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SAWTRI BULLETIN

SOUTH AFRICAN
WOOL TEXTILE RESEARCH INSTITUTE
OF THE CSIR

P.O. BOX 1124
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SAWTRI BULLETIN

Editor: M. A. Strydom, M.Sc.

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CONTENTS

SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
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INSTITUTE NEWS

Planning the Research Program for 1976/77

During the past few months, considerable time has been spent on planning the Institute's research program for the next financial year. The annual meeting of the S.A. Wool Board Steering Committee took place on January 14th, and several aspects of the research program for 1976/77 were discussed. The meeting was also attended by Dr John McPhee, who acts as a consultant to the S.A. Wool Board. Prior to this important meeting, members of the Steering Committee were conducted on a tour of the Institute. Project leaders of projects involving wool gave brief summaries of their activities over the past year in order to assist the Steering Committee in formulating its policy on new and existing projects for the coming year.

The Annual Meeting of SAWTRI's Research Advisory Committee (RAC) took place on January 15th. On this occasion the President of the CSIR, Dr C. van der Merwe Brink, who presided over the meeting, congratulated Dr McPhee (an R.A.C. member) on his promotion to Director of Planning and Service of the I.W.S. as from May 1st, 1976. Dr J. Visser, Director of the National Productivity Institute (NPI), was also congratulated on being awarded his Doctorate. On the same occasion leave was also taken of Dr J. S. Starke who decided to retire from the RAC. Dr Starke's successor will be announced by the President of the CSIR at an opportune time.

THE SAWTRI RESEARCH ADVISORY COMMITTEE

BACK ROW, left to right: Mr A. E. Nilsen, Mr J. Goddard, Dr J. Visser, Mr D. S. Uys, Mr D. F. de Wet, Dr J. H. Hofmeyer, Mr G. Fouché, Mr W. McDonald, Mr O. H. G. Beier.
FRONT ROW, left to right: Mr J. Z. Moolman, Dr J. McPhee, Dr D. P. Veldsman, Dr C. v.d. M. Brink, Mr A. Paul, Dr J. S. Starke

During the RAC meeting, the Director also commented upon SAWTRI's Annual Report and also reported on current National projects. Motivations were given for existing projects to continue and for new projects to commence.

The annual budget meeting of SAWTRI with the CSIR Executive took place on February 18th. Matters related to the financing of the 1976/77 Research Program were discussed. In these times of economic pressures we are grateful to the CSIR Executive for the sympathetic ear that we received as regards our financial needs.

Director's Address to International Conference on Fibre Science

Dr D. P. Veldsman addressed an International Conference on Fibre Science in Arad, near Jerusalem, which was held from February 29th to March 5th. The Conference was organised by the National Council for Research and Development of Israel, and was attended by textile scientists and authorities from many parts of the world. The Director's paper dealt with "Recent advances in the chemical modification of wool and wool blends".

SAWTRI Staff Members attend Sympotex '76

Three members of the SAWTRI staff attended Sympotex '76 which was organised by the Society of Dyers and Colourists of South Africa and held at the Elangeni Hotel in Durban on March 20th/21st. The Symposium was officially opened by the Director, who also presented a summary at the end of the proceedings. The Symposium was also attended by Drs Roberts and Hayes of the Dyeing and Finishing Group.

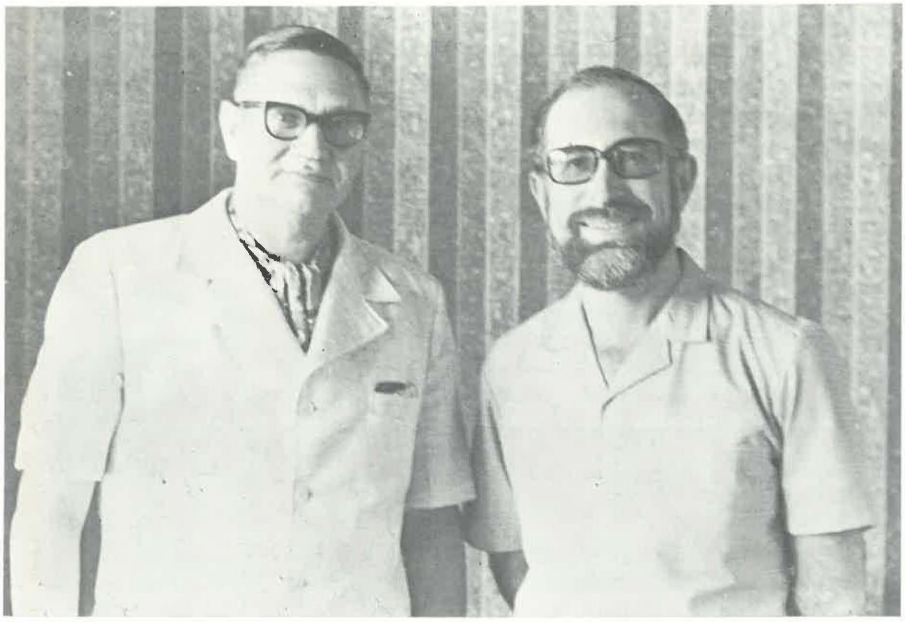
Examining a jet-dyed fabric during a recent visit of senior SAWTRI research staff to Rhodesia are, from left to right the Director, Dr Veldsman, Dr Malcom Roberts of SAWTRI and Mr Peter Johnson

Next International Wool Textile Conference to be held in South Africa

The Director of SAWTRI is glad to announce that the next quinquennial Wool Textile Research Conference is to be held in South Africa in 1980. The Conference will be organised by him in collaboration with the S.A. Wool Board, the S.A. Mohair Board and other wool textile interests in the country. The conference will be held in the CSIR's new conference centre in Pretoria where facilities will be available for simultaneous interpretation of papers into English. The previous conference (Aachen, Germany, 1975) was attended by more than 500 delegates from 29 countries. The Pretoria Conference should, therefore, be one of the scientific highlights in South Africa in 1980.

Visits and Visitors

A number of distinguished visitors were received at the Institute during the past 3 months. On January 8th, Mr Neville Vogt received Dr I. McDonald of the Rhodesian Tobacco Research Board, while Dr Bate and Professor Davies of the University of Salisbury also discussed points of mutual interest with Mr Vogt on January 26th. A senior Israeli scientist, Dr I. Ziderman of the Fibre Research Institute in Jerusalem visited SAWTRI on February 10th and 11th addressing staff members and members of the Eastern Cape branch of the Textile Institute on various aspects of his research.



Dr I. Ziderman of the Israel Fibre Research Institute, right, with the Director during the former's two-day visit to SAWTRI

A well-known British Scientist, Sir Ieuan Maddock and Lady Maddock also visited SAWTRI on March 9th. Sir Ieuan and Lady Maddock visited South Africa as guests of the CSIR and were accompanied through the country by Dr Rigden of the CSIR and Mrs Rigden. The visit of Sir Ieuan, who is a highly-ranked scientific advisor to the British Government, is part of the CSIR's policy of fostering good relations with similar overseas bodies, and included tours to various areas of industrial development. On one such tour through the Ciskei and Transkei, the couple was accompanied by Mr Vogt.

An expert from the National Productivity Institute, Mr B. van Loggerenberg, visited the Institute on February 11th and 12th discussing various aspects of costing and productivity with senior research staff. It is hoped that with the background provided by the discussions with Mr Van Loggerenberg, it will be possible to give readers of our technical literature more information on the cost implications, both on the short and the long term, of the implementation of research findings in their particular fields.

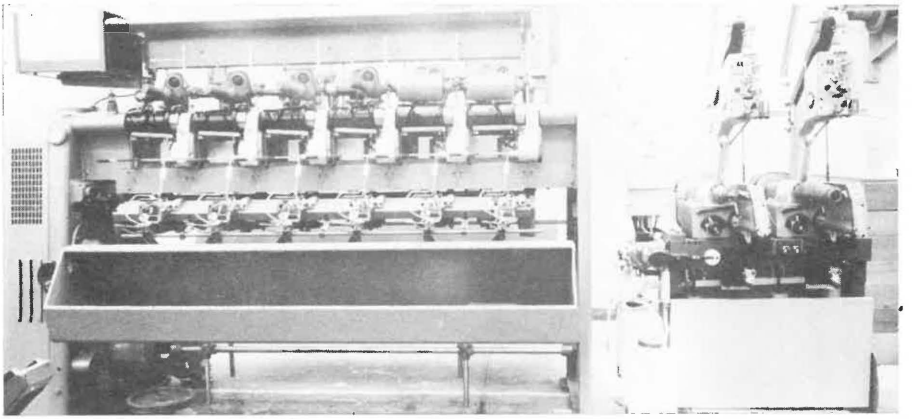
A group of 24 West Germans, representing various levels of the German wool farming industry, visited the Institute on February 11th.

SAWTRI's 25th Anniversary

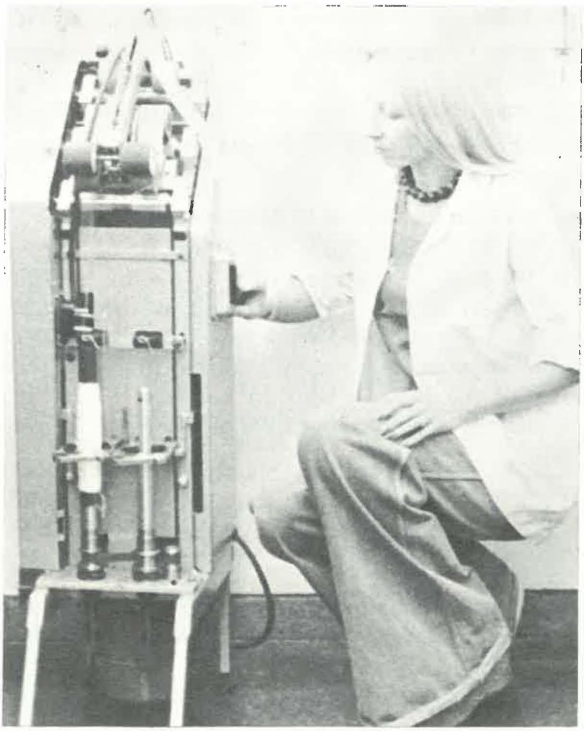
In May 1976 SAWTRI will be in existence for 25 years. In order to combat inflation, it has been decided to postpone the planned festivities for one year.

New Contributors

We would like to welcome another two firms as contributing members to the work of the Institute. They are Messrs Gatooma Textiles Ltd, and Darryn Textile Mills of Salisbury. We look forward to a fruitful relationship with these two new members.



SAWTRI's new Schlafhorst IRN Cone Winder with the Uster Classimat for precision winding and clearing. On the right is the FMN Schuster & Co. "Conorapid" for the winding of texturised yarns



The I.W.S. Sample Spinner Twister used as part of the quality control system for testing the shrink-resistance of resin-treated tops

SAWTRI PUBLICATIONS

Since the previous edition of the "Bulletin", the following papers have been published by the Institute:

Technical Reports

No. 279 : Robinson, G. A., Green, M. V. and Hunter, L., Cockling in Fully-Fashioned Knitwear, Part I: A Preliminary Report, (January 1976).

No. 280 : Robinson, G. A. and Roberts, M. B., The Transfer Printing of Fabrics Woven from Cotton-Rich Blends of Cotton and Polyester, (February 1976).

No. 281 : Robinson, G. A. and Ellis, R., The Use of Leno in All-Wool Lightweight Shirting and Safari Suiting Fabrics, (February 1976).

No. 282 : Leigh, R. A., Bleaching of 55/45 Wool/Cotton Blend Fabrics, Part I: Using Hydrogen Peroxide, (March 1976).

extremely effective in reducing oligomer deposition. A laboratory test, the Uster Oligomer Test, has been developed and found to provide a quick and accurate means of predicting the degree of oligomer deposition.

(L.H.)

Setting and Curing of Cotton Blend Knitted Fabrics, by D. H. Black, E. M. Buras and P. Hough, *Text. Chem. and Col.*, 7, No. 9, 50/163 (Sept., 1975).

The stabilisation of single and double jersey fabric dimensions in cotton and cotton/polyester blends (feeder and intimate) has been investigated. It was found that a single high temperature operation (termed union setting) both heat-sets the polyester and crosslinks or resin-cures the cotton resulting in effective laundering shrinkage control. The resin level should be adjusted according to the percentage of cotton in the blend and the union setting can be applied to the fabric off the machine. The control of shrinkage during laundering of the union-set goods depends largely upon the control of dimensions during finishing.

(L.H.)

Durable Press and Abrasion Resistance, by R. D. Mehta and Eun Young Kim, *Textile Asia*, 3, No. 6, 19 (June, 1975).

The application of various formulations consisting of (a) crosslinking agent and/or (b) a polymer former precondensate with or without (c) a film-forming preformed polymer on cotton, cotton/polyester and cotton/wool blend fabrics has been investigated. One of the main objectives was to arrive at a formulation which would give durable press properties with satisfactory strength and comfort retention. The treatment of all the fabrics with a cross-linking agent (a low temperature curing derivative of DMDHEU) and a film-forming preformed polymer (a self-crosslinking acrylate emulsion) resulted in durable press properties with good retention of flex abrasion resistance and also acceptable handle. This treatment also reduced the pilling propensity of the polyester/cotton fabric but did not effect the moisture regains of the various fabrics, although the rate of water absorption was affected.

(L.H.)

REGAIN CHANGES OF GREASY AND CLEAN WOOL STORED IN POLYTHENE BAGS

by E. GEE

ABSTRACT

The half-life of the increasing regain from the bone-dry state of clean and of greasy wool to equilibrium at 65 per cent R.H. while stored in standard core-sample polythene bags has been found to be about 40 days. As equilibrium was approached the half-life increased to about 60 days.

The contributions to the total regain of greasy wool by the clean wool, the suint and the grease plus dirt agreed well with published data. The respective values of grams of moisture per gram of substance were 0,14; 0,33 and 0,035. Typically, 25 per cent of the total moisture content of greasy wool could be attributed to the non-wool components.

INTRODUCTION

The regain of greasy wool is of the utmost importance in the determination of yield from core samples and is particularly relevant to the recent developments in objective measurement. Changing moisture content of such samples when stored in polythene bags prior to yield determination would influence the accuracy of the determination adversely and is therefore also of importance.

When previously discussed at I.W.T.O. meetings this was not considered to be a serious problem. Nevertheless, it is now thought worthwhile to devote some effort to the determination of the rate of change of regain of greasy wool stored in typical sample bags if only to gain a measure of the possible magnitude of the effects and to re-emphasise the time scale of these changes.

EXPERIMENTAL

A sample of merino greasy wool of mean fibre diameter 25 μm and mean fibre length 75 mm was used in all experiments. Several hundred grams of this greasy wool were solvent scoured and yielded 64,8 g of bone-dry "clean" wool per 100 g of bone-dry greasy wool. The suint content was also determined and gave 4,27 g of suint per 100 g of bone-dry greasy wool, and 1,52 g of suint for 100 g of bone-dry "clean" wool.

For the study of the rate of absorption of moisture through polythene, 52 g of bone-dry "clean" wool, and 52 g and 80 g respectively of bone-dry greasy wool were sealed into tared standard core-sample polythene bags of film thickness 55 μm. Each sample was duplicated. The bags were maintained in a constant

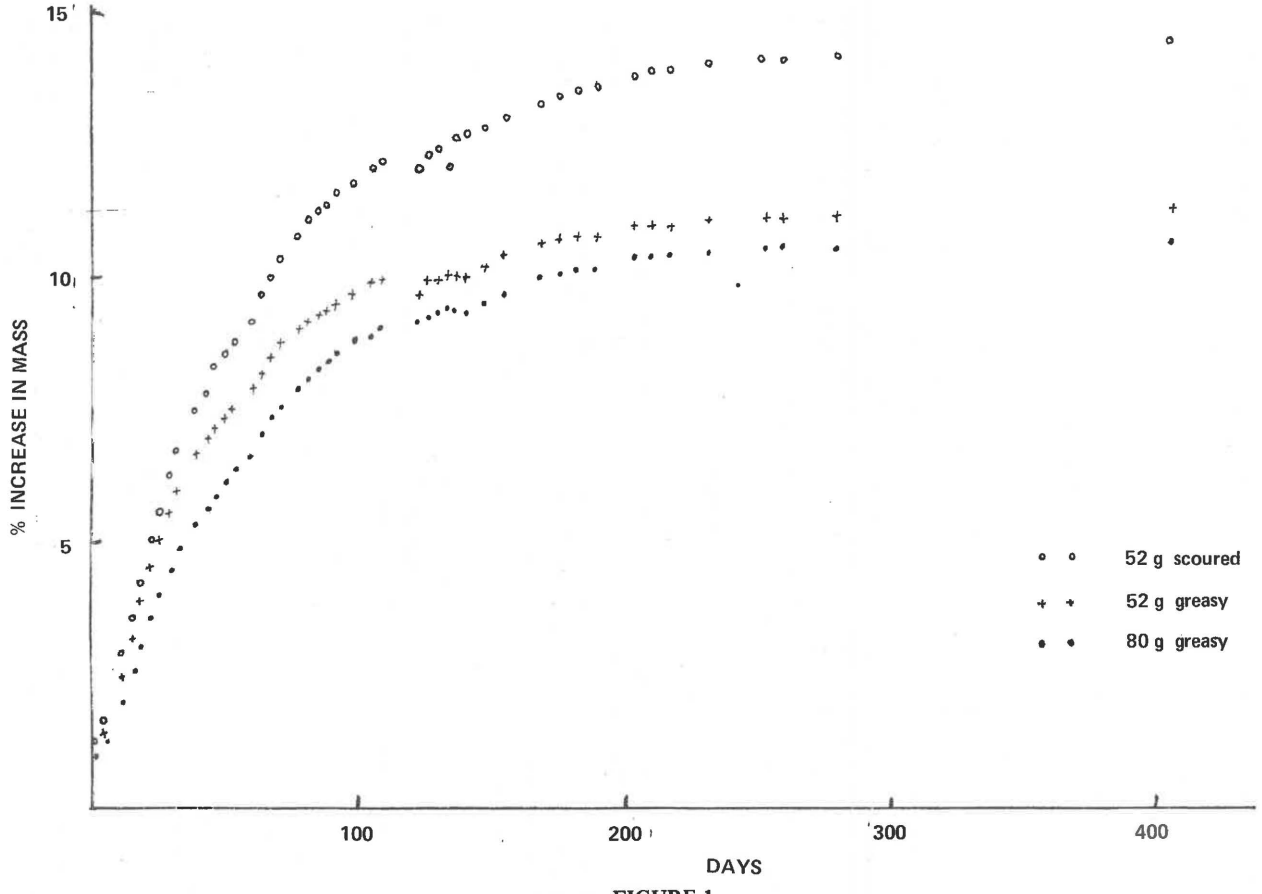


FIGURE 1

Increasing mass vs Days storage at 65% RH and 21°C

atmosphere of 21°C, 65 *per cent* R.H., and were weighed at regular intervals until 407 days had elapsed.

The sample masses were selected so that 80 g of greasy wool contained 52 g of "clean" wool.

RESULTS AND DISCUSSION

Figure 1 shows the mean moisture uptake or regain as a percentage increase of the initial bone-dry sample mass for each pair of samples. Each curve shows a typical decreasing rate of absorption as the amount absorbed increased. After 407 days the samples were removed from their bags and their mass determined daily for a further 21 days. During this time the mass stayed constant. It was concluded that the polythene bag was only a rate determining factor and that the fibres had effectively reached equilibrium after 407 days.

The curves of figure 1 show two discontinuities at approximately 60 days and 140 days. This may be a consequence of a change in the storage conditions although an examination of the records does not confirm it. Alternatively the discontinuities could reflect the addition of three exponential type curves which represent the fast wave and slow wave curves, referred to by Henry[1] and Cassie[2] (related to the heat evolved an absorption of moisture by the wool and to the dissipation of this heat), and a third wave controlled by the polythene barrier.

The exponential type curves of figure 1 can be characterised by determining their "half-lives". For a true exponential curve, half or 50 *per cent* of the ultimate change occurs in a given time, the next 25 *per cent* taking the same time as does the further 12,5 *per cent* and 6,25 *per cent*, etc. By taking the 407 day regain or moisture absorbed value as the equilibrium or ultimate value and by calculating the percentage change in the amount of absorbed moisture, the time for 50, 75 and 87,5 *per cent* of the equilibrium value were found. These three "half-life" values for each sample are given in Table I.

TABLE I

HALF-LIVES AT 50,75 AND 87,5 *PER CENT* CHANGE IN REGAIN

Time in days for	0 to 50%	50% to 75%	75% to 87,5%
80 g greasy	43	43,5	64,5
52 g scoured	38	42	55
52 g greasy	32	36	42

The table shows that the half-lives are not constant but increase progressively with time. This agrees with the three rate determining factors discussed above.

The first practical implication of this data is that when core-samples, in their polythene bags, are stored in an atmosphere different from their original atmosphere a long period of time must elapse before equilibrium with the new condition is attained.

Further, core samples from bales, which are in regain equilibrium with an environment of 45 *per cent* R.H., on being stored in an environment of 65 *per cent* R.H. will increase their regain from about 10 *per cent* to about 14 *per cent.* Such core samples of the size used in this experiment will increase their regain to about 12 *per cent* after 40 days. After the first week their regain will have increased by about one sixth of the ultimate change, to about 10,7 *per cent.* These values relate to small samples loosely packed in the sample bags. In practice core samples are usually tightly packed, masses of two kg being contained in one bag. It is estimated that the effect of the increase in bulk density together with an allowance for the shape of the package will be to lengthen these time values by a factor of about one hundred. Thus during the relatively short periods that core samples remain in their bags there will be a negligible change in their regain. This is in agreement with reports made at recent I.W.T.O. conferences.

Finally, from considerations of the equilibrium regain, it is possible to apportion the total regain to the wool, suint and grease constituents. Table II shows that the greasy wool samples had an average regain of 11,25 *per cent* and the scoured wool samples an average regain of 14,5 *per cent.*

TABLE II

EQUILIBRIUM REGAIN VALUES BASED ON ORIGINAL BONE-DRY MASS

Sample	Regain		Average
	1	2	
80 g Greasy wool	11,5	10,75	11,25
52 g Greasy wool	11,0	11,7	
52 g Scoured wool	14,8	14,2	14,5

By taking into account the yield, suint content and amount of moisture absorbed at equilibrium, the following values in grams are obtained from each sample.

TABLE III

COMPOSITION OF THE WOOL SAMPLES AT EQUILIBRIUM (g)

Original Sample	"clean wool"	suint	"grease +"	moisture
80 g greasy	48,58	3,42	28	9,0
52 g Scoured	51,21	0,79	0	7,54
52 g greasy	31,28	2,22	18,5	5,86

Assuming that the amount of moisture absorbed depends on each of these three terms, then the derived absorption coefficients are:-

0,141 g moisture per 1 g of "clean wool"
0,327 g moisture per 1 g of suint
0,035 g moisture per 1 g of "grease +"

Roberts[3] gives a value for suint at 65 *per cent* R.H. of about 0,37 and quotes Lipson and Black[4] who gave 0,01 to 0,03 for grease and dirt. The above values of 0,33 and 0,035 are in reasonable agreement. The wool value of 0,14 which can be regarded as a regain of 14 *per cent* is also a reasonable value considering the method of its derivation.

If it is assumed that 100 g of dry greasy wool contains 60 g of clean wool, 5 g of suint and 35 g of grease and dirt then, when the wool is in equilibrium at 65 *per cent* R.H., the contributions to the total moisture content will be:

from the wool	8,4 g
from the suint	1,6 g
from the grease + dirt	1,0 g

Thus about 25 *per cent* of the total moisture is derived from the non-wool constituents of the greasy wool.

SUMMARY AND CONCLUSIONS

By measuring the rate of regain of bone dry samples of greasy and of scoured wool contained in standard sealed polythene bags (film thickness 55 μm) and stored in a constant atmosphere of 21°C and 65 *per cent* RH it was found that equilibrium was attained in about 400 days. The time required for half of the ultimate change to occur was about 40 days and this "half-life" increased to about 60 days as equilibrium was approached. After 7 days it is estimated that about one sixth of the ultimate change will have occurred.

Core samples for the objective measurement of clean wool content are usually transported in very tightly packed bags and any change in regain during a few days

will be completely negligible.

Values for the amount of moisture absorbed by clean wool, suint and grease plus dirt were 0,141; 0,327 and 0,035 g per g.

ACKNOWLEDGEMENT

The author wishes to thank the S.A. Wool Board for permission to publish this article.

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CALCULATION OF SHORT FIBRE CONTENT OF WOOL TOPS FROM THEIR MEAN FIBRE LENGTH AND COEFFICIENT OF VARIATION

by E. GEE

ABSTRACT

It is possible to calculate the short fibre content of wool from the values of mean fibre length and CV by using the properties of the Normal Distribution curve, which is assumed when coefficients of variation of fibre length are measured.

It has been shown that the results so obtained correlate well with the results obtained from the WIRA Single Fibre Method but not with those from the Almeter or the WIRA Fibre Diagram.

The mean fibre length and coefficient of variation values obtained from these latter two methods have been reassessed by a paired comparison test.

INTRODUCTION

The length of each of the many wool fibres in a sample from a staple, a fleece, or from a flock is not constant, but varies over a wide range. A useful measure of this is obtained by assuming that the distribution is Normal or Gaussian and calculating the standard deviation, or the coefficient of variation (CV).

An example of the usefulness of this assumption is the work of Rottenburg and Andrews[1] and Whan[2] who have been able to demonstrate that, of the total variance of fibre length from skirted fleeces in a flock, 80 *per cent* may be attributed to variation within staples, the remainder being due to variation between staples and between skirted fleeces within a flock. This knowledge is relevant from the classing of wool and the making of lines of wool for sale at auction.

Further use may be made of the properties of Normal distributions. In this work the aspect of calculating the short fibre content from the mean value of fibre length (m.f.l.) and its coefficient of variation (CV) has been examined, the short fibre content being expressed as the percentage fraction of the fibres whose length is less than 25 mm.

POPULATION DISTRIBUTIONS

A population is a group of objects such as the fibres in a bale of wool that can be identified by some common factor. The group of people in a city are a population in the general sense as are the fibres in a bale of wool. A statistical population is a little more than this. In these two examples the populations could be the weights or masses of each individual person, or the lenghts of each fibre i.e. a quantity as well as a quality description of the items.

TABLE II
COMPARISON BETWEEN OBSERVED AND CALCULATED SHORT FIBRE CONTENT

Method	WIRA Single Fibre		Almeter I		Almeter II		WIRA Diagram	
Sample	Obs.	Calc.	Obs.	Calc.	Obs.	Calc.	Obs.	Calc.
A	13,4	12,7	4,4	11,5	4,5	15,2	4,9	8,1
B	10,9	6,8	7,3	9,3	8,7	7,4	8.8	5.6
C	10,8	8,9	9,6	9,7	7,4	9,9	7,6	8,2
D	8,9	5,6	5,4	8,9	6,2	6,5	5,7	10,0
E	9,6	6,9	6,9	7,8	4,3	9,0	5,7	5,0
F	8,1	8,6	10,0	10,2	6,8	12,7	9,1	10,0
G	8,8	9,0	4,3	10,2	3,0	11,3	2,8	6,7
H	9,5	10,7	5,0	12,7	5,2	11,1	2,1	9,5
I	7,4	8,5	3,9	8,5	4,5	10,9	3,2	6,7
J	9,9	12,3	9,6	13,8	9,9	13,3	4,3	9,9
K	3,7	7,9	1,7	10,9	1,4	10,2	5,3	7,8
L	14,0	14,9	12,4	14,0	10,0	15,2	15,3	11,1
M	9,4	9,3	15,3	14,0	12,1	13,6	10,0	12,7
N	7,3	5,6	9,7	9,5	9,5	9,9	4,5	6,5
O	9,2	9,5	10,1	10,2	7,9	12,1	4,5	7,2
P	4,7	6,1	4,7	9,9	3,5	9,0	5,0	6,1
Q	9,8	12,3	10,9	13,3	8,7	14,0	9,8	12,5
R	11,8	14,7	13,5	14,2	10,9	15,4	8,5	13,3
S	11,0	14,7	10,3	15,2	10,4	14,9	7,7	12,9
T	7,1	9,0	3,7	10,7	4,6	9,7	2,2	7,5
U	10,2	11,1	13,0	13,8	15,9	14,0	13,5	11,9
V	10,2	12,7	14,7	9,5	12,4	9,5	3,3	7,2
W	20,8	19,2	18,6	18,4	18,5	19,5	15,5	14,2
X	8,1	10,4	6,7	7,9	2,7	10,6	3,3	4,9
Y	11,1	9,7	15,1	12,5	12,8	12,5	13,3	8,5

TABLE III

MEAN DIFFERENCES BETWEEN OBSERVED AND CALCULATED SHORT FIBRE CONTENT ($\bar{x}$) AND THE STANDARD DEVIATIONS (σ)

Method	$\bar{x}$	σ	Comment
WIRA Single Fibre	− 0,56	2,16	Difference not real
Almeter I	− 2,4	3,47	Real difference
II	− 3,82	3,51	Real difference
WIRA Diagram	− 1,92	3,13	Real difference

Hence, in general the value for short fibre content calculated from mean fibre length and CV is the same as the measured value – for the Single Fibre method. That some samples showed differences of 4 to 5 units (in either direction) implies that either the measurements are inaccurate, or not all samples conform to the Normal distribution pattern, some deviating in one direction and some in the other. Skew distributions (positive or negative tails) will tend to produce too low a calculated short fibre value, while a negative tail (implying a large observed value) will exaggerate the discrepancy.

For each set of the Almeter results and for the WIRA Diagram results the calculated short fibre content was significantly higher than the measured short fibre content. This suggests that the three methods are not measuring the same properties.

This aspect was investigated further by performing the paired comparisons test between test methods for short fibre content as indicated in the following Table IV.

On average the observed short fibre content values from the Single Fibre method was significantly higher than that from the Almeter and from the Fibre Diagram methods, higher by approximately 2 units and 3 units respectively.

The calculated values, based on the assumption of Normal Distribution, for the Single Fibre method were significantly higher than the Almeter but were not higher than the Diagram method.

Paired comparison tests between the different methods for mean fibre length and for CV gave the following results.

Mean fibre length:

The single fibre method gave higher m.f.l. values (by about 1,2 mm) than the Almeter method. The difference of 0,72 mm for the WIRA diagram method could not be judged to be a real difference.

TABLE IV

PAIRED COMPARISON OF TEST METHODS FOR OBSERVED AND CALCULATED SHORT FIBRE CONTENT VALUES

Data	Methods compared	$\bar{x}$	σ	Comment
Observed Short fibre	Single v Almeter I	1,37	3,39	Real difference
	Single v Almeter II	2,36	3,24	Real difference
	Single v Diagram	3,40	3,61	Real difference
Calculated Short fibre	Single v Almeter I	-1,79	1,98	Real difference
	Single v Almeter II	-2,11	1,63	Real difference
	Single v Diagram	0,71	2,66	Difference not real

TABLE V

PAIRED COMPARISON OF TEST RESULTS FOR MEAN FIBRE LENGTH AND CV

	Single Fibre Method versus	$\bar{x}$	σ	Significance
Mean fibre length	Almeter I	0,95	1,81	Real difference
	Almeter II	1,32	1,91	Real difference
	Diagram	0,72	2,12	Not Real
CV	Almeter I	-2,18	3,32	Real difference
	Almeter II	-2,77	2,84	Real difference
	Diagram	2,76	3,94	Real difference

The single fibre method gave lower values for CV (by about 2,5) than the Almeter and higher values (by about 2,8) than the WIRA diagram method.

Lack of agreement between the observed and calculated short fibre content values probably reflects a departure from a normal distribution of the measured parameters.

SUMMARY AND CONCLUSION

Knowledge of the short fibre content of wools is useful e.g. for the Top-making stages of carding and combing and in the spinning stage.

That the mean value and CV are widely used suggests that the distribution of fibre length is Normal or Gaussian or is close enough to justify the assumption.

If only mean fibre length and CV is known then it is possible to calculate, by assuming a normal distribution, a value for the short fibre content. Comparisons of observed and calculated values have shown some agreement. Where they differ implies that there is sufficient departure from Normality in the measured distributions to make the calculated value for short fibre content inaccurate.

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A PRELIMINARY NOTE ON THE CENTRIFUGAL TREATMENT OF MOHAIR SCOURING LIQUORS

by D. W. F. TURPIE and S. A. MUSMECI

ABSTRACT

Some laboratory experiments on the centrifugal treatment of mohair scouring liquors indicated that the grease recovery potential from such liquors was rather poor. The choice of non-ionic detergent had a noticeable effect on the results obtained.

INTRODUCTION

The efficiency of grease recovery from scouring liquors by centrifugal means is subject to many limitations. Work has been carried out by many laboratories throughout the world on scouring liquors obtained from raw wool scouring. It has been shown that higher recoveries of wool grease in a centrifuge may be obtained if detergent dosing is minimised during scouring, a detergent with a relatively low density is employed and excessive agitation is avoided. The highest recoveries were also obtained with raw wools containing relatively low proportions of oxidised matter in the wool-grease constituent[1].

As the fleece grows and is exposed to the atmosphere the upper layers of grease are oxidised but the inner layers near the skin remain unoxidised. In the scouring process, the oxidised grease forms extremely stable emulsions with the detergent used which are difficult to separate, while the unoxidised grease forms relatively unstable emulsions which are easily separated in a commercial centrifuge[2]. Research carried out on various types of wool has shown, for example, that the 'tip' wool from a 64's merino gave a centrifugal yield of wool grease of only 21 *per cent* whereas the 'base' wool gave a yield of 59 *per cent*, and in another case comeback lambs gave a yield of 65 *per cent*[2]. Further work has demonstrated that there is a linear relationship between the efficiency of recovery of grease in a centrifuge and the methanol-insoluble fraction ('unoxidised' grease) in the grease extracted from raw wool[3].

Although anhydrous wool grease can be recovered by a single centrifuging of a scour liquor, yield and quality are improved if a three-stage process is used[2]. Variations of this process may be found. The first stage, for example, may be confined to clarification only with separation taking place at the second operation. Generally, the first separator produces a cream containing about 15 *per cent* of

wool grease, and this is concentrated in the subsequent operation(s). The recovery has been defined as

$$\frac{R_fC_f - R_eC_e - R_sC_s}{R_fC_f} \times 100$$

where R = flow rate
C = concentration of grease ,
subscripts f, e and s refer to the feed liquor, effluent and sludge respectively[4]. This represents the maximum possible (theoretical) recovery of anhydrous grease since, when the cream is re-centrifuged with water in a secondary operation, some of the droplets of 'non-recoverable' grease will still not coalesce and will be discharged along with the aqueous phase.

While merino wool contains somewhere in the region of about 15 *per cent* of grease, mohair contains a much smaller amount, generally only about four to six *per cent*. By virtue of its open fleece structure on the goat, it is more exposed to weathering than wool and, therefore, one could expect the wax to be oxidised to a greater extent[5]. This being so, it would seem likely that the grease recovery potential from liquors derived from the scouring of mohair would not be very promising. Nevertheless, it was decided to carry out a few laboratory experiments in an attempt to gain some sort of indication of the grease recovery potential from one or two locally available types of mohair.

EXPERIMENTAL

Raw Materials

Two different samples of mohair were selected. One sample was taken from a lot of Adult hair of mean fibre diameter 39 μm and the other from a lot of Locks of mean fibre diameter 37 μm. Each of these samples was cut up with scissors into small pieces and thoroughly mixed by hand. Sub-samples of these were then used for the experiment.

Scouring

A sub-sample of mass 100 g of one of the above lots was scoured for several minutes in one litre of water at 70° C containing 0,1 *per cent* m/v of a non-ionic detergent. The hair was squeezed from time to time and agitated with a glass rod to ensure that most of the grease was removed from the fibre. The liquor was strained through wire mesh and an aliquot taken for composition analysis. Three further aliquots were taken, heated to 90°C, and then centrifuged (in 200 ml centrifuge tubes), commencing while hot, for 30 minutes at 3 200 r/min in a laboratory centrifuge type BHG 700. These were used for the determination of grease, detergent and methanol-insoluble matter in the cream (light phase) and

effluent (intermediate phase), and for the determination of grease and detergent in the sludge (heavy phase). Practical difficulties precluded accurate determination of the methanol-insoluble matter in the sludge and this was, therefore, estimated by difference. The experiment was repeated for another non-ionic detergent, and for both types of raw material.

One of the non-ionic detergents which was selected could be described as a nonylphenyl ethylene oxide derivative. This detergent had a relative density (specific gravity) of 1,04. The other non-ionic detergent could be described as a primary alcohol ethylene oxide derivative. This had a relative density of 0,99 and was also bio-degradable.

The grease contents of the cream, effluent and sludge were measured along the lines of the rapid method suggested by Veldsman[6] in which a suitable aliquot is transferred to a rectangular piece of filter paper and dried quickly over a hot plate; then the paper is placed in a micro-soxhlet and the grease extracted (in this case, for 30 minutes) with dichloromethane. The solution then is transferred to an aluminium tray and any grease remaining in the solvent container is rinsed into the aluminium tray with dichloromethane. The solution in the aluminium tray then is evaporated to determine the grease.

The detergent contents of the cream, effluent and sludge were determined after evaporation of the water from an aliquot of each. In the case of the cream and sludge, this was carried out in a drying oven at 105° C whereas for the effluent the aliquot was first evaporated to a syrup on a hotplate under an airstream. The method used for the determination was a rapid colorimetric method using cobalt-thiocyanate reagent[7] but the test procedure which was followed was, however, slightly modified in the sense that, instead of dispersing the sample in water, the test solution was prepared using dichloromethane as solvent[8].

The methanol-insoluble matter in the grease was determined in a manner similar to that followed by McCracken and Chaikin[1], suitably scaled down to suit the relatively small amounts of grease available for testing.

From the above determinations for grease, detergent and methanol-insoluble matter, the relative proportions of each in the three phases were calculated. The entire series of experiments was repeated twice.

RESULTS AND DISCUSSION

The liquors obtained from hand-scouring the Adult hair and the Locks were analysed for grease content, detergent content and for the methanol-insoluble proportion of the grease (hereafter referred to loosely as 'unoxidised' grease). These results are given in Table I. From this table it can be seen that the grease content of the liquor produced from the Adult hair was about 0,5 *per cent* and was slightly higher than that for the Lox, which was 0,4 *per cent*. The added amount of non-ionic detergent, namely 0,1 *per cent*, was almost entirely accounted for in both cases. A significant difference was found in the results for unoxidised grease. The Adult hair had a fairly low proportion of unoxidised grease at 33 *per cent*, but the

Lox had even less than half this amount, at 15 *per cent*. Similar, though not identical, experiments referred to previously[1] had shown that, when 0,2 *per cent* non-ionic detergent was used, the predicted maximum recovery of grease from a liquor in which the grease comprised less than about 29 *per cent* of unoxidised grease was zero. Although it is appreciated that this cannot be extrapolated to the present case, the inference is that a negligible recovery may be expected.

TABLE I

ANALYSES OF LIQUORS AFTER SCOURING

	Liquor from Adult Hair	Liquor from Locks
Grease content (%) (m/v)	0,54	0,41
Detergent content (%) (m/m)	0,093	0,099
Methanol-insoluble proportion of grease (%) (m/m) ("unoxidised" grease)	33	15

The distribution of grease, unoxidised grease and detergent in the three phases obtained after centrifugal treatment of the liquors produced from the Adult hair is given in Table II. The results show that, on average, about 25 *per cent* of the total grease present went into the sludge, and about 54 *per cent* went into the effluent, leaving only about 21 *per cent* in the cream. The average results for detergent B showed that, when this particular detergent was used, the amount of grease recoverable as a cream tended to be higher than when detergent A was used. The results for unoxidised grease show that a fairly high proportion of this grease found its way into the sludge. When detergent A was used as the scouring agent, it appeared that about 55 *per cent* of the unoxidised grease found its way into the sludge, whereas when detergent B was used, the average amount of unoxidised grease in the sludge appeared to be much lower. The results show that, when the latter detergent was used, the reduction in the amount of unoxidised grease in the sludge was accompanied by a noticeable increase in the amount of unoxidised grease in the cream. Thus, whereas the cream obtained from the liquor produced using detergent A contained about 20 *per cent* of the total available unoxidised grease, the cream obtained from the liquor produced using detergent B contained about 37 *per cent* of the total available unoxidised grease. The results for detergent show that the bulk of the detergent was concentrated in the effluent layer, amounting, on average, to about 78 *per cent*. About 14 *per cent* of the detergent was distributed in the sludge layer, but it was clear that when detergent B was used, the amount of detergent in the sludge was lower than when detergent A was used.

TABLE II

DISTRIBUTION OF GREASE, METHANOL-INSOLUBLE MATTER AND DETERGENT IN THE THREE PHASES FROM THE CENTRIFUGE – ADULT HAIR

		GREASE			METHANOL-INSOLUBLE MATTER ("UNOXIDISED" GREASE)			DETERGENT		
		Detergent A	Detergent B	Average	Detergent A	Detergent B	Average	Detergent A	Detergent B	Average
Percentage in the cream	Test 1	15,6	26,5		24,9	36,2		7,4	10,5	
	Test 2	21,7	21,7		14,9	37,3		7,3	8,2	
	Average	18,7	24,3	21,5	19,9	36,8	28,3	7,4	9,4	8,4
Percentage in Effluent	Test 1	58,3	46,8		24,9	38,6		74,1	81,6	
	Test 2	51,7	58,7		25,0	22,6		75,0	80,8	
	Average	55,0	52,8	53,9	25,0	30,6	27,8	74,6	81,2	77,9
Percentage in Sludge	Test 1	26,1	26,3		50,2	25,2		18,5	7,9	
	Test 2	26,6	19,6		60,1	40,1		17,7	11,0	
	Average	26,3	22,9	24,6	55,2	32,7	43,9	18,0	9,4	13,7
	TOTAL	100	100	100	100	100	100	100	100	100

TABLE III

DISTRIBUTION OF GREASE, METHANOL-INSOLUBLE MATTER AND DETERGENT IN THE THREE PHASES FROM THE CENTRIFUGE – LOCKS

		GREASE			METHANOL-INSOLUBLE MATTER ("UNOXIDISED" GREASE)			DETERGENT		
		Detergent A	Detergent B	Average	Detergent A	Detergent B	Average	Detergent A	Detergent B	Average
Percentage in the cream	Test 1	7,4	11,4		20,5	47,1		4,1	5,6	
	Test 2	7,1	10,8		14,3	33,3		3,8	4,4	
	Average	7,3	11,2	9,2	17,4	40,2	28,8	4,0	5,0	4,5
Percentage in Effluent	Test 1	73,0	83,8		53,5	27,5		82,7	86,5	
	Test 2	71,4	73,2		45,7	40,4		85,8	87,8	
	Average	72,2	78,5	75,4	49,6	34,0	41,8	84,2	87,2	85,7
Percentage in the Sludge	Test 1	19,6	4,8		26,0	25,4		13,2	7,9	
	Test 2	21,4	15,9		40,0	26,3		10,4	7,8	
	Average	20,5	10,3	15,4	33,0	25,8	29,4	11,8	7,8	9,8
	TOTAL	100	100	100	100	100	100	100	100	100

The distribution of grease, unoxidised grease and detergent in the three phases obtained after centrifugal treatment of the liquors produced from the Locks is given in Table III. These results show that much less grease was recovered as a cream from the Locks than was the case with the Adult hair, being on average only about nine *per cent*. There was, however, also less grease in the sludge than for the Adult hair, the bulk of the grease (about 75 *per cent,* on average) being concentrated in the effluent. Results for detergent B again showed that when this particular detergent was used, the amount of grease recoverable as a cream tended to be higher than when detergent A was used. Results for unoxidised grease again show fairly high proportions in the sludge, though not as high as with the Adult hair, and again show a tendency to reduce when detergent B was used. The results also show that, when the latter detergent was used, the amount of unoxidised grease in the cream was noticeably increased. The bulk of the detergent was concentrated in the effluent layer, amounting, on average, to about 86 *per cent*. About 10 *per cent* of the detergent was distributed in the sludge, but it was clear that when detergent B was used the amount of detergent in the sludge was lower than when detergent A was used.

SUMMARY AND CONCLUSIONS

Some laboratory experiments were carried out on the centrifugal treatment of mohair scouring liquors in an attempt to gain some sort of indication of the maximum grease recovery potential from two locally available types (Adult hair and Locks) under a particular set of conditions. The experiments were repeated for two different non-ionic detergents.

Average results for the two different detergents showed that the amount of grease recoverable as a cream was about 21 *per cent* from the Adult hair and about nine *per cent* from the Locks. Further losses would occur during secondary centrifugal treatment (not considered here) in the production of anhydrous grease. In the light of this, it is clear that the grease recovery potential from mohair scouring liquors is rather poor, though perhaps not quite as poor as might have been envisaged from the low proportion of methanol-insoluble matter in the grease extracted from the raw hair. The choice of non-ionic detergent had a noticeable effect on the results obtained. These results appear worthwhile following up.

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MECHANICAL HARVESTING AND GINNING OF COTTON IN THE U.S.A. – SOME RECENT RESEARCH FINDINGS

by DE V. ALDRICH

INTRODUCTION

The introduction of mechanical harvesting of cotton in South Africa not only necessitated the need for additional cleaning equipment at the local gins, but also raised the question of what effect the harvesting process itself and subsequent additional cleaning would have on the lint quality. The effects of excessive cleaning on cotton quality have been the subject of many research efforts and still remain the subject of intensive discussion.

The United States Department of Agriculture (USDA) is actively engaged in research covering both the above-mentioned aspects of harvesting and ginning. The purpose of this article is to summarise briefly and emphasise some of the findings that were published by the USDA in the last few years.

CLEANING AT THE GIN

The use of lint cleaners in cotton gins has become accepted practice, with more than 90 *percent* of the gins in the U.S.A. employing one or more saw type lint cleaners[1]. This type of cleaner is now recognised as the standard type of cleaner in the ginning industry. Of the 4625 gins in the U.S.A. employing lint cleaning in 1967, 60 *per cent* had two stages of lint cleaning and 16 *per cent* had three stages[2].

Lint cleaning experiments conducted by Mangialardi and Griffin[3] showed that the relationship between decrease in trash content and the resultant grade improvement obtained by saw type lint cleaners was highly significant. These improvements were, however, accompanied by highly significant decreases in the length characteristics of the fibre (for example classer's staple length and uniformity ratio), and also by highly significant increases in nep count.

Experiments by LaFerney *et al*[4] indicated that substantial quantities of impurities may be left in the ginned lint, and then removed during mill processing, with no adverse effect on processing performance. These findings suggest that a decrease in the amount of lint cleaning at the gin (with a concommitant decrease in grade) might be acceptable if this reduced cleaning results in an improvement in staple length, fewer neps and improved spinning performance.

Ross and LaFerney[5] investigated the economic implications of trash removal from cotton at the gin. They concluded that there is no economic advantage for the ginner by over-emphasizing the removal of trash at the ginning process, but rather a disadvantage. The textile manufacturer may gain by the use of cotton which received minimum to average gin cleaning.

Mangialardi[1] reported on an extensive investigation of the effect of saw speed and feed roller speed on the trash removal and on fibre length distribution of cleaned lint. The conclusions of the author can be summarised as follows:

(i) Increasing the combing ratio (ratio of the surface speed of the saw to that of the feed roller) by increasing the saw cylinder speed to 1 400 r/min (saw diameter 300 mm) resulted in considerably more fibre breakage compared with speeds of 800 and 1 100 r/min. Similar results were obtained for a constant combing ratio with increasing saw cylinder speeds.

(ii) Although saw cylinder speeds of 400 and 600 r/min resulted in lower fibre breakage the results were generally not significantly lower than those for 800 and 1 100 r/min. These lower speeds, however, resulted in significantly higher trash contents and lower grades.

(iii) A saw speed of 1 400 r/min resulted in a significant decrease in the long fibre content as well as in the classer's staple length, and in a high nep content compared with saw speeds of 800 and 1 100 r/min. The slight decrease in trash content of the lint produced at 1 400 r/min was not reflected in the classer's grade.

(iv) For maximum trash removal commensurate with minimum changes in fibre length characteristics saw speeds of 800 to 1 100 r/min (for a 300 mm diameter) and combing ratios of 12,5 to 37,5 are recommended. A saw speed of 800 r/min is preferred for minimum fibre damage, but if additional cleaning is preferred, 1 100 r/min may be used together with combing ratios around 12,5.

Low moisture content of the lint is preferred for maximum cleaning efficiency[3], but the fibres are then more prone to damage. High moisture contents are accompanied by decreased cleaning efficiency but the fibres are stronger and less susceptible to damage. It is feasible to develop automatic recording systems for the moisture content of the lint and to use these measurements to control the speed of the saw cylinder and combing ratio to give maximum cleaning and minimum fibre damage at the particular moisture content of the lint going through the cleaner.

It is well-known that inadequate removal of impurities before ginning can reduce the ginning capacity and contribute to the trash content of the lint. Two machines that are commonly used as seed cotton cleaners are the *stick machine* and *bur machine*. The findings of Baker[6] on a comparative study of the cleaning efficiency of these two machines can be summarised as follows:

(i) The *stick machine* was more effective in the removal of sticks, burs and fine trash than the *bur machine*.

(ii) Excessive quantities of cotton were lost by the *stick machine* when it was used as the first machine in the cleaning sequence.

(iii) The *bur machine* pulverised some of the larger trash particles and produced more fine trash than it removed.

(iv) No differences were observed in the length characteristics and grade when cottons from the two machines were compared.

Tests have shown that there is no correlation between the dust content and the method of ginning (saw gin or roller gin), but that the method of harvesting has a direct influence on the dust content[7]. Mechanical harvesting results in a much higher dust content of the cotton lint than hand picked cotton. This is of importance when judged against the emphasis that is placed on the removal of *dust* and *fine trash* in cotton used for *open-end* spinning. Several machine manufacturers have already developed blowroom equipment for the cleaning of trashy cottons where much emphasis is placed on the removal of very fine dust with specific reference to open-end spinning. These developments in blowroom equipment are also of interest to the ginner, since the successful use of open-end spinning for lower quality cottons requires a sliver of exceptional cleanliness.

The importance of cleaning mechanical harvested seed cotton for efficient ginning and acceptable lint quality is illustrated by the persistent efforts to improve the cleaning efficiency of cleaning systems.

Laird and Baker[8] reported on a new cleaning principle that has been included into a machine called the *limb and stalk remover.* A saw cylinder is used in conjunction with a combing cylinder to remove limbs and stalks from seed cotton. The saw cylinder consists of saw-toothed discs stacked on a mandrel with a spacer between each disc. The combing cylinder, which rotates in the opposite direction, has steel fingers which operate in the spaces between the discs. A combing action is thus achieved, in addition to the "sling-off" action used in a conventional stick cleaner. The cleaning efficiency of the limb and stalk remover was compared with that of the primary saw (first saw) of a conventional stick cleaner. The combing mechanism gave significant increases in stick removal efficiency, especially when the impurity content of the seed cotton was high.

The combing mechanism of the limb and stalk remover, however, resulted in a considerable increase in the loss of seed cotton. Before the machine can be put into practical use either the amount of seed cotton lost together with the trash will have to be reduced, or better reclaiming systems are to be developed, or both.

Mechanical Harvesting

Baker *et al*[9] studied the effects of mechanical harvesting and the conveying system of cotton picker (the transport of the seed cotton from the spindle to the basket) on the fibre and seed quality and on cleaning and spinning requirements. A two-row tapered spindle picker was used for these studies.

Cotton collected after passing through the picker-conveying system was compared with cotton collected immediately after doffing from the spindles.

The pneumatic-conveying system on a cotton picker which subjects the seed cotton to impact from the conveying fan blades as well as the picker basket grates almost doubles the amount of visible damage to cotton seed. The ginning

machinery creates an additional 7 *per cent* of damaged seed. The fan of the cotton picker also sucks in more foreign matter together with the harvested seed cotton, thereby increasing the trash content of the seed cotton.

Cyclone collector to remove dust from waste air

Ginning plants require large volumes of high-pressure air to move the seed cotton and lint through the plant. Separating and collecting the fine dust particles from large volumes of air is a sizeable problem if air pollution is to be minimised or prevented.

Wesley *et al*[10] determined the particle size composition of normal gin trash from mechanical harvested cotton and studied the collection efficiency of a small-diameter cyclone. Measurements showed that the particle size of 96,5 *per cent* of the total gin trash was bigger than 150 μm* while the particle size of 3,2 *per cent* of the total was between 30 and 150 μm, whereas 0,3 *per cent* had a particle size smaller than 30 μm. Further experiments conducted over a three-year period at the U.S. Cotton Ginning Research Laboratory at Stoneville, Mississippi showed that the small-diameter cyclone is virtually 100 *per cent* efficient for removing those particles larger than 20 μm in diameter. Particles smaller than 20 μm were partly collected in decreasing amounts as they became smaller. The air velocities significantly affected the cyclone's collection efficiency at approximately 919 metres/min (3 000 ft/min). For normal input concentrations (less than 250 grams per cubic metre), trash size and input concentrations had a significant effect on the collection efficiency of the cyclone.

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*1 μm = 10^{-6} metre

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THE CORRELATION BETWEEN THE ALKALI CENTRIFUGE VALUE OF COTTON AND MATURITY RATIO, FIBRE LINEAR DENSITY AND MICRONAIRE VALUE, AS DETERMINED ON THE IIC/SHIRLEY FINENESS-MATURITY TESTER

by R. E. HORN and DE V. ALDRICH

ABSTRACT

The alkali centrifuge values (ACV), maturity ratios, Micronaire values and fibre linear densities (millitex) have been obtained for 50 different local cottons. Excellent correlations were found to exist between ACV and maturity ratio, and between ACV and Micronaire value, whilst a slightly lower value for the correlation coefficient was obtained between ACV and fibre linear density. The 95 per cent confidence limits of a future prediction or determination was found to be greater than ± 10 per cent in all three cases.

INTRODUCTION

Immature cotton fibres are less rigid than mature ones and consequently tend to tangle into neps during mechanical processing. The greater the number of immature fibres present, the more neppy the final fabric will appear. The "maturity ratio" (M), defined elsewhere[1, 2], is a measure of the proportion of mature fibres in a cotton and with most cottons, this problem tends to arise only when the value of M falls below 0,80[1]. It is important, therefore, that methods should be available in which M can be evaluated *accurately* and *quickly* in a *routine manner.* Although the most reliable method involves classifying fibres, under the microscope, which have been swollen in 18 *per cent* NaOH into the groups normal, dead and thin-walled (this is the U.K. method[3])*, this is however, a slow and laborious technique and requires much skill of the test operator.

As a consequence, more rapid methods have been devised and one in particular involves the measurement of the air flow through a porous plug of cotton fibres. Many instruments[6, 7, 8, 9], which are quick and simple to operate, have been developed on this principle. Unfortunately, however, the maturity ratios so obtained tend to be less accurate as they are affected by fibre fineness. Recently, however, the IIC/Shirley Fineness-Maturity Tester has been developed which, it is claimed, provides maturity ratios and fineness values independently of one another. This instrument lately has been studied by Aldrich[10].

More recently, the alkali centrifuge technique, devised by Marsh, Merola and Simpson[11], has been examined by Venkatesh and Dweltz[12]. These workers

*There is also the American method[4] which classifies the swollen fibres into only two groups, mature and immature from which the "percentage mature fibres" (PM) is calculated. PM and M are related by a simple formula[5].

found that a linear relationship existed between the *alkali centrifuge value* (ACV) and percentage maturity (PM), and concluded that this was a "simple, fast and highly reproducible test method for determining the maturity of cotton fibres". The object, therefore, of this study was to ascertain how well the ACV correlated with the maturity ratio, fibre linear density and Micronaire value, as estimated on the IIC/Shirley Fineness-Maturity Tester, for cottons grown locally.

EXPERIMENTAL

The 50 cotton samples used were of the American Upland type, *Gossypium hirsutum*, grown in South Africa. All the samples were passed through a Shirley Analyser before testing.

The *maturity ratios, fibre linear densities (millitex)* and *Micronaire values* were estimated on an IIC/Shirley Fineness-Maturity Tester. Two determinations were made for each sample and the mean taken.

The *alkali centrifuge values* were determined by the method due to Marsh *et al*[11] and Honald and Grant[13]. Cotton fibres (approximately 0,25 g accurately weighed) were vigorously shaken with 20 ml of 15 *per cent* NaOH (w/v) until thoroughly wetted out and then agitated for 15 min, at room temperature, on a mechanical shaker. The fibres were filtered through a Gooch crucible, transferred to a No. 3 glass-sintered crucible and centrifuged in sealed tubes for 10 min at 1 400 r/min (radius of centrifuge, 13 cm). The fibres then were placed in a tared weighing bottle, accurately weighed, and the ACV calculated from equation[1].

$$\text{ACV} = \frac{\text{Increase in mass of the fibres}}{\text{Original mass of the fibres}} \times 100\% \quad \ldots\ldots\ldots\ldots (1)$$

The mean of three determinations was calculated for each sample.

RESULTS AND DISCUSSION

The coefficient of variation of three determinations of ACV was calculated as 0,97 *per cent* and this yielded, at the 95 *per cent* confidence limits, a mean error of ± 1,1 *per cent*. These values compare favourably with those found by other workers; Landstreet[14], for instance, obtained a coefficient of variation of 0,68 *per cent* in his study whilst Venkatesh *et al*[12] obtained a value of 2,1 *per cent*. There is little doubt that the reproducibility of the alkali centrifuge technique is very high.

In Figures 1, 2 and 3, the ACV's are plotted against Micronaire values, fibre linear densities (millitex) and maturity values respectively for the 50 cotton samples. Also included are the linear regression lines ($y = mx + c$) and the 95 *per cent* confidence regions (the shaded areas) for a future prediction or determination.

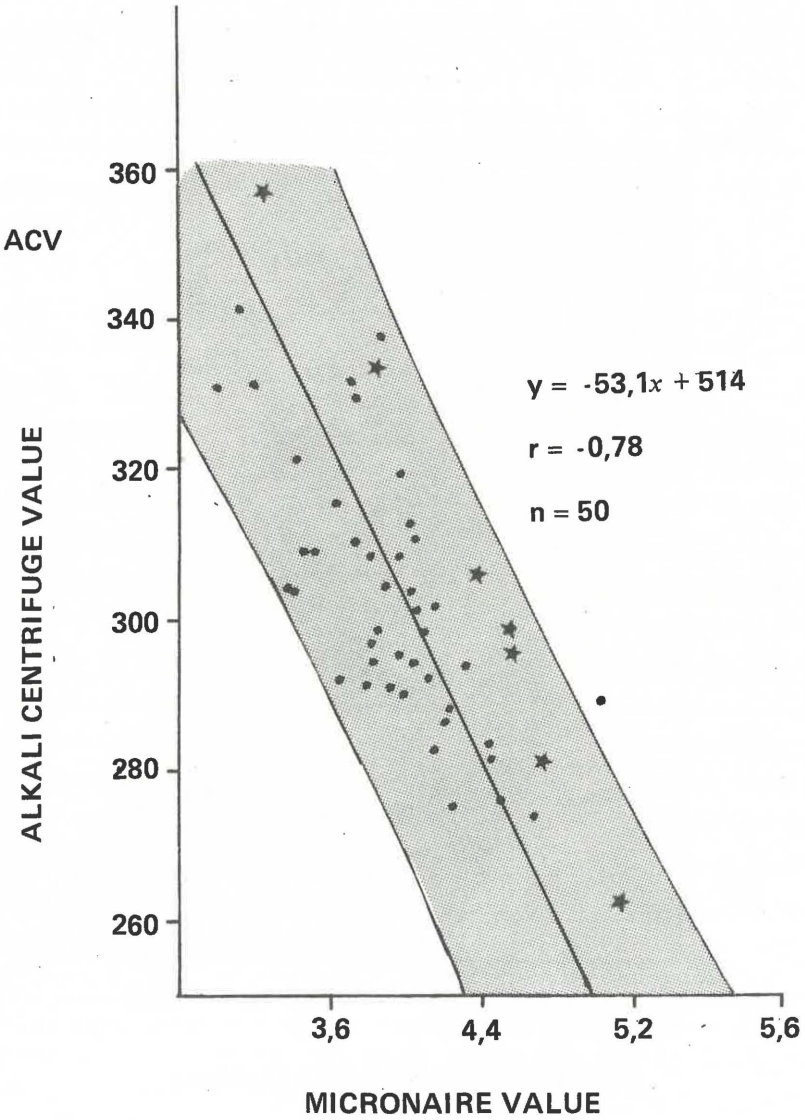

FIGURE 1
The Relationship between Alkali Centrifuge Value (ACV) and Micronaire Value

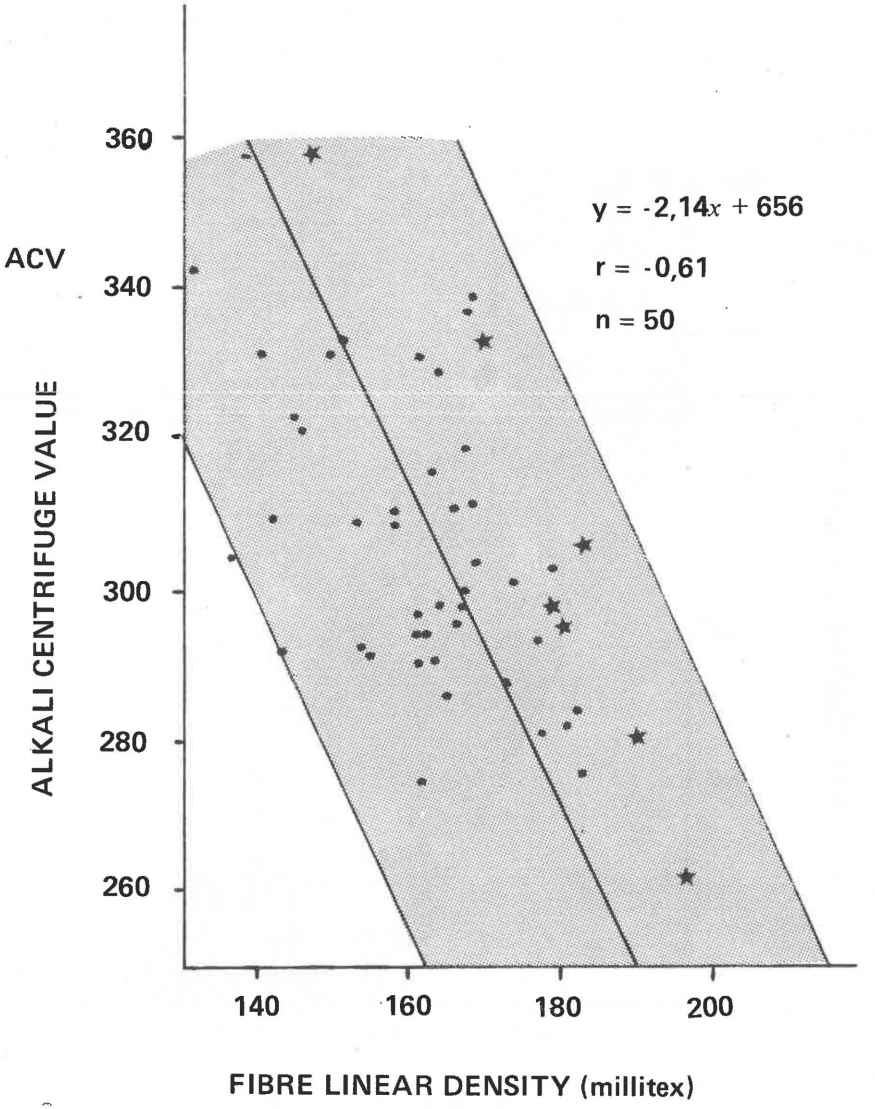

FIGURE 2

The Relationship between Alkali Centrifuge Value (ACV) and Fibre Linear Density (Millitex)

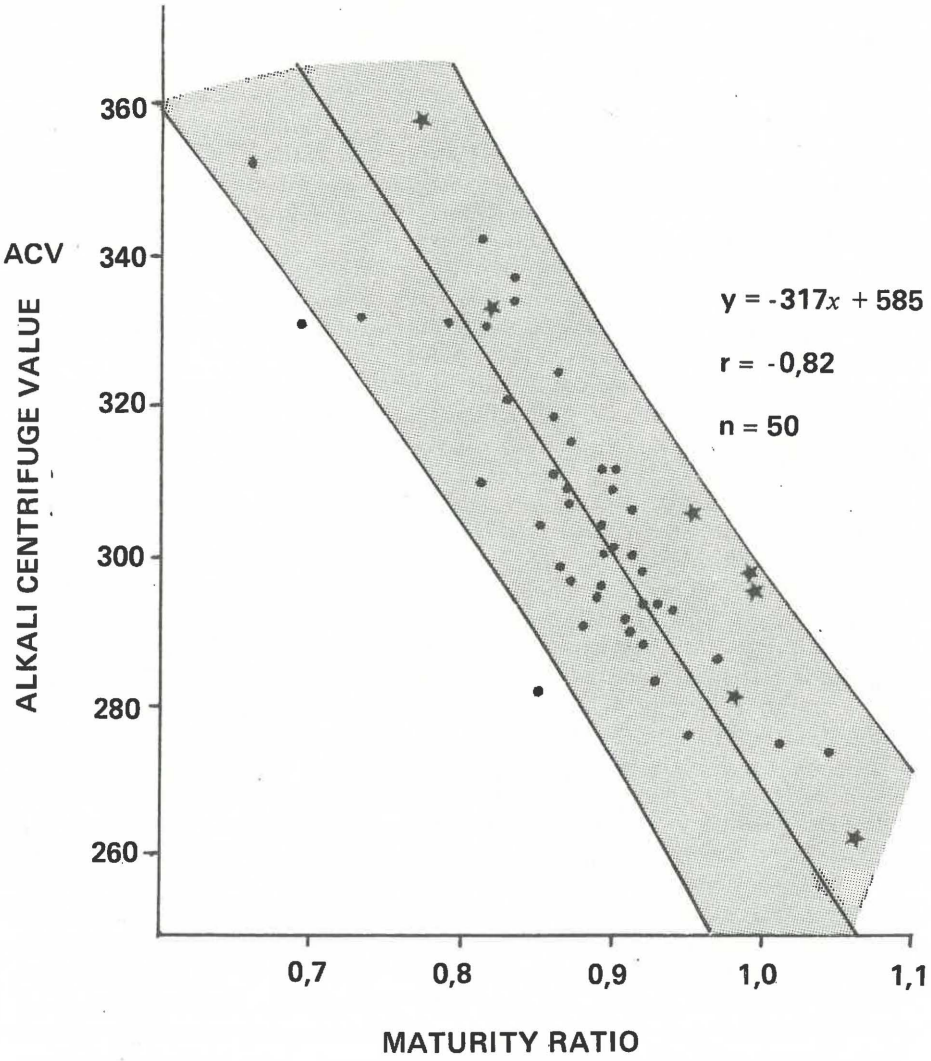

FIGURE 3
The Relationship between Alkali Centrifuge Value (ACV) and Maturity Ratio

The highest value for the correlation coefficient (r) was obtained from the plot of ACV against maturity ratio (r = -0,82, Fig. 3). This is lower than the value of r = -0,97 obtained by Venkatesh *et al*[12] when they correlated the ACV with percentage maturity, determined by examining NaOH swollen fibres under a microscope[4]. In our experiments, however, the maturity ratios have been estimated using the IIC/Shirley Fineness-Maturity Ratio Tester, and it has been shown by the manufacturers, for 100 cotton samples, that maturity ratios obtained on this instrument yield a correlation coefficient of 0,934 with maturity ratios calculated from the classification of swollen fibres.

An excellent correlation also was obtained between the ACV's and Micronaire values (Fig. 1, r = -0,78) which is in agreement with the work of Marsh *et al*[11]. They showed that the ACV was correlated with the Arealometer reading although they did not calculate the correlation coefficient.

In Fig. 2, it can be seen that there was not quite so good a correlation (r = -0,61) between ACV and fibre linear density (millitex). This was not unexpected as similar observations have been made by Marsh *et al*[11], Landstreet[14] and Venkatesh *et al*[12].

For all three plots, the 95 *per cent* confidence limits for future predictions or determinations (shaded areas) are all rather broad. For an ACV of 310, for example, both the Micronaire value and the fibre linear density are predicted with an accuracy of ± 16 *per cent* which is probably too great an error to be acceptable to most workers. The figure for maturity ratio is ± 11 *per cent* which means that a cotton, with this ACV, will have a maturity ratio of between 0,78 and 0,96, that is, it could be mature or immature. It is possible, however, to state from these results that a cotton, having an *ACV of 290 or less,* will probably have a maturity ratio greater than *0,85* and will be *mature*. On the other hand, a cotton with an ACV of *345 or more* will likely be *below average* in maturity. Little can be stated with confidence concerning cottons with ACV's *between 290 and 345,* and it is unfortunate that the bulk of the cottons studied fell into this region.

A useful feature of the alkali centrifuge technique is its ability to indicate cottons which have suffered attack by micro-organisms[15, 16]. A cotton sample which has been imperceptibly damaged by mildew will yield a higher ACV than an undamaged sample, and yet the two will show little difference in Arealometer readings. It was, therefore, necessary to check that none of the samples studied here had suffered such attack and given false 'high' ACV's. As it would have been too time-consuming to examine all the cotton samples, only those (marked with *'s in Figures 1–3) which showed large deviations *above* the regression lines were studied. For this purpose, the Congo Red Test[17, 18] was employed.

Of the seven samples that were investigated, only two showed fibres which had suffered microbial attack and in both cases the percentage of such fibres was less than 4 *per cent* of the total number examined. This is a very low figure and indicates little or no damage of the cotton. It was concluded, therefore, that it seemed unlikely that any of the fifty cotton samples studied had been damaged by micro-organisms to such an extent as to affect their respective ACV's.

SUMMARY

The alkali centrifuge values, maturity ratios, Micronaire values and fibre linear densities (millitex) have been obtained for 50 different locally-grown American Upland cottons. Correlation coefficients of -0,82 and -0,78 were obtained between ACV and maturity ratio and between ACV and Micronaire value respectively, whilst a lower value of -0,61 was obtained between ACV and fibre linear density (millitex). The 95 *per cent* confidence limits, for a future prediction or determination was found to be ± 16 *per cent* between both ACV and Micronaire, and ACV and fibre linear density (millitex) whilst between ACV and maturity ratio a figure of ± 11 *per cent* was obtained.

ACKNOWLEDGEMENT

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THE USE OF PROPRIETARY NAMES

The fact that instruments with proprietary names have been used in this investigation in no way implies a recommendation to the exclusion of others which may be suitable.

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