of South Africa in Pretoria on August 6th and 7th was attended by some 180 delegates and proved to be a great success. The papers read adequately covered the field of the theme and, as a service to our readers who were unable to attend, the "BULLETIN" presents the following brief summaries of the papers read:

*"The Concept of Quality Assurance"*, by E. H. Ingamells, S.A. Bureau of Standards.

Mr. Ingamells outlined the objectives of quality assurance approaching the matter from the points of view of both producer and consumer. The producer's objectives are to improve his competitive position and he can do so if he can offer either an article which is better than that currently available or a similar one at a lower price. The consumer on the other hand, is motivated by quality as a secondary rather than a primary objective. He purchases at what he considers to be the best value, quality being a contributory factor affecting his choice. His objective is usually to find something which will do its job at the lowest cost and all too rarely does he think beyond the purchase price.

Taking into account the objectives of producer and consumer, a better general concept would be to achieve an article which is fit for the purpose for which it is intended. For the manufacturer this should define a product which should capture an increasing share of the market and be favourable to his long-term profit and reputation. For the consumer, fitness for purpose equates to the concept of the lowest cost of ownership.

The author then discussed the functional rôles of quality assurance such as design assessment, variability, factorial analysis, sampling and control charts and concluded his paper with a brief reference to the rôle of the Bureau of Standards especially as regards the setting up of standards, testing and the SABS mark scheme.

*"How to Construct Sampling Plans and Control Charts from First Principles"*, by E. Gee, Head of Textile Testing and Statistics, SAWTRI.

The author reaffirmed viewpoints of other speakers on the desirability of quality control and pointed out that products were usually manufactured to a specification either self-defined or that of a buyer or a consumer and which might or might not be based on national or international specifications. This implied that certain properties were measured (objectively or subjectively) the object being to find the rejects before they were made. This is possible, the author said, if you were able to judge the trend of the quality – whether it is going wrong or out of control. He said that this had economic advantages and referred to a cost/quality relationship in which an increase in control effort gave a corresponding increase in

SYMPOSIUM SPEAKERS : TUESDAY, 6th AUGUST, 1974
**BACK: Mr H. V. Liebenberg; Mr L. Dolpire; Dr L. Hunter; Mr E. Gee and Mr J. E. Highley**
**FRONT: Mr L. Kerley; Mr A. Ormerod**

money spent on the control scheme and a corresponding decrease in the cost of poor quality. As the amount of control is increased, the actual cost decreases to a minimum and then increases again for a greater quality control effort. The aim of a control scheme says the author, is to operate as closely to the minimum as possible.

He referred to the necessity for monitoring material characteristics and quality at various control stations throughout the processing sequence. He stressed the importance of statistical methods which provide adequate sampling techniques, adequate sample size allowing useful decisions to be made and an objectively valid basis for decision making. He said that statistical methods offered a means of separating real from chance changes. He gave some very useful information on sampling schemes and quality control charts explaining the essential elements of statistical methods with special reference to normal and Poisson type distributions and measurement of their relative parameters. The author concluded with an examination of the influence of sampling on the assessment of the accuracy of product property and construction of quality control charts to maintain product quality.

*"The Control of Yarn and Fabric Quality"* by Dr. L. Hunter, Group Leader, Textile Physics, SAWTRI

Outlining the steps involved in deciding which tests to perform, the author pointed out that these steps were basic to the setting up of a quality control programme. In the author's opinion, the following steps should be taken:

1. A critical study should be made of all the processes involved in the production line to determine which properties of the material, at each stage of manufacture, influence the type of processing conditions employed, the processing efficiency and the performance of the end product;

2. Means of measuring and relevant property should be established bearing in mind that, ideally, the methods employed should simulate the actual functional conditions;

3. A sound sampling scheme should be instituted and measuring or monitoring of properties should be carried out on a routine basis;

4. Specifications (standards) should be drawn up and limits, based on statistical analysis of the data, set at which action should be taken;

5. It should be established what affects the relevant properties in order that optimum conditions may be selected and corrective action be facilitated when necessary;

6. Concentrate on problem areas as determined by experience and consumer complaints.

The author listed a number of fibre properties commonly measured in the case of wool, cotton and synthetics (staple) and pointed out the importance of each of these properties in the assessment of quality. He also listed the quality characteristics of yarn as well as the factors expected to feature in yarn property determination. Reference was also made to average or expected values for certain of the properties. Dr. Hunter concluded his paper with a discussion of the influence of tensile properties, yarn irregularity, yarn friction, yarn faults, crimp rigidity, etc. on cloth quality.

**SYMPOSIUM SPEAKERS: WEDNESDAY, 7th AUGUST, 1974**
**BACK: Mr J. B. Stuart; Mr E. A. Goosen; Mr.C. W. Peel; Dr N. Cryer**
**FRONT: Mr J. M. Brown; Mrs E. Hirzel; Mr J. G. Brink; Mr H. Mueller; Mr G. W. Mikula**

OVERSEAS SPEAKERS AT SYMPOSIUM

**Mr H. Mueller; Mr J. M. Brown; Dr D. P. Veldsman (Symposium Chairman) and Dr H. Wignall**

*"Recent Developments in Texturised Polyester Yarns, Finishing Routes and Use of Computers for Dyehouse Quality Control"* by K. Gregory, S.A. Nylon Spinners (Pty) Ltd.

The author described the factors influencing the quality control in dyeing and finishing as it is affected by variables in the textured polyester yarn used. These factors include batch to batch differences, variations in parent yarn supply, throwster variables and autoclave variables. The author pointed out the advantages to be gained in improved dyeing and mechanical properties, by combining drawing and texturing of polyester yarns, into one process. The advantages and disadvantages of scour/dye/heatset routines compared with scour/heatset dye routines were discussed with reference to tightly knit plain men's wear fabrics which would be liable to "cockle" under high temperature jet dyeing conditions. The effect of the type of yarn and fabric on heatsetting temperatures was also discussed; e.g. HT jet dyed Crimplene regain setting at 165–170°C for optimum stretch and stability. The effect of type of dyeing machine and dyeing parameters was discussed in relation to creasing and "crow's feet" formation. The author showed that the ratio between rope length and running speed in jet dyeing is important; to prevent hydrosetting (i.e. creasing) the ratio rope length (m) : speed (M/min) should ideally be between 0,8 : 1 and 1,0 : 1,0. Bowing and skewing were also briefly discussed; for certain fabrics tolerances of 1° skew from the horizontal are required.

As far as quality assurance in the dyehouse is concerned, two topics were discussed, viz. computer colour matching and computer colour difference measurement. In match prediction, the development of the ICI system was outlined, up to the stage where the ICI Colour Match Prediction (C.M.P.) involves installation of a spectrophotometer and mini computer in the dyehouse. A summary of commercially available recipe prediction systems was given. The author claimed that 80% of instrumental match predictions will be on shade in the pre-dye laboratory matching; 9–10 disperse dyes will allow 30 recipe predictions per day whereas 6 dyestuffs will permit 200 predictions per day.

Colour difference measurement systems (HATRA, I.C.I., Hunterlab, etc.) were briefly discussed in relation to pass/fail decisions by the dyer between the laboratory matching and bulk dyeing. The use of the ANLAB system and its limitations as far as fastness testing is concerned was briefly discussed.

In conclusion the application of sewing lubricants to minimise needle damage (e.g. Alkolube CRA, Mystolube TRS and Bradsyn PE, etc.) and the control of snagging in textured polyester fabrics were discussed.

*"Testing Equipment for Quality Control of Textiles"*, by J. G. Brink, Chief Scientist, S.A. Bureau of Standards.

The apparatus used for the testing of Textiles was discussed in this paper. Utilising audio-visual equipment, the author showed how samples are taken in the factory and how these are cut up and distributed to test the various properties. He showed apparatus for the testing of fibres, yarns, fabrics, dyestuff properties, finishes, etc.

Some of the instruments mentioned in the paper are rather sophisticated and expensive. It was pointed out, however, that when quality control was carried out for production purposes, much less sophisticated equipment could often be used. This was because the complete manufacturing background of the product was known and it might only be necessary to do quick routine checks. Equipment and methods used in industry might therefore differ from those preferred by test houses and research laboratories. The author stressed that when it came to arbitration however, standard equipment and methods should be used.

Replacement of instruments can be very expensive, not only because of price increases over the last few years but also because many instruments are becoming more sophisticated, frequently containing built-in scanners, analysers and computer systems the author said. With the shortage of trained technologists this might be a boon but the advantages accrueing from such innovations were expensive.

*"Quality Control in the Knitting Industry"* by L. A. Kerley, Llama (Pty) Ltd.

A basic understanding of the factors which determine the production of commercially acceptable goods is a prerequisite for quality control of knitted fabrics or garments. Apart from the specific mechanisms involved in the production of knitwear, that require detailed knowledge, very careful consideration must be given to the raw materials or yarns used to feed machines. A detailed knowledge of the characteristics and behaviour of the diversity of yarns available is an essential part of the successful overall quality control scheme.

Yarns should be of knittable quality and a batch of yarn must be expected to do its job when it is placed in the knitting room.

Fabric length, width and mass are functions of stitch length. One of the major causes of variation in stitch length is yarn friction. Variables in this parameter are due to irregularity of yarn lubricant within and between yarn packages and from shade to shade in dyed yarns and differ with the various raw materials. The effects may be counteracted to a certain extent by means of positive feed systems where applicable.

Perhaps the simplest knitted fabrics to control are plain circular fabrics, single and double jersey.

Finishing equipment plays a vital rôle in obtaining and maintaining dimensional standards. Solvent scouring equipment for animal fibres offers significant advances over traditional aqueous scouring and milling techniques. These modern machines are automatically controlled for reproducibility and offer additional advantages for the application of shrink-resist finishes to wool.

The author demonstrated various control instruments (e.g. yarn tension, speed and length meters, a friction tester etc.) commonly used to control fabric quality in a knitting mill.

*"Quality Control in Knitwear"* by Dr. Harry Wignall, Leicester Polytechnic, U.K.

The term quality refers to the degree of excellence of the product. The highest standards can be set and the most perfect system of control can be installed but bad human relationships within the mill can ruin our fondest dreams and frustrate the most comprehensive system of control. A film was shown to illustrate that quality is dependent upon the attitude and knowledge of the operators. Some knitting companies have built up high standards of quality to the extent that buyers automatically have confidence and suppliers take great care.

Some of the main factors involved in the assurance of quality in knitted goods are serviceability and fabric dimensions. Serviceability involves the preparation of specifications for well designed articles that have been priorly tested for serviceability.

As regards fabric dimensions the problem is connected with the need to supply the public with garments that will retain their dimensions regardless of laundering and stress of all kinds during wear. A number of standard tests can be applied to determine dimensional changes during washing of fabrics containing wool. Ultimate dimensions of a knitted fabric are controlled by the length of yarn per stitch unit. The length of yarn per stitch can be controlled accurately only if either uniform input tensions can be guaranteed or the exact amount of yarn per stitch can be delivered according to the specifications. This could be achieved through positive and storage feeds. The importance of the length of yarn in a knitted loop in determining the dimensions of the knitted fabric was stressed.

*"Quality Assurance in the Soft Floor Covering Industry"* by J. E. Highley, The Carpet Manufacturing Co. (S.A.) Limited.

In the soft floor covering industry quality control can be divided into three main areas, before, during and after manufacture. *Pre-manufacturing* examination is undertaken on pile fibres for quality of pile and backing yarns for linear density, strength, twist, stability, moisture content, and of dyestuffs for fastness properties. Checks *during manufacture* cover materials content, weave specification, shade and pattern, faults caused by mechanical malfunction or human error. *Post manufacturing* examination is undertaken for pattern and colour faults, mechanical imperfections, stability and size. In addition simulated wearing tests, involving tuft withdrawal, compressibility, dynamic and static loading, and abrasion tests, are carried out together with examination in respect of specialised items such as flame resistance, insect and bacteria resistance, appearance retention, electric and accoustic properties. Nevertheless, from a wear point of view nothing can equal a genuine floor trial under controlled conditions although two machines which imitate wear appear to hold some promise.

*"Quality Assurance in the Rope Industry"* by H. V. Liebenberg, Ropes & Mattings (Pty) Ltd.

The industrial application of cordage products demands specific performance characteristics. Achievement of these is directly related to quality assurance activities. The necessary processes to make a rope and the repeated tests made at all stages of manufacture to ensure that the rope will conform to the relevant specification, and will perform reliably during use were described.

The author mentioned that when the fibre arrives at the rope making plant, it is inspected to ensure that it conforms to the accepted physical standards. During *Preparation of the Fibre* i.e. during lubrication, blending and parallelization checks are carried out to ensure that the correct amount of lubricant is added to the fibres and that the linear density of the slivers is suitable for the following process of spinning. Tests are carried out during spinning to ensure correct twist factor, sliver regularity, linear density, twist per metre, yarn regularity, etc. Up to this stage all the physical testing is carried out by the personnel of each department. Random samples are drawn and submitted to the quality assurance staff who carry out further tests for the parameters mentioned.

The remaining stages in rope manufacture include stranding and closing, and heat treatment in the case of synthetic fibre ropes. Various tests are carried out on complete ropes including tests for breaking strain.

Although rope-making has become a science, the skill of the rope-maker is as important now as it was in prehistoric times, particularly on the rope-walk.

*"Quality Control in a Vertical Worsted Mill"*, by L. J. A. Dolpire, Hex River Textile Mills (Pty) Limited.

The author discussed quality control as it is applied in a vertical worsted mill consisting of four main departments, Combing, Spinning, Weaving and Dyeing and Finishing and listed the various tests carried out in each of the departments. Each department is equipped with its own specific testing laboratory. This quality assurance system relies on the involvement of all departmental heads, who, together with the raw material purchaser, are responsible for the quality of their processed and finished products.

In each department quality specifications have been established after consultation between the producers and the receivers. These specifications consist of a description of the goods, tolerances which are permitted and the method or instrument used during testing. This information is compiled in a manual of procedure which is available at all testing points. The production units are responsible for the procedure, action and supervision required to ensure that the final product has the desired attributes. At times when products are not up to required standards or when there is a dispute, the Factory Manager acts as arbiter.

Statistical analyses are carried out in every department to monitor performance. An analysis of the rejected work at final inspection of the finished goods is discussed during monthly meetings and production centres responsible for the faulty work report on the causes and action taken to improve production quality. Effective control is not possible unless staff and management's relations are good. The author maintained that quality products were not obtained by testing but by the state of mind of every individual concerned with their manufacture. According to the author testing can ensure efficient and effective quality control but no amount of testing can overcome apathy.

*"Quality Assurance in Modern Textiles"*, by A. Ormerod, Consolidated Frame Cotton Corporation.

The author outlined the special difficulties associated with quality control in textile operations. These are largely of two classes: those associated with the heterogeneous and anisotropic properties of the materials, and those associated with the almost unique diversity factor of the S.A. Textile Industry.

He examined statistical concepts of variability and the use of the Quality Control charts in relation to the tensile strength and regularity of a spun rayon yarn; and discussed variations of short, medium, and long term periods. He referred to the special long-period problem of count control in a spinning mill with particular reference to the necessity for a thorough understanding of the technology, and the provision of manufacturing conditions where control was a practical proposition. The control of fabric quality was considered as an integrated procedure, and a control scheme which was adequate for ensuring that final product testing was relegated to an indicator of effectiveness of the intermediate controls. The author emphasized that the control-function was exercised on the machines and operators, and not in the laboratory.

Finally, the author examined the problems of the subjectivity of faults in fabric and associated losses in garment manufacture, and made a case for a point assessment system of piece evaluation to be related to the cost of each type of fault to the fabric user, and not to purely technical concepts which had no relevance to cutting losses.

*"Yarn Faults in Woven and Knitted Fabrics – Their Control by Means of Electronic Yarn Clearing"* by H. Mueller, Sales Engineer in the Electronic Textile Division of Zellweger Uster Ltd.

By means of an electronic yarn clearing installation, disturbing yarn faults can be extracted from the yarn during the winding process and replaced by knots.

In considering the economies of electronic clearing of yarn faults at the winding stage, the fundamental decision has to be made as to whether or not the faults can be extracted at a later stage, e.g. during worsted mending, or whether the faults can be "strung" and by-passed during garment manufacture.

It is known that the mending department is as expensive to the cloth manufacturer as the weaving department and that if mending times per piece could be reduced, the price of the cloth could also be correspondingly reduced.

In contrast to woven fabrics with knitted fabrics the criteria with which one evaluates the fabric are much different. It is necessary, therefore, in order to obtain an optimum yarn clearing effect, to set the clearing limit according to quite different conditions in the case of knitted fabrics as compared with woven fabrics. The extraction of yarn faults is limited by the frequency of the faults in the yarn being considered and the number of knots which can be accepted in terms of ease of subsequent processing and appearance of the finished fabric. Only by means of an analysis of the yarn faults according to their frequency and type is it possible to arrive at "optimum clearing" conditions.

The author described trials undertaken and discussed results which had been statistically evaluated to determine the fundamental values for arriving at this "optimum clearing" value.

The problem of a woven or knitted fabric becoming acceptable or otherwise is particularly acute at the garment manufacturing stage. Quality control procedures account for the majority of labour costs, and with present day conditions of inflationary wage costs, this item alone could prove extremely problematic for the garment manufacturer in the future.

*"Quality Assurance in the Cotton Spinning System – State of Affairs in 1974"* by Georg W. Mikula, Consolidated Flame Cotton Corporation Ltd.

Quality *characteristics* of yarn are determined by specification of final products, the efficient functioning of subsequent processes such as weaving and knitting, the intrinsic properties of the raw material; the characteristics and limitation of the process technology and the influence of labour attending machinery.

Quality *assurance* is therefore based on:

(a) consistent, adequate and reliable selection of raw material;

(b) strict quality control of manufacturing processes; and

(c) inspection and grading of finished products.

The raw materials are examined in respect of their direct influence on the quality of the yarn and also their indirect influence on the conversion process, and through it on the end product.

Manufacturing processes are considered in respect of the theoretical and actual optimum yarn quality which can be achieved by a particular type of process – whether conventional or new developments. A further consideration here is the capability of a process resulting from equipment and design inspection and grading of finished products entailing statistical control of defects per unit of product. The zone of acceptability is based on economic viability and conversion properties with reference to traditional and automated processes.

The author presented a number of tables and graphs which illustrated, amongst other things, the correlation between yarn and fibre properties and between ends down and fibre properties, the effect of temperature and humidity – cotton drafting forces, the formation of neps at the various stages of cotton processing as well as some typical properties (characteristics) of various cottons. Reference was also made in the paper to some unconventional methods of yarn production.

Quality control with modern instruments and applied statistics can be effective. Any alteration and change can be followed up and inferences to final product quality is possible. This should already result in an increase of product quality and therefore productivity achieving better utilization of raw material.

*"The Inspection and Grading of Woven Fabric"* by Dr. Norman Cryer, Technical Adviser – Textiles, S.A. Bureau of Standards.

Variation is inherent in the manufacture of textiles and it is not feasible to produce piece goods free from faults. With the maker-up, retailer and consumer now much more conscious of the price and quality of textiles and clothing, increased attention is being focussed on fabric faults, particularly from the aspect of their adverse effect on the cost of garment manufacture.

Although fabric defects cover a wide range of deficiencies, such as excessive variation in width, discrepancy in piece length and undue shrinkage, these were only briefly discussed, and the paper dealt more fully with the procedure for inspecting woven cloth for yarn, weaving and finishing faults as an integral part of quality control.

The author referred to definitions of the various types of cloth faults, and the evaluation and classification of fabric defects as well as the stringing of faults. Various systems of grading woven fabrics, taking into account their end use, were fully discussed.

Lastly, the paper dealt with the application of standards and recommendations in connection with tolerances and string allowances. Special reference was made to the "4 point system" of grading faults in fabrics and this system was discussed in some detail.

*"The Snap Decision – The Basis of Meaningful Quality Assessment in Sewing Thread Manufacture"* by E. A. Goosen, Marketing Director, J & P Coates (S.A.) Ltd.

Sewing thread manufacture is a complex matter involving extensive processing from raw material to finished article.

The ultimate quantity of finished goods is heavily dependent on strict processing/quality control through all facets of production. A wide multiplicity of sewing thread specifications must be engineered from a consumer angle to ensure that the total needs of industry and domestic user are comprehensively catered for. It is important in this context to decide what performance is expected of sewing thread, both in the stitching operation and in garment durability.

A sewing thread by definition must sew and that presupposes that it will withstand the exacting requirements imposed on it by modern sewing machines which run at very high speeds.

Sewability is only one side of the coin. Garment durability is the other and in this connection the seam is the weakest link in a garment. Using cheap thread is a false economy both in terms of down time through thread breakage on the production floor and in terms of garment return.

There is sufficient evidence to suggest that certain sewing threads despite superior tensile strength, can produce less satisfactory results in the seam than those which have lower tensile strength. This aspect is becoming the focal point of interest in the sewing thread arena and the conclusion to which current studies are pointing is that in a proper scale of quality priorities it is more pertinent to consider seam durability as the starting point with the other relevant quality aspects, including tensile strength, listed after seam strength in descending order of importance.

*"Quality and the Consumer"* by Elizabeth Hirzel, S.A. National Consumer Union and S.A. Coordinating Consumer Council.

Drawing heavily on overseas statistics and relating them to South African conditions, the author showed how a significant percentage of all consumer complaints related to textiles. High on the lists of complaints appear those pertaining to inadequate colour fastness and shrinkage. The rest comprised a miscellany of troubles, such as difficulty in identifying sizes of garments, materials which frayed or split, seams that came apart, buttons poorly attached and "hopes raised" by such descriptions as pre-shrunk, crease resistant, etc., which were not realised.

Mrs. Hirzel expressed the hope that the matter would receive serious consideration in order that the situation might be improved. She went on to single out a number of problem areas requiring consideration, listing the following:

1. **Multiplicity of fabrics currently on the market**:

Consumers are often perplexed, confused and frustrated by the dazzling array of technological innovations and great variety of man-made fibres. Mrs. Hirzel suggested the compulsory declaration of the fabric content of every fabric as is already being done in some other countries.

2. **The Consumer's lack of knowledge**:

The consumer is still largely less informed about fabrics than ever before because the information is not presented in the correct form. Owing to confusion when presented with a huge variety of textiles, the consumer is unable to choose what is best suited to her needs.

The techniques used by the Woolmark Standards Department are:

Consumer use research

Complaint analysis

Retail experience feed-back

Market Research – Consumer Product Testing

– Purchase Panels – Response to Products

– Attitude studies

Test Method Evaluation and Development

Specification attainability studies.

The key element in the matter of quality control is the choice of test method and this choice is always governed by Accuracy, Precision, Sensitivity and General Viability.

As already mentioned above, one objective of the Woolmark scheme is to bring about consumer satisfaction with Woolmark products. The I.W.S. has as yet, however, come only part of the way along the road to complete success and many improvements are yet to be made.

The author contrasted test methods which give precise but not accurate results and *vice versa.* He gave as an example of the former a particular carpet wear test which, although precise, showed no correlation with actual wear life.

## SAWTRI PUBLICATIONS

### TECHNICAL REPORTS

No. 227 : Turpie, D. W. F., The Processing of Wool/Cotton Blends on the Worsted System, Part I: An Introductory Investigation.

No. 228 : Hunter, L. and Turpie, D. W. F., Some Comments on the Spinning Performance and Resulting Yarn Properties of Wool and Wool/Polyester Blends.

No. 229 : Hunter, L. and Smuts, S., A Preliminary Report on Certain Physical Properties of some Commercial Double Jersey Wool Fabrics.

No. 230 : Robinson, G. A., Layton, L. and Ellis, R., Some Novel Methods for Producing Mohair Blankets.

No. 231 : Meissner, H. D. and McIver, B. A., Solvent Dyeing of Wool with a Reactive Dye/Surfactant Complex.

No. 232 : Gerritsen, J. J., The Development of a Small Decorticator.

No. 233 : Buys, J. G. and Hunter, L., The Influence of Certain Machine Settings on the Knitting Performance of All-wool Yarn on Some Double Jersey Machines.

**Papers Appearing in Local and Overseas Journals:**

Silver, H. M., Water-Assisted Solvent Dyeing of Cellulose, *Journal of the Society of Dyers and Colorists,* **90**, p.11 (March, 1974).

## ABSTRACTS OF RECENT SAWTRI TECHNICAL REPORTS

No. 227: The Processing of Wool/Cotton Blends on the Worsted System, Part I: An Introductory Investigation, by D. W. F. Turpie

The advantages of the worsted system of wool yarn production are numerous but are particularly centered around the sleekness and general superiority of the yarns. Although the production of blends of wool and other fibres on the worsted system therefore has an obvious appeal it would mean that if wool and cotton were to be blended and processed on this system, the cotton selected would have to be of a moderately long staple length to achieve adequate fibre control of the blend during processing. Many other questions arise from possible worsted processing of blends of wool and cotton. This prompted the author to investigate the possibility and feasibility of processing wool/cotton blends on the worsted system.

Hand blended lots of scoured 6/7 months Spinner's wool and mechanically opened Acala 442 cotton lint were carded, gilled and combed on the worsted system. Blend ratios of 70/30 and 50/50 wool/cotton were selected for the investigation. Performance was improved significantly by applying about half a *per cent* of lubricating oil to the blend prior to carding and a most satisfactory all-round performance was achieved. It is interesting to note that the improvement in the performance of the cotton component due to lubrication was more pronounced than that of the wool. The investigation indicates that higher production rates may be achieved by the use of cottons of lower nepping propensity.

During the investigation, drawing and spinning of recombed tops consisting of 55 *per cent* wool and 45 *per cent* cotton were successfully carried out on conventional worsted equipment. The resultant yarn, 21 tex Z860, although of good appearance, was somewhat irregular. The investigation continues.

No. 228 : Some Comments on the Spinning Performance and Resulting Yarn Properties of Wool and Wool/Polyester Blends, by L. Hunter and D. W. F. Turpie

This investigation has been concerned with wool/polyester blends. The effect of both the type of polyester and type of additive as well as of polyester content on the end-breakage rate during spinning and on the physical properties of the resulting yarns has been investigated. Three polyester types (Trevira types 220, 330 and 340) in blends with a 64's quality merino wool have been covered.

The effect of the above-mentioned parameters on the end-breakage rate during spinning was small.

In general the type of additive did not have a great effect on the results obtained although the application of a fumed alumina additive tended to increase the yarn strength and the number of neps and total number of Classimat faults in the yarn.

It appeared that yarn strength increased consistently as the polyester content increased, with the normal polyester (i.e. type 220) producing yarns which had significantly higher breaking strength and extension than those of the yarns containing the low pilling (i.e. type 330) polyester.

In the case of the polyester types 220 and 330 the yarn irregularity and the frequencies of thin and thick places tended to decrease with an increase in polyester content, with no consistent differences between the two polyester types. In the case of the polyester type 340, used in the hosiery yarns, both the 70/30 and 55/45 wool/polyester blends were more even than the pure wool yarns, with the 70/30 blend superior to the 55/45 blend.

No. 229 : A Preliminary Report on Certain Physical Properties of Some Commercial Double Jersey Wool Fabrics, by L. Hunter and S. Smuts

A number of commercial wool and wool blend double jersey fabrics were analysed for fibre diameter, air permeability, drape, bagging, abrasion resistance, pilling and bursting strength. These results were related to mass per unit area, run-in-ratio, density and machine tightness factor. For the pure wool Punto-di-Roma fabrics it is shown that the fabric mass per unit area is dependent on the machine tightness factor only, whereas the fabric thickness depends only on the run-in-ratio. Fabric density is shown to be a function of MTF, run-in-ratio, and yarn linear density. Graphs in which the results of certain properties of all the fabrics tested are plotted against the fabric mass per unit area can be used as reference levels for use in practice to assess the performance of similar double jersey wool fabrics.

No. 230: Some Novel Methods of Producing Mohair Blankets, by G. A. Robinson, L. Layton and R. Ellis

This report describes three new methods of producing mohair blankets which the authors compare with the conventional woven mohair blanket.

1. A new idea was to warpknit a gaily coloured scrim fabric from coarse mohair yarns with low twist. This patterned scrim was then needlepunched with matching shades of mohair fibre to give a blanket. Fibre loss is prevented by treating the blanket with resin before gentle raising.

2. Mohair loop yarns were warpknitted on the Co-we-nit (Raschel) machine in a two-bar fabric using polyester/cotton yarns for the pillar stitches. The blanket is lightweight and cheaper than the traditional mohair blanket because polyester/cotton yarns are used instead of wool in the loop yarns. The blankets are raised in the normal manner.

3. Again mohair loop yarns are used, but woven as weft so that all the mohair is on the surface of the fabric and the cotton/polyester warp forms a type of "sheet" backing. This blanket is non-slip and the mohair pile is very dense. It is also ideal for use as a bedspread.

No. 231 : Solvent Dyeing of Wool with a Reactive Dye/Surfactant Complex by H. D. Meissner and B. A. McIver

The advantages of dyeing wool from organic solvents rather than from aqueous media have become known over the past few years. The various attempts to establish a suitable solvent dyeing process have, however, left some unsolved problems. The most important of these is the fact that most of the existing wool dyes are insoluble in organic solvents. Attempts to overcome this, such as emulsifying the dye with the aid of co-solvents in the organic solvent have met with obstacles like unlevel dyeing and the retention of undesirable substances in the fibre after dyeing. The authors of this paper describe results of an investigation into the solvent dyeing of wool making use of a reactive dye/surfactant complex to achieve solubility of the dye in perchloroethylene. They found that wool can be successfully dyed in this manner provided small amounts of water or ethylene glycol are added to the dyeing liquor. These compounds seem to act as fibre-swelling agents rather than co-solvents for the dyestuff but the amount of experimental material available at present is not adequate to establish the mechanism of the process. The applicability of the process to bulk dyeing is yet to be determined.

No. 232 : The Development of a Small Decorticator for *Phormium tenax* leaves, by J. J. Gerritsen

The author outlines the principles of decortication for the recovery of leaf fibres for textile use pointing out the special problems associated with the decortication of *Phormium tenax* leaves. The paper further describes in detail the development of an improved model of a small decorticator. The improved model is based on a former machine, the Elgin Mini Decorticator and is currently being produced as the Mini Mark II. An important feature of the improved model is the reduced cost of maintenance. The new decorticator has a much better discharge of fibre than the older model throwing the fibres correctly and untangled over a travelling rope thus saving labour in the transfer of fibre from decorticator to the next stage of the production line. The machine is robust and together with reduced maintenance costs is more economical to run. The machine is currently being used for routine fibre production on the Ndaleni farm of the KwaZulu Government Service.

No. 233 : The Influence of Certain Machine Settings on the Knitting Performance of All-wool Yarn on Some Double Jersey Machines, by J. G. Buys and L. Hunter

The influence of certain machine variables such as dial height and feeder sequence on the knitting performance of all-wool yarn was investigated for the Punto-di-Roma structure employing three different double jersey machines and two different run-in-ratios. Positive feed was used throughout and the yarn input tension, fabric take-down tension and length of yarn knitted into a repeat unit (SCSL) were kept constant for a particular machine.

It was found that the different machines did not always behave in the same manner when their settings were changed. This was ascribed to differences in the cam systems and distribution of take-down tension amongst other things.

From this study there emerged a few settings which would definitely improve knitting performance, provided they are used under the conditions described. It appears that the influence of feeder sequence on knitting performance has been underestimated in the past and by using the correct feeder sequence, important increases in knitting performance can be obtained.

Using a run-in-ratio of 1:1 on the Albi Combirib (22 gauge) and Mellor Bromley MSJ (18 gauge), the best knitting performance was generally obtained with the feeder sequence $I_1$-$I_2$-C-D while at a run-in-ratio of 1,5:1 the feeder sequence $I_1$-$I_2$-D-C gave the best knitting performance. On both these machines a medium to high dial height appears to be advisable at a run-in-ratio 1,5:1. At a low run-in-ratio (1:1) excessively high dial heights should be avoided since the breakages in the interlock courses, which are a function of dial height, would become excessive. On the Mellor Bromley 8RD (18 gauge) the best knitting performance was also obtained at a run-in-ratio 1:1, but using the feeder sequence $I_1$-$I_2$-D-C.

At a run-in-ratio 1,5:1 the feeder sequence $I_1$-$I_2$-C-D is preferred on this machine.

An intermediate dial height generally seemed preferable. On the Mellor Bromley 8RD machine, most yarn breakages occurred in the dial only courses when using a run-in-ratio of 1,5:1. In contrast, most breakages generally occurred in the cylinder only courses when using the Mellor Bromley MSJ and Albi Combirib at the above run-in-ratio. Whenever feeder blends are used, the yarns with the highest tensile strength or elasticity should be knitted into these courses. From the results obtained, it appears that a run-in-ratio of around 1:1 would, in general, give a better knitting performance than a run-in-ratio of 1,5:1 for the same length of yarn knitted into a repeat unit.

# TEXTILE ABSTRACTS

Rapid Dyeing Methods and Their Influence on Dyeing Equipment, H. U. von der Eltz, A. Reuther and H. J. Wassmuth (In German), *Melliand Textilberichte Int.* **55** (6), 549, 1974.

In the field of High Temperature dyeing of polyester goods (in particular packages), great advances have been made in the improvement of the economy of the process by reducing the total dyeing time. A detailed description of new developments in machine construction is given, with specific reference to the various manufacturing concerns like Gaston County, Obermaier, Thies, Brückner, Serracant, Callebaut, de Blicquy and others. Theoretical and practical applications of the new Hoechst-Rapidcolour process are also described in detail. Using elevated starting temperatures (125°C), a high pump capacity (80 *l*/kg/min) and dyeing for only 20 min at 135°C, the total dyeing time can be reduced to only 1 hour. The slightly higher energy requirements (steam and electricity) are offset by the saving in time, provided that the number of batches per shade is large enough.

(M.A.S.)

Developing High Style Looks, J. C. Loughlin, *American Dyestuff Reporter* **63** (3), 25, 1974.

A new trend away from the mass-produced look in textiles has been developing over the last few years. The "old" or "worn" look in corduroys and denims has been developed which shows up after four or five washes, or alternatively the goods may be treated in such a way that they may be sold as "old" or "worn". Various methods, all based on doing almost everything wrong, are described. These methods include treating the loomstate cloth in a badly wrinkled state, sprinkling the badly creased goods with caustic soda or alkaline hydrogen peroxide before padding on the dyestuff, steaming in a crowded, creased condition and colour padding without drying. Various combinations of the outlined procedures may be introduced to produce the required results. The worn or old look may also be produced on level dyed goods by spray- or sprinkle application of colour destroying chemicals (e.g. chlorine or hydrosulphite) followed by wrinkle padding or other haphazard techniques. A number of typical recipes and routines are listed.

(M.A.S.)

Some Factors Affecting Yarn Irregularity by Ratnam, T. V., Seshan, K. N. and Govindarajulu, K., *J. Text. Inst.*, **65**, 2, 61 (Feb., 1974).

This paper attempts to extend the equation derived by Anderson and Foster who related cotton yarn irregularity to input irregularity, ringframe draft and linear density (count) to include fibre characteristics and the condition of the ringframe. An expression has been derived relating yarn irregularity to the fibre properties and processing parameters.

From this investigation it appeared that the additional irregularity (added variance) introduced by the ringframe was independent of the irregularity of the rovings.

From the results obtained on thirteen cottons, differing widely in their fibre properties and spun to counts ranging from 5,9 tex to 29,6 tex, it was concluded that, as a rough approximation, nearly 72% of the variation in yarn irregularity due to the quality of the raw material can be explained by the 50% span length and about 22% by the fineness/maturity coefficient. The factor $F/L$ (where F = fineness (μg/in)/maturity coefficient
and L = the 50% span length)
which roughly depends upon the ratio of fibre diameter to fibre length, could be regarded as a measure of the drafting quality of a cotton from the point of view of yarn evenness.

The authors state that, for the types of cotton used in that part of India familiar to them 60% of the total yarn irregularity is due to fibre quality, 25% is due to the condition of the ringframe and 15% is due to roving irregularity.

(L.H.)

The Causes of Warp Breaks in the Weaving of Spun Yarns by Dolecki, S. K., *J. Text. Inst.*, **65**, 2, 68 (Feb., 1974).

The investigation showed that the occurrence of shedding obstructions, which result in abnormal tensions in some warp threads, was an important cause of warp breakages in spun yarn. On the average 54% (most often about 70%) of warp breaks in adequately sized warps, for a range of cloths, were attributed to lumps (e.g. knot tails, slubs, neps or other protuberances) in the yarn. These breaks were mainly confined to the shedding zone (i.e. from the fell to lease rods or drop wires) and most occurred in a thread next to that carrying the lump. Breaks appeared to be most likely when a lump arrived in, or just in front of, the healds.

A prior investigation had shown that, although relatively long-tailed lumps (approximately 5 mm or longer) tended to cause more traps than those with shorter tails, the stiffness of the tail, rather than its length alone, was important.

Warp breaks due to lumps (i.e. obstructions) increased with increasing size (sago) content while those due to abrasion decreased. Lubricating the warp over a wax rod at the loom generally reduced the number of warp breaks. It appeared that, above a certain critical level of yarn strength, warp-breakage rate was relatively insensitive to increases in yarn strength. The critical strength of the yarn was believed to be related to the warp tension.

The degree of heald-slating had a considerable influence on the number of warp breaks due to obstructions when weaving plain on four staves of healds. It was shown that a much greater degree of slating than is normally accepted in industry was required to substantially reduce warp-breakage rate. This could be achieved at the shed-crossing, without any interference with the shuttle traverse, by the use of variable heald-slating. Mill trials showed this technique to be an effective means of reducing warp breaks, and the required heald movement could be obtained by modifying the shape of the shedding tappets.

(L.H.)

The Dimensional, Mechanical and Other Physical Properties of Swiss-Double-Piqué and Punto-di-Roma Wool Fabrics: R. Postle and H. J. Suurmeyer, *Annales Sci. Textiles Belg.*, 22, No. 1, 7 (March, 1974).

This is an excellent article on these two double-knit structures. The authors correctly point out that for the Swiss double piqué, most of its mechanical properties are dependent on the cover factor (or tightness of knitting) only and not on run-in-ratio. In the case of the Punto-di-Roma structure these properties are heavily dependent on run-in-ratio. For example, an increase in run-in-ratio produces a shorter but wider fabric.

One of the major problems encountered with the Punto-di-Roma structure is *width*. This structure knits ideally at a run-in-ratio of 1,2 but then the fabric comes out too narrow (for the fabric to be 150 cm wide the run-in-ratio should be of the order of 1,6). Furthermore, at a run-in-ratio of 1,2 the fabric has a vertical rib-like appearance. To overcome these two problems at a run-in-ratio of 1,2 the authors suggest the use of an eight-feeder repeating unit rather than the usual four-feeder repeating unit.

D.P.V.

# THE INFLUENCE OF TIMING ON THE KNITTING PERFORMANCE OF ALL-WOOL YARN IN THE PUNTO-DI-ROMA STRUCTURE

*by J. G. BUYS and L. HUNTER*

## ABSTRACT

*The influence of timing on the knitting performance of all-wool yarn in the Punto-di-Roma structure has been investigated on three double jersey machines (two 18 gauge and one 22 gauge). On the one 18 gauge machine (Mellor Bromley 8RD) the number of holes formed during knitting decreased as the timing was delayed and it appeared that on this machine a delayed timing of 6 needles gave relatively good knitting performance. On the other 18 gauge machine (Mellor Bromley MSJ) intermediate timing positions (2, 3 and 4 needles delay) generally gave the worst knitting performance. On the 22 gauge machine (Albi Combirib) a delayed timing of 10 needles was generally found to be best.*

## KEY WORDS

Timing — double jersey — Pundo-di-Roma — knitting performance — synchronised timing — delayed timing.

## INTRODUCTION

In a previous study[1] it was found that when knitting an interlock structure, a delayed timing of approximately six needles gave optimum results. Although synchronised timing is normally used when knitting the Punto-di-Roma structure, it was considered to be of some interest to determine whether or not this is in fact the best condition under which to knit this structure. This was considered necessary in view of the results obtained on the interlock structure and the fact that the Punto-di-Roma is interlock based. Furthermore, in a recent article[2] it was suggested that it is always preferable to knit with delayed timing (5 to 9 needles) except when knitting with a 2 × 2 needle set-out. The influence of timing on knitting performance was therefore investigated, for the Punto-di-Roma structure, on three different double jersey machines. The general approach and the assessment of knitting performance were the same as those used in other investigations[1, 3, 4] of this nature.

## EXPERIMENTAL

**Knitting machines:**

The following knitting machines have been employed in this study —

(a) a 22-gauge, 20 inch diameter, Albi Combirib double jersey machine, equipped with a Rosen trip-tape positive feed;

(b) an 18-gauge, 30 inch diameter, 8RD Mellor Bromley double jersey machine, fitted with conical positive feed wheels;
(c) an 18-gauge, 30 inch diameter, MSJ Mellor Bromley mini-jacquard double jersey machine, fitted with Rosen trip-tape positive feed.

On the first two machines IRO storage feed units were used in conjunction with the positive feed systems.

It should be noted that on the Mellor Bromley MSJ the timing could only be delayed by six needles. For purposes of comparison, therefore, the timing on the Mellor Bromley 8RD was also delayed to six needles only. On both these machines the feeder sequence interlock-interlock-dial-cylinder (i.e. $I_1$-$I_2$-D-C) was used while on the Albi Combirib both feeder sequences possible were employed. In the case of the latter machine two different dial heights were also employed for the one feeder sequence. The experimental lay-out is given in Table I.

Unless stated otherwise the knitting conditions, evaluation of knitting efficiency and means of determining the various settings were the same as those in the other investigations[1, 3, 4].

**Input tension:**

Yarn input tension was measured by means of a Zivy tension meter and *was kept constant (at 3 gf in the case of the 18 gauge machines and at 2,5 gf in the case of the 22 gauge machine) for each experiment by, where necessary, adjusting the stitch cams after each change of settings. The yarn speed and, therefore, course length, remained unaffected by these cam adjustments due to the positive feed system employed.*

**Timing:**

Timing refers to the distance between the cylinder and dial knock-over positions at the same feeder and this is expressed here in terms of the number of needle spaces (referred to simply as "needles") in the *cylinder* between the cylinder and dial knock-over positions.

**Run-in-Ratio:**

A run-in-ratio of 1,5:1 was used throughout.

**Yarn treatments:**

Wool yarns, originally from the same undyed lot and which had been subdivided into four lots and dyed to four different shades prior to knitting, were used in the experiment. The yarns were waxed and cleared on a Schweiter horizontal waxing unit. Care was taken to ensure that the same amount of wax was applied at each winding head of the machine.

## TABLE I

## EXPERIMENTAL LAY-OUT TO INVESTIGATE THE INFLUENCE OF TIMING

| Exp. No. | Machine | Feeder sequence | Dial height (mm) | Yarn linear density | Needles delayed* | No. of courses knitted | MTF | No. of Feeders |
|---|---|---|---|---|---|---|---|---|
| 1 | Mellor Bromley 8RD | $I_1$-$I_2$-D-C | 0,9 | 24 tex | S, 1, 2, 3, 4, 5, 6 | 2000 | 16,5 | 4 |
| 2 | -do- | -do- | 0,9 | 28 tex | S, 2, 3, 4, 5, 6 | 2000 | 17,8 | 4 |
| 3 | Mellor Bromley MSJ | $I_1$-$I_2$-D-C | 0,9 | 24 tex | S, 1, 2, 3, 4, 5, 6 | 2000 | 18,3 | 8 |
| 4 | Albi Combi-rib | $I_1$-$I_2$-D-C | 1,1 | 22 tex | S, 2, 4, 6, 8, 10 | 2000 | 19,8 | 8 |
| 5 | -do- | -do- | 1,8 | 22 tex | S, 2, 4, 6, 8, 10 | 2000 | 19,8 | 8 |
| 6 | -do- | $I_1$-$I_2$-C-D | 1,1 | 22 tex | S, 2, 4, 6, 8, 10 | 2000 | 19,8 | 8 |

*S refers to synchronised timing

**Location of breakage:**

To determine in which particular course a breakage occurred, different coloured yarns were used at the various feeders. Any differences between the yarns caused by the different dye shades were eliminated by knitting each of the four colours in turn at each of the feeders for any one set of conditions.

The tests were carried out in a conditioned atmosphere with a relative humidity of 65% and temperature of 20°C.

## RESULTS AND DISCUSSION

In Tables II to V the yarn breakages are given for each set of conditions.

On the Mellor Bromley 8RD it seems as if the number of yarn breakages decreased as the timing delay was increased. This was found to be true for all the different courses and is consistent with the results obtained on the interlock structure[1].

From the results obtained on the Mellor Bromley MSJ and Albi Combirib, the following conclusions may be drawn:

(a) The number of yarn breakages which occurred in the *first interlock courses* seemed to attain a maximum at an intermediate timing position.

(b) In general, it can be said that the number of yarn breakages in the *dial only courses* was lowest at a delayed timing of approximately 6 needles.

(c) It was rather difficult to draw any definite conclusions from the yarn breakages in the *cylinder only courses.* Nevertheless, on the Mellor Bromley MSJ, it seemed as if the number of yarn breakages reached a maximum value at from 2 to 4 needles delayed timing. On the Albi Combirib no consistent trend could be observed.

(d) As far as the total number of yarn breakages are concerned it is difficult to detect any consistent trends in the results of these two machines. If anything, timing positions of 2, 3 and 4 needles delay gave relatively poor knitting performance on the MSJ while on the Albi Combirib a delayed timing of 10 needles was, on the average, the best. When using the feeder sequence $I_1$-$I_2$-C-D on the Albi Combirib synchronised timing appears to be the best.

It is interesting to note the higher number of breakages on the cylinder only courses compared to that on the dial only courses for both the MSJ and Combirib machines since this confirms results obtained on these two machines in two other studies[3, 4].

Before any explanations are given for the results obtained, the method of setting the timing should be described. In all the experiments the procedure followed was to commence at synchronised timing. The first step was usually to set the dial and cylinder stitch cams at the interlock feeders to the same cam depth. With the necessary adjustments the positions where the needles moved the deepest into the tricks, were set opposite each other, i.e. the knitting points on the cylinder

### TABLE II

**NUMBER OF YARN BREAKAGES OBTAINED ON THE MELLOR BROMLEY 8RD FOR TWO YARNS OF DIFFERENT LINEAR DENSITIES (Dial Height = 0,9 mm)**

| Needles delayed | | Breakages (24 tex yarn) | | | | | | Breakages (28 tex yarn) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $I_1$ | $I_2$ | D | C | Total | | $I_1$ | $I_2$ | D | C | Total |
| Synchro-nized | Experiment No. 1 | 19 | 0 | 118 | 54 | 191 | Experiment No. 2 | 0 | 117 | 10 | 92 | 279 |
| 1 | | 9 | 0 | 75 | 50 | 134 | | | Not done | | | |
| 2 | | 7 | 0 | 69 | 33 | 109 | | 0 | 50 | 8 | 58 | 116 |
| 3 | | 12 | 0 | 51 | 37 | 100 | | 4 | 51 | 15 | 72 | 142 |
| 4 | | 7 | 0 | 12 | 17 | 36 | | 0 | 47 | 4 | 51 | 102 |
| 5 | | 2 | 0 | 46 | 27 | 75 | | 4 | 25 | 6 | 41 | 76 |
| 6 | | 6 | 1 | 24 | 45 | 76 | | 1 | 25 | 6 | 33 | 65 |

Feeder sequence: $I_1$-$I_2$-D-C

## TABLE III

### NUMBER OF YARN BREAKAGES OBTAINED ON THE MELLOR BROMLEY MSJ USING THE FEEDER SEQUENCE $I_1$-$I_2$-D-C (Dial Height = 0,9 mm)

| Needles delayed | | Breakages | | | | |
|---|---|---|---|---|---|---|
| | | $I_1$ | $I_2$ | D | C | Total |
| S | Experiment No. 3 | 24 | 0 | 93 | 234 | 351 |
| 1 | | 10 | 0 | 44 | 6 | 60 |
| 2 | | 45 | 8 | 104 | 874 | 1031 |
| 3 | | 47 | 0 | 181 | 757 | 985 |
| 4 | | 63 | 1 | 106 | 374 | 544 |
| 5 | | 8 | 1 | 28 | 51 | 88 |
| 6 | | 12 | 1 | 28 | 226 | 267 |

and dial were opposite each other. The dial and cylinder cam depths were then adjusted to cause an almost simultaneous knock-over of the dial and cylinder parts of the interlock loops. As soon as the timing was delayed, the dial cams at the interlock feeders were set just deep enough to cause knock-over to occur. To maintain the same input tension, the cylinder cam depths were increased. This setting implied that the indirect and direct stitch cam effects referred to in another report[4] could influence the number of breakages occurring in the first interlock courses. The high number of breakages in the first interlock courses on the Mellor Bromley MSJ and Albi Combirib suggested that the indirect stitch cam effect could have played a rôle.

Further investigations showed that a maximum cylinder cam depth at the interlock feeders was reached at approximately six needles delayed timing. The initial increase in cam depth was due to the fact that at the interlock feeders the ability of the dial needles to draw yarn directly from the positive feed via the cylinder needles was reduced. It was found that if the cylinder and dial cam settings at the interlock feeders were kept constant when changing from synchronised to 2 needles delayed timing, a decrease in input tension occurred at these feeders. This proved that the dial needles could not draw the same amount of yarn as before. The main reason for this was that the cylinder part of the interlock loop which had been cast off, restrained the flow of yarn due to the frictional forces which developed at the interyarn contact points. To keep the input tension constant, therefore, the cylinder stitch cam depth had to be increased.

## TABLE IV

### NUMBER OF YARN BREAKAGES OBTAINED ON THE ALBI COMBIRIB USING TWO DIFFERENT DIAL HEIGHTS AND THE FEEDER SEQUENCE $I_1$-$I_2$-D-C

| Needles delayed | | Breakages (Dial height 1,1 mm) | | | | | | Breakages (Dial height 1,8 mm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $I_1$ | $I_2$ | D | C | Total | | $I_1$ | $I_2$ | D | C | Total |
| S | Experiment No. 4 | 640 | 42 | 3447 | 3129 | 7258 | Experiment No. 5 | 292 | 103 | 2926 | 3754 | 7075 |
| 2 | | 2848 | 49 | 239 | 5964 | 9100 | | 1891 | 75 | 689 | 1598 | 4253 |
| 4 | | 4787 | 25 | 521 | 3417 | 8750 | | 1713 | 129 | 1922 | 1285 | 5049 |
| 6 | | 507 | 32 | 300 | 2343 | 3182 | | 6723 | 308 | 244 | 1125 | 8400 |
| 8 | | 114 | 49 | 913 | 2194 | 3270 | | 268 | 110 | 396 | 2068 | 2842 |
| 10 | | 102 | 62 | 709 | 2255 | 3128 | | 200 | 50 | 263 | 2983 | 3496 |

## TABLE V

## NUMBER OF YARN BREAKAGES OBTAINED ON THE ALBI COMBIRIB USING THE FEEDER SEQUENCE $I_1$-$I_2$-C-D (Dial Height = 1,1 mm)

| Needles delayed | | Breakages | | | | |
|---|---|---|---|---|---|---|
| | | $I_1$ | $I_2$ | C | D | Total |
| S | Experiment No. 6 | 233 | 16 | 2012 | 260 | 2521 |
| 2 | | 2301 | 47 | 5006 | 336 | 7690 |
| 4 | | 3220 | 22 | 4538 | 102 | 7882 |
| 6 | | 451 | 404 | 8891 | 77 | 9823 |
| 8 | | 156 | 45 | 6714 | 48 | 6963 |
| 10 | | 288 | 32 | 2224 | 115 | 2659 |

It was also found that, at a delayed timing of six needles, the setting of the dial cam, when it was changed, had very little influence on the input tension.

The decrease in cam depth which occurred after a delayed timing of six needles, can be explained by the needle construction. When delayed timing is used, the yarn is drawn over the dial needles which act as sinkers. Clearly the position at which the yarn is drawn over the needles is a function of timing. As the timing is delayed, the dial needles at the interlock feeders start to retract at a later stage. Consequently the position of the yarn on the dial needles moves from the needle hook towards the latch. This has the same effect as increasing the cam depth or increasing the dial height since the thickness of the needles at their highest and lowest parts can differ by as much as three hundred *per cent*. The increase in the "sinker height" (i.e. in needle thickness) necessitated the decrease in cam depth. No satisfactory explanation was found for the decrease in the breakages which occurred in the dial only courses. It is felt, however, that the position of the different type of cam in the opposite needle beds, played a rôle. For instance, at synchronised timing, the dial and cylinder cams are directly opposite each other. This implies that when the dial only needles are selected to knit the opposite cylinder needles are at the stitch forming position, i.e. the lowest point in this cam track. As soon as the timing is delayed, these two "lowest" points in the cam systems move out of phase and the cylinder needles can compensate for the build up of tension by moving upwards.

## CONCLUSION

It was found that on the Albi Combirib and Mellor Bromley MSJ, intermediate timing positions generally gave poor knitting performance. The best knitting performance was generally obtained on the Albi Combirib at a delayed timing of 10 needles while in two out of the four experiments synchronised timing also gave relatively good knitting performance. On the MSJ 2, 3 and 4 needles delayed timing resulted in the greatest number of yarn breakages and, from the practical point of view, it seemed as if synchronised timing would be preferable, because of the difficulty in determining the correct number of needles delay to use.

On the Mellor Bromley 8RD it was found that a delayed timing of about six needles was the most favourable setting. This corresponds to the findings when knitting an interlock structure[1].

It is felt that the number of breakages which occurred in the first interlock courses on the Mellor Bromley MSJ and Albi Combirib, was again influenced by indirect and direct stitch cam effects referred to in another publication[4]. These effects were, however, a function of timing since timing influenced the position at which the yarn was wrapped over the needles.

The decrease in the dial only breakages which occurred with a delay in timing, could to some extent be explained by the position of the different cams in the opposite needle beds with respect to each other.


## ACKNOWLEDGEMENTS

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# PROPERTIES OF COTTON LINT FROM THREE SUCCESSIVE PICKINGS AT DIFFERENT LOCALITIES IN THE LOWER-ORANGE RIVER AREA

*by DE V. ALDRICH*

## ABSTRACT

*The fibre characteristics of cotton lint obtained from the first, second and third pickings of four cultivars were determined. Micronaire value, 2,5% span length, zero-gauge bundle strength (Stelometer) and maturity per cent decreased with time after the first picking. This reduction in fibre quality was reflected in the count-strength-product (CSP) values of the yarns spun from three of the four cultivars.*

## KEY WORDS

Cotton cultivars – first picking, second picking and third picking – fibre characteristics – Micronaire value – maturity – 2,5% span length – zero-gauge bundle strength – count-strength-product (CSP).

## INTRODUCTION

It is well-known that the cotton plant responds to variations in its environment like any other living thing. As a consequence of differences in soil characteristics, rainfall, irrigation, temperature, farming methods, etc., variations in characteristics of cotton lint from different localities or from the same locality are obtained.

The bolls on a particular cotton plant do not open simultaneously, but rather over a period starting from the bottom of the plant. When hand-picking is practised, two or more pickings are performed per season, with the result that those bolls at the bottom of the plant are generally picked first and those at the top last. A correlation exists between the time of picking and fibre quality, with the bolls from the lower half of the plant generally producing a better quality fibre.

To establish the differences in fibre properties to be expected from South African cultivars grown under local climatic conditions, samples of four cultivars, grown in the Lower-Orange River area under irrigation, were analysed for fibre properties. The cultivars chosen were Cape Acala, Acala SJ-1, Del Cerro 153 and a cultivar designated as 68/4/21 and were all from the 1973 crop. These four cultivars were grown in each of seven localities in the above-mentioned area (see Table I). Three pickings by hand, picked on the dates given in Table I were obtained for all the cultivars, except in the case of Opwag where only two pickings were obtained for the Cape Acala and Del Cerro 153 cultivars.

## TABLE I

### DATES OF PICKING OF THE VARIOUS CULTIVARS AT DIFFERENT LOCALITIES IN THE LOWER-ORANGE RIVER AREA

| Locality | First Picking | Second Picking | Third Picking |
|---|---|---|---|
| Augrabies | 27/3/73 | 18/4/73 | 29/5/73 |
| Kakamas | 7/3/73 | 28/3/73 | 18/4/73 |
| Keimoes | 28/3/73 | 17/4/73 | 8/5/73 |
| Upington | 26/3/73 | 26/4/73 | 14/5/73 |
| Sultana-oord | 29/3/73 | 24/4/73 | 30/5/73 |
| Opwag | 15/4/73 | 9/5/73 | 28/5/73 |
| Rietrivier | 20/3/73 | 15/4/73 | 10/5/73 |

The samples were analysed for fibre length, maturity, fineness, strength and micronaire value. In addition samples from the first and third picking from Keimoes, Upington, Rietrivier and Opwag were spun into 15 tex yarns on the Shirley Miniature Spinning System.

**Testing:**

All fibre tests were carried out at 20°C and 65% relative humidity and the samples were allowed to condition for at least 24 hours at this temperature and relative humidity before testing commenced. In each case a sub-sample of approximately 30 to 40 grams was carefully drawn from the original sample, and all fibre tests were carried out using the sub-sample.

Ginning was carried out on a laboratory type saw-gin.

Micronaire values were determined on a Port-Ar instrument and the immaturity ratio (I) on an Arealometer using an 8-gram and a 152-milligram sample respectively.

Hertel and Craven[1] reported a correlation coefficient of -0,93 between Arealometer immaturity ratio (I) and percentage maturity as determined by the caustic-soda method. The equivalent percentage maturity (M) was, therefore, calculated using the following regression formula given by Hertel and Craven[1]:

$$M(\%) = 150,5 - 38,1\ I$$

where I = immaturity ratio from the Arealometer.

Fibre bundle strength at zero-gauge was determined on the Stelometer instrument. The results are expressed in gramforce per tex and when these values are multiplied by 2,02, the bundle strength values expressed in thousand pounds per square inch are obtained.

A Fibrograph Model 330 was used for fibre length determination using suction during measuring.

Three 50-gram samples, from each of the first and third pickings of all the cultivars from Keimoes, Upington, Rietrivier and Opwag were converted into 15 tex yarn (Nominal twist constant = 38)* on the Shirley Miniature Spinning System. This system consists of a miniature card with stationary flats, a miniature drawframe having a 4-over-4 drafting system and an 8-spindle miniature ringframe equipped with 2-inch rings and a composite double-apron drafting system capable of drafts of up to 250.

The lea strength of the yarns was determined using 80 wraps of 1,5 yards each. The results are expressed as count-strength-product, i.e. English Cotton Count X Lea strength in lbf.

* Twist constant = (t.p.cm.) x $Tex^{\frac{1}{2}}$
English Twist factor = Twist Constant/9,57

## RESULTS AND DISCUSSION

The individual results of Micronaire value, maturity per cent (equivalent NaOH-method), 2,5% span length and zero-gauge bundle strength for each cultivar from the seven localities have been plotted in Figures 1 to 4 against the number of days which lapsed between first and second, and between first and third pickings. On the average the second picking took place 24 days after the first and the third picking 51 days after the first. All results of the first, second and third pickings were averaged in each case and plotted against zero, 24 and 51 days respectively in Figures 1 to 4. The average values so obtained for the four characteristics are also given in Table II. It is clear from these figures that there is a significant decrease in all of the four characteristics from the first to the third picking. The length uniformity ratio (the ratio of the 50% span length to the 2,5% span length), and the fibre linear density ($\mu$g per cm), not quoted here, also decreased significantly from the first to the third picking.

The scatter of the results, however, is such that no locality could be isolated as giving consistently the highest or the lowest values for the four characteristics given in figures 1 to 4. The average values given in Table II, column 6, should not be taken as average inherent values of the four cultivars as an equal weight was given to all of the three pickings in calculating this average. This is not normally the case, because the percentage lint from the third picking is usually less than that from the first or second picking. Furthermore the samples are representative of a limited area.

The percentage decrease in the average values from the first to the third picking are given in Table III. The biggest decreases (expressed as a percentage) occurred in the Micronaire value and maturity per cent. Decreases of up to 24% in the average Micronaire value were observed between the first and third pickings.

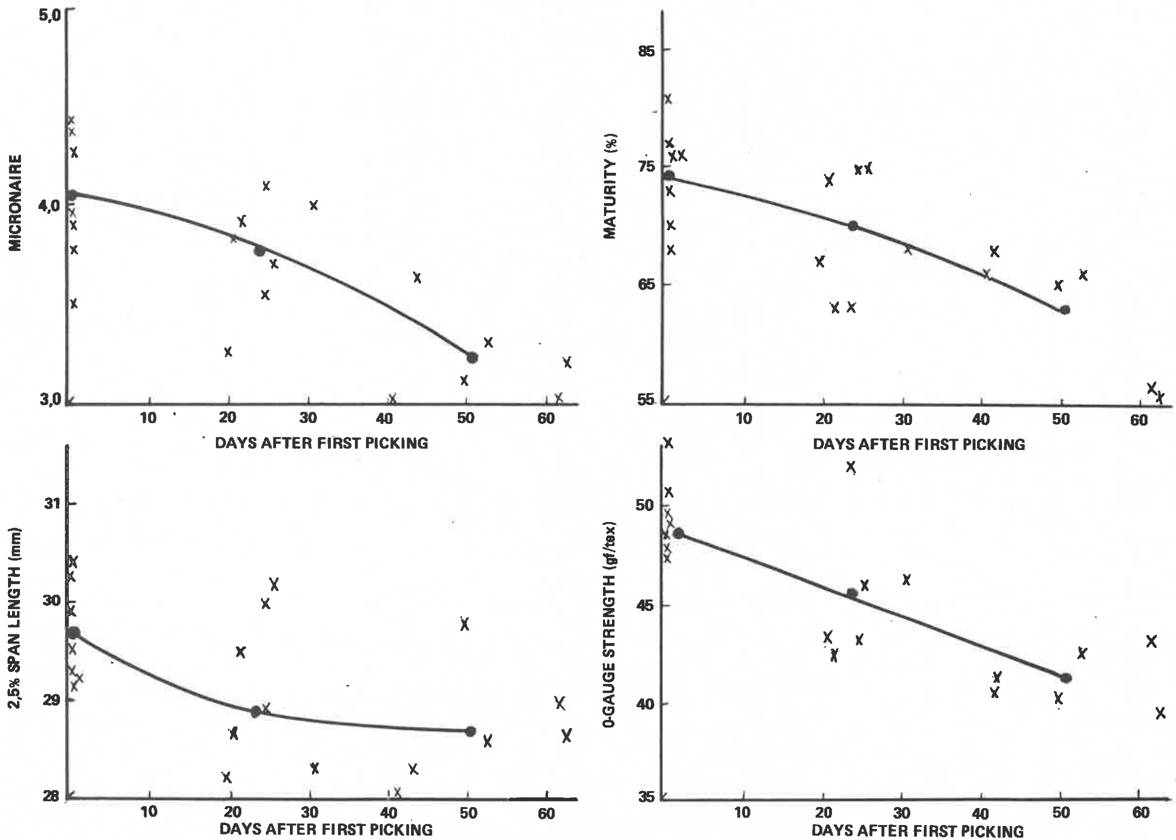


**FIGURE 1**

**Fibre properties of Cape Acala**

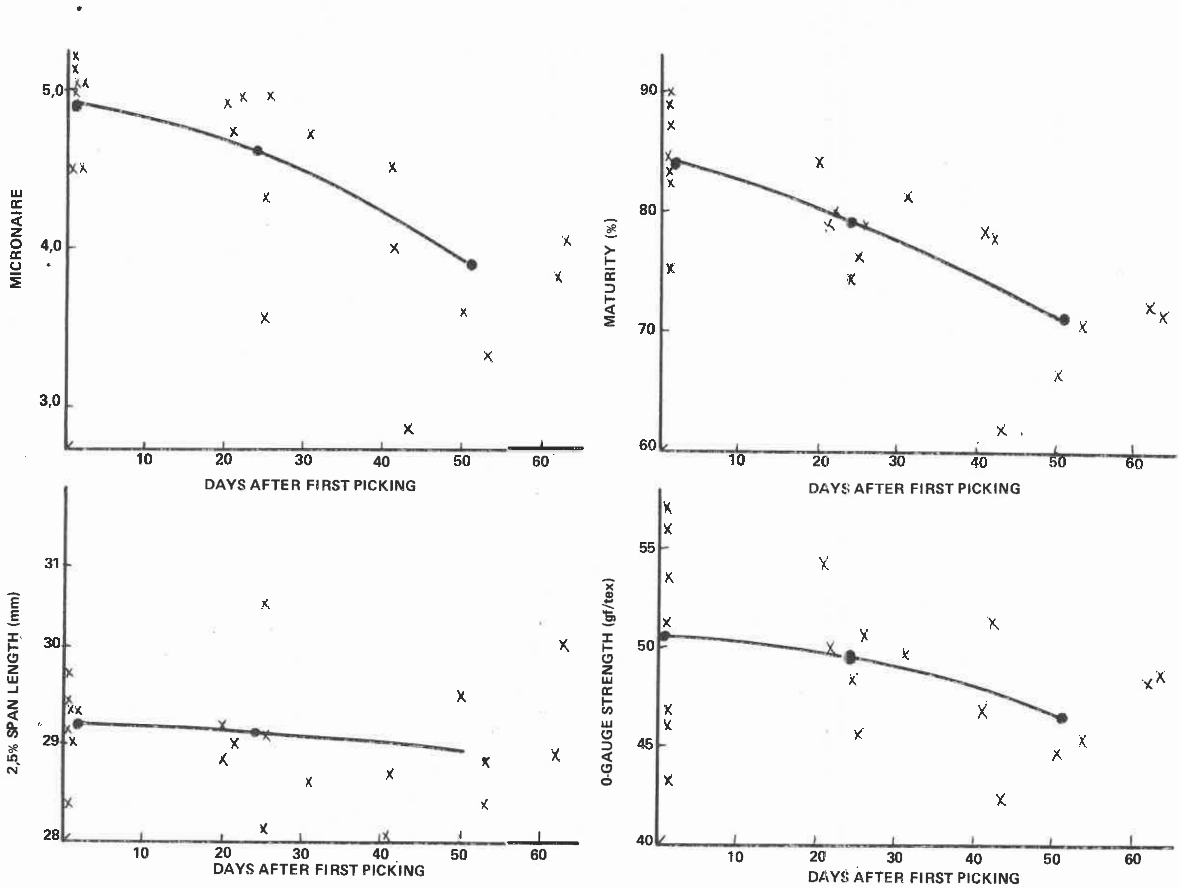


**FIGURE 2**

**Fibre properties of Acala SJ 1**

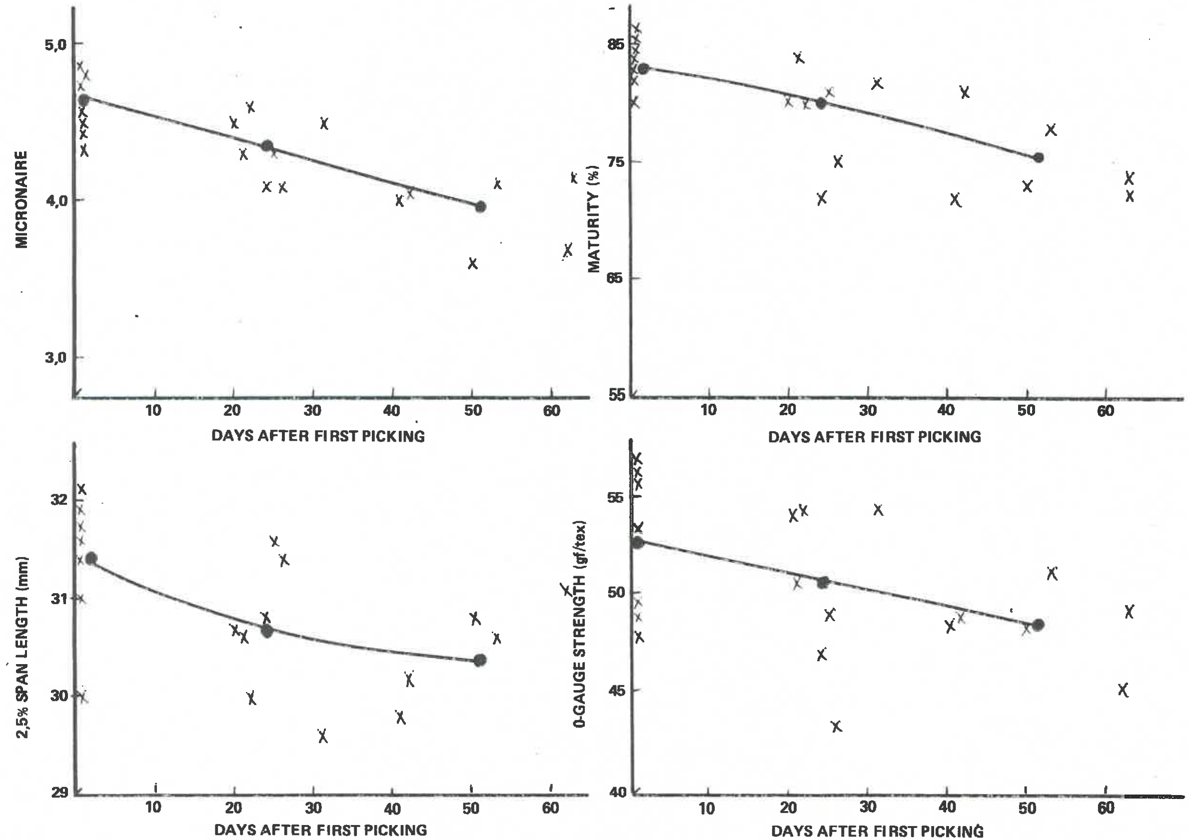


**FIGURE 3**

**Fibre properties of Del Cerro 153**

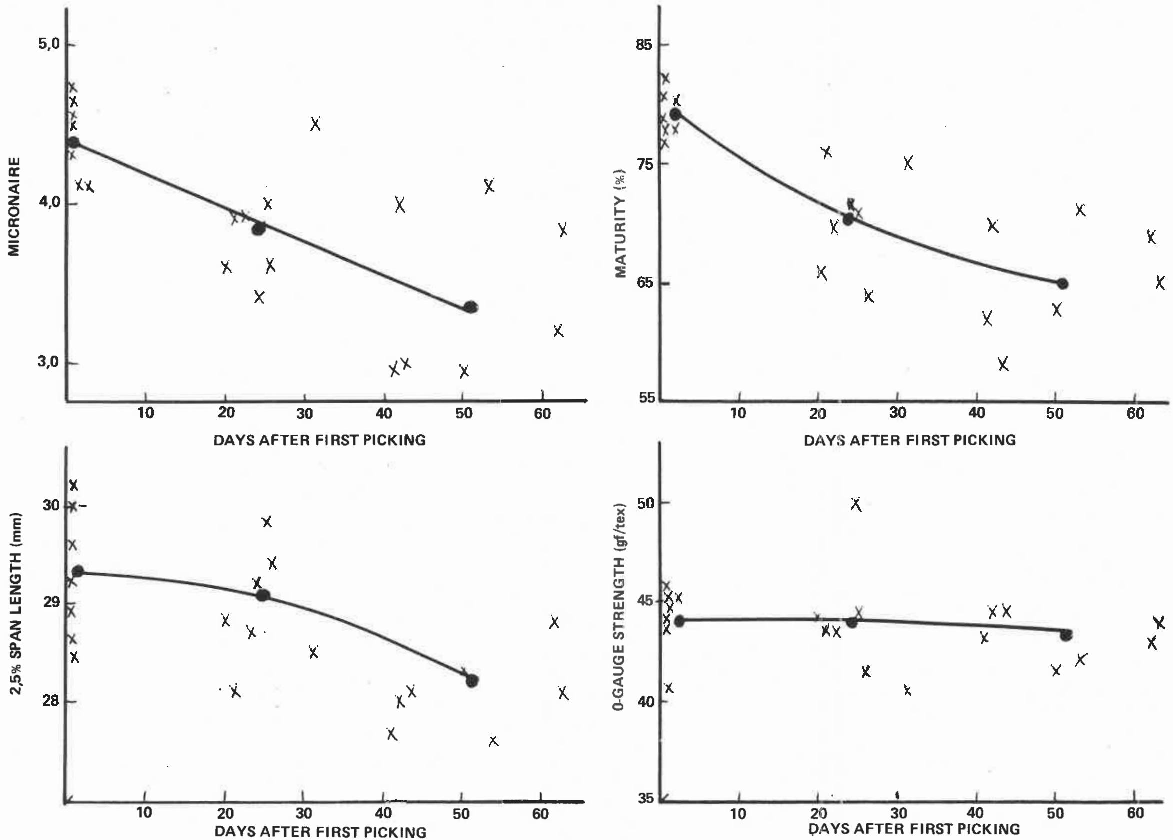


**FIGURE 4**

**Fibre properties of 68/4/21**

## TABLE II

### FIBRE CHARACTERISTICS AT FIRST, SECOND AND THIRD PICKING (AVERAGE VALUES FOR 7 GROWING AREAS)

| Charac-teristic | Cultivar | First Picking | Second Picking (24 Days after First Picking) | Third Picking (51 Days after First Picking) | Average of 1st, 2nd & 3rd Picking |
|---|---|---|---|---|---|
| Micronaire | Cape Acala | 4,04 | 3,77 | 3,21 | 3,67 |
| | Acala SJ-1 | 4,91 | 4,60 | 3,89 | 4,47 |
| | Del Cerro 153 | 4,60 | 4,35 | 3,96 | 4,30 |
| | 68/4/21 | 4,40 | 3,84 | 3,35 | 3,86 |
| Maturity (%) | Cape Acala | 74 | 70 | 63 | 69 |
| | Acala SJ-1 | 84 | 79 | 71 | 78 |
| | Del Cerro 153 | 83 | 80 | 76 | 80 |
| | 68/4/21 | 79 | 71 | 65 | 72 |
| 2,5% Span Length (mm) | Cape Acala | 29,7 | 28,9 | 28,7 | 29,1 |
| | Acala SJ-1 | 29,2 | 29,1 | 28,9 | 29,1 |
| | Del Cerro 153 | 31,4 | 30,6 | 30,4 | 30,7 |
| | 68/4/21 | 29,3 | 29,1 | 28,2 | 28,9 |
| Strength (gf/tex) (zero-gauge) | Cape Acala | 48,8 | 45,6 | 41,2 | 45,2 |
| | Acala SJ-1 | 50,2 | 49,7 | 46,6 | 48,8 |
| | Del Cerro 153 | 52,8 | 50,6 | 48,8 | 50,7 |
| | 68/4/21 | 44,1 | 44,1 | 43,4 | 43,9 |

Although the decreases for the 2,5% span length and zero-gauge bundle strength were relatively small (except for the Cape-Acala), it does not mean that they are unimportant, because singly, fibre length and strength are the two most important fibre properties determining yarn strength. Generally the lowest percentage decrease in fibre quality was observed in the case of the Del Cerro 153 cultivar.

It was, however, also of interest to record the maximum and minimum values obtained for each cultivar. These values are given in Table IV and are an indication of the range in fibre characteristics to be expected from each cultivar. These values may, however, be strongly influenced by seasonal variations in climatic conditions as well as other factors such as soil characteristics, farming methods, etc. They should, therefore, be considered with these factors in mind. The considerable range of Micronaire values (as well as maturity levels) is apparent from

## TABLE III

### CHANGE IN FIBRE CHARACTERISTICS FROM FIRST TO THIRD PICKING FOR VARIOUS CULTIVARS

| Cultivar | Characteristic | Average Value at First Picking | Percentage Reduction in Average Value at Third Picking |
|---|---|---|---|
| Cape Acala | Micronaire Value | 4,04 | 20,3 |
| | Maturity (%) | 74 | 14,9 |
| | 2,5% Span Length (mm) | 29,7 | 3,4 |
| | Zero-gauge (gf/tex) | 48,8 | 15,6 |
| Acala SJ-1 | Micronaire Value | 4,91 | 20,8 |
| | Maturity (%) | 84 | 15,5 |
| | 2,5% Span Length (mm) | 29,2 | 1,0 |
| | Zero-gauge (gf/tex) | 50,2 | 7,2 |
| Del Cerro 153 | Micronaire Value | 4,60 | 13,9 |
| | Maturity (%) | 83 | 8,4 |
| | 2,5% Span Length (mm) | 31,4 | 3,2 |
| | Zero-gauge (gf/tex) | 52,8 | 7,6 |
| 68/4/21 | Micronaire Value | 4,40 | 23,9 |
| | Maturity (%) | 79 | 17,7 |
| | 2,5% Span Length (mm) | 29,3 | 3,8 |
| | Zero-gauge (gf/tex) | 44,1 | 1,6 |

Table IV, especially in the case of Acala SJ-1 and to some extent also for the cultivar 68/4/21. In these two cases the difference between the maximum and minimum values (based on the maximum value) were 45% and 37% respectively. The corresponding differences for zero-gauge bundle strength varied from 20% to 25%. The differences between maximum and minimum values for the 2,5% span length were similar in all of the four cases, varying from 7,5% to 9,0% only.

It should be noted that these maximum and minimum values were obtained from relatively small samples of first, second and third pickings. It is to be expected that the maximum and minimum values obtained from a commercial crop will differ much less due to blending at the gin. The maximum and minimum values quoted here, therefore, merely serve to illustrate the extreme fibre properties that large bulk quantities of cotton lint can have. The maximum and minimum

## TABLE IV

## MAXIMUM AND MINIMUM VALUES OF MICRONAIRE VALUE, MATURITY, 2,5% SPAN LENGTH AND ZERO-GAUGE BUNDLE STRENGTH

| Cultivar | Characteristic | Maximum value | Minimum value |
|---|---|---|---|
| Cape Acala | Micronaire Value | 4,41 | 3,02 |
| | Maturity (%) | 81 | 53 |
| | 2,5% Span Length (mm) | 30,4 | 27,6 |
| | Zero-gauge strength (gf/tex) | 52,0 | 39,5 |
| Acala SJ-1 | Micronaire Value | 5,20 | 2,85 |
| | Maturity (%) | 90 | 58 |
| | 2,5% Span Length (mm) | 30,4 | 28,1 |
| | Zero-gauge strength (gf/tex) | 57,0 | 42,4 |
| Del Cerro 153 | Micronaire Value | 4,80 | 3,64 |
| | Maturity (%) | 87 | 72 |
| | 2,5% Span Length (mm) | 32,1 | 29,3 |
| | Zero-gauge strength (gf/tex) | 57,0 | 43,5 |
| 68/4/21 | Micronaire Value | 4,68 | 2,95 |
| | Maturity (%) | 82 | 58 |
| | 2,5% Span Length (mm) | 30,2 | 27,8 |
| | Zero-gauge strength (gf/tex) | 50,0 | 40,5 |

values found for the 2,5% span length could also have been influenced by the efficiency of the ginning process. It is not an easy task to maintain ginning efficiency at a constant level when small laboratory gins are used.

The corrected count-strength-product (CSP) values for the 15 tex yarns spun on the Shirley Miniature Spinning System are given in Table V. These values are the average of three spinning tests on each sample. These CSP-values are not directly comparable to CSP-values obtained from commercially spun yarns from the same lint samples since they are generally lower than the CSP-values of commercially spun yarns[(2)].

Of the four cultivars tested only Del Cerro 153 did not show any decrease in CSP-value from the first to the third pickings. The cultivar 68/4/21, which is also the weakest and shortest, showed the biggest decrease in CSP-value from first to third picking, namely 189 CSP-units.

## TABLE V

### COUNT-STRENGTH-PRODUCT (CSP) VALUES FOR 15 TEX YARNS SPUN ON SHIRLEY MINIATURE SPINNING SYSTEM

| Cultivar | Locality | CSP-Values | |
|---|---|---|---|
| | | First Picking | Third Picking |
| Cape Acala | Rietrivier | 2 216 | 2 115 |
| | Upington | 2 225 | 1 989 |
| | Keimoes | 2 426 | 2 267 |
| | AVERAGE | 2 289 | 2 124 |
| Acala SJ-1 | Rietrivier | 2 099 | 1 993 |
| | Upington | 2 166 | 1 892 |
| | Keimoes | 2 109 | 2 058 |
| | AVERAGE | 2 135 | 1 987 |
| Del Cerro 153 | Rietrivier | 2 445 | 2 426 |
| | Upington | 2 480 | 2 483 |
| | Keimoes | 2 470 | 2 447 |
| | AVERAGE | 2 465 | 2 452 |
| 68/4/21 | Rietrivier | 2 052 | 1 872 |
| | Upington | 1 953 | 1 759 |
| | Keimoes | 2 117 | 1 945 |
| | AVERAGE | 2 035 | 1 846 |

## SUMMARY

The four cultivars (Cape Acala, Acala SJ-1, Del Cerro 153 and 68/4/21) all showed significant decreases in Micronaire value, length, maturity and strength when the second and third pickings were compared with the first picking of the 1973 season in the Lower-Orange River area.

Bearing in mind the limited scope of this investigation it seems as though the long staple Del Cerro 153 cultivar is far less prone to Micronaire variation between pickings than any of the other three cultivars. The weaker cultivar 68/4/21, however, showed less variation in zero-gauge bundle strength than did any of the other three cultivars investigated.

Except in the case of Del Cerro 153 the decreases suffered in the fibre quality of the third picking were reflected in the CSP-values of the 15 tex yarns.

## ACKNOWLEDGEMENTS

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# THE EFFECT OF HEATING THE TOP COMB IN RECTILINEAR COMBING

*by T. O. GODAWA and D. W. F. TURPIE*

## ABSTRACT

*The top comb of a rectilinear comb was fitted with a thermostatically controlled heating element, and the temperature of the top comb pins was regulated between room temperature (21°C) and 90°C.*

*There was a small reduction in percentage noil when the top comb was heated up to 60°C, which, at this stage, may only be of academic value. It appeared that the reduction of percentage noil was due to more short fibres migrating into the top.*

## KEY WORDS

Top comb – wool – top – noil – fibre breakage – short fibre content – regain – neps – heating element.

## INTRODUCTION

The importance of using heated comb pins on the combing performance of the Noble comb is generally appreciated. Townend *et al*[1] confirmed that slightly lower percentage noil was obtained with the circle pins at above room temperature.

Turpie and Kruger[2, 3] have thoroughly investigated the Noble comb and its effect on the optimum temperature selection in the production of minimum noil. However, to the authors' knowledge, using heated comb pins on the rectilinear comb has as yet, received no attention.

## EXPERIMENTAL

### COMBING

The experimental work was carried out on a Schlumberger PB26 rectilinear combing machine. The top comb was fitted with a 350 Watt Calrod (General Electric) Strip Surface heater, and connected through a Simmer-stat control to a 250 Volt mains supply. The temperature of the comb pins was set at various values between room temperature (21°C) and 90°C.

Three series of experiments were carried out. The first and second series concerned *First Combing*, whereas the third series concerned *Re-combing*.

## MATERIALS

### First Combing:

Two different types of wool were used, one of which was of 8/10 months length (Wool A) and the other of 9/12 months length (Wool B). The latter was classified as overcrimped and the former as normally crimped (using Duerden's scale for crimp-diameter relationship).

### Re-combing:

A 10/12 months Cape top (Wool C) of m.f.l. 63,0 mm and m.f.d. 20,9 $\mu$m was selected for this investigation.

## MECHANICAL PROCESSING

### Wool A and Wool B

These wools were scoured on a 310 mm wide Petrie & McNaught pilot scouring plant, to a grease content value of about 0,4%. Prior to carding the wools were sprayed with 0,5 *per cent* by mass of Topsol (Price Ltd.), 0,02 *per cent* by mass of Lissapol NX (I.C.I.) and sufficient water to produce a regain of about 17 *per cent* on the fibre. After spraying the wools were left to condition for one hour before carding was commenced.

The wools were carded on a double swift Continental worsted card equipped with a breast works, single morel and burr beater. The swifts and doffers were clothed with metallic wire and the auxiliary rollers with flexible clothing. Worker settings were progressively closer from 18 to 30 B.W.G. The card production rate was about 16 kg per hour at a swift speed of 82 r/min.

After carding, the wools were gilled twice on an NSC Autoleveller gill box and stored until required. Wool A was subsequently divided into three sublots (sublot 1, 2 and 3), and wool B into two sublots (sublot 4 and 5). Each sublot was gilled three times on an NSC Intersecting gill box, using successive nominal drafts of 6, 6,5 and 7, and fallers with a pin density of 6,5 p.p.cm. At the first gilling operation, however, water was applied such that the regains of sublots 1, 2 and 3 were 14, 16 and 18 *per cent* respectively. The regains of sublots 4 and 5 were 15 and 16 *per cent.*

After final gilling Wools A and B were combed on a Schlumberger PB26 rectilinear combing machine. The total input loading of the comb was about 288 g per metre. The gauge setting was 28 mm, the feed 4,2 mm and the comb speed 150 cycles per minute.

### Wool C

Wool C was gilled twice and then re-combed at a gauge setting of 32 mm. The feed was 4,5 mm and the comb input loading and speed were the same as for Wools A and B.

## TESTING

The moisture content of the wools was measured according to the I.W.T.O. method specified for wool. The mass of the combed slivers and noils required for the determination of percentage noil was corrected to Standard Regain. The mean fibre length of the tops was measured on an Almeter. The temperatures of the pins of the top comb were measured by means of a direct-reading thermistor temperature gauge.

## RESULTS AND DISCUSSION

### FIRST COMBING

The percentages of noil obtained during first combing together with the characteristics of the tops produced with a heated top comb at various temperatures are given in Table I.

From Table I, it can be seen that there was a tendency in the case of both wools and all sublots for percentage noil to decrease as the temperature of the top comb pins was increased from room temperature to 60°C. This decrease was only slight being, on average, of the order of four *per cent* of the value obtained at room temperature. There appeared to be no further reduction in percentage noil by heating the top comb pins above this temperature.

In the case of Wool A the mean fibre length of the top appeared to remain more or less constant as the temperature of the top comb was increased. In the case of Wool B, however, the mean fibre length of the top appeared to decrease as the temperature of the top comb was increased.

The percentages of fibres shorter than 25 mm given in Table I indicate a slight tendency to increase with increasing temperature of the top comb, particularly in the case of Wool B.

The results for percentage noil, mean fibre length of the top and percentage short fibre in the top in the case of Wool B indicate that migration of progressively more short fibres into the top may have taken place as the temperature of the top comb was increased. Such an occurrence would tend to decrease the number of short fibres removed as noil, but at the same time would reduce the mean fibre length of the top and increase its short fibre content. In the case of Wool A, the downward trend for percentage noil could not be substantiated by the results for mean fibre length and percentage short fibre alone and it seems therefore that in addition less breakage might have occurred as the temperature of the top comb was increased.

It is possible that in the case of both Wools A and B, heating of the top comb produced patterns for the mean fibre length of the top which were the results of a complex combination of fibre breakage and fibre migration.

## TABLE II

## MEAN FIBRE LENGTH OF THE TOPS PRODUCED DURING RE-COMBING TOGETHER WITH PERCENTAGE SHORT FIBRES <27,5 mm*

| Temperature | Percentage Short Fibres | Mean Fibre Length of Re-combed Top |
|---|---|---|
| 21°C | 3,1 | 67,5 |
| 30°C | 3,6 | 66,5 |
| 45°C | 3,8 | 66,2 |
| 60°C | 4,1 | 66,0 |
| 75°C | 3,7 | 66,6 |
| 90°C | 4,0 | 66,2 |

*Average of results for percentage short fibres <25 and < 30 mm

**RE-COMBING**

Two sets of results are shown in Figure 1. One represents the results obtained when the top comb pins were *heated* from room temperature (21°C) to 90°C. The other set represents the results obtained when the top comb pins were *cooled* from 90°C to room temperature.

From these results it can be seen that the percentage noil decreased as the temperature of the top comb pins increased from room temperature (21°C) to 60°C. This decrease was about eight *per cent* of the value obtained at room temperature. Again, as with first combing there appeared to be no further reduction in percentage noil by heating the top comb pins above 60°C.

The percentage of short fibres together with the mean fibre length of tops are given in Table II, showing that the percentage short fibres in the top generally increased as the temperature of the top comb pins was increased. At the same time the m.f.l. of the top showed a tendency to decrease. These results are similar to those obtained for Wool B.

## SUMMARY AND CONCLUSIONS

The top comb of a rectilinear combing machine was fitted with a thermostatically controlled heating element, and the temperature of the top comb pins was regulated between room temperature (21°C) and 90°C.

The combing performances of three different types of wools were investigated at various temperatures of the top comb pins, in an attempt to establish at which temperature, if at all, a minimum of noil would be produced.

The results indicate that percentage noil decreased slightly as the temperature of the top comb was increased from room temperature (21°C) to 60°C. This decrease may have been due either to relatively more short fibres migrating into the top or to less fibre breakage occurring during combing, or both. In two cases out of three, however, it was clearly due to migration of short fibres into the top.

There appeared to be no further reduction in percentage noil by heating the top comb above 60°C. The improvement in percentage noil was equivalent to about four *per cent* of the value obtained at room temperature, in the case of first combing and about eight *per cent* in the case of re-combing.


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## PROPRIETARY NAMES

The fact that chemicals with proprietary names have been mentioned in this report does not in any way imply that SAWTRI recommends them or that there are no substitutes which may be of equal value or even better.

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