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Removal of Vegetable Matter from Scoured Wool during the Processing of Wool/Cotton Blends on the Cotton System

by

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REMOVAL OF VEGETABLE MATTER FROM SCOURED WOOL DURING THE PROCESSING OF WOOL/COTTON BLENDS ON THE COTTON SYSTEM

by J. D. SPENCER and H. TAYLOR

ABSTRACT

Relatively short scoured wool (of type 320) with moderately heavy vegetable fault was processed successfully, when blended with cotton in 75/25 and 50/50 ratios on standard cotton machinery. The preferred route is via a tandem card. It appears that there is no necessity to comb the wool for the spinning of relatively coarse linear densities. The consequent reduction in production costs should increase the demand for this rather inferior wool considerably. Rotor spun yarns appear to be limited to relatively high linear densities.

INTRODUCTION

During some earlier preliminary work investigating the feasibility of processing wool on normal standard cotton machinery a lot of faulty wool containing moderately heavy vegetable matter was processed through the blowroom. Whilst the lap produced was extremely uneven and full of holes, a sufficient quantity was produced to make it possible to feed the cards by hand. The resultant webs were, however, so uneven that they could not be made into slivers. It was noticed, however, that the vegetable matter, *particularly in the case of a tandem card,* had been almost entirely removed. It appeared that this was worth investigating further. If it was possible that short wool with high vegetable fault could be processed on the cotton system after scouring without either combing or carbonizing, a considerable saving in production costs would occur. This could increase the demand for these rather inferior short wools, such as locks, considerably. The South African Wool Board regard the Trade Type 320 as a carbonizing type.

King *et al*[1], Veldsman and Taylor[2] and Spencer and Taylor[3] had all found that it was commercially impossible to produce an *all wool* lap in the blowroom. Spencer and Taylor[3] concluded that the addition of a minimum of 20 to 25% of cotton to the wool was necessary to ensure the production of satisfactory laps. It was therefore decided to commence the present investigation.

EXPERIMENTAL

In order to evaluate the ability of standard cotton machinery to remove vegetable matter from wool/cotton blends, three separate trials were made as follows on:

1) all wool;
2) a 75/25 wool/cotton blend;
3) a 50/50 wool/cotton blend.

The fibre properties of the individual raw materials are recorded in Table I.

In the *first* trial a scoured wool (lot A) with a vegetable matter content of 4,5% was processed through a blowroom using three cleaning points, namely, a porcupine cleaner, a two-bladed beater and a Kirschner beater. The resulting lap, whilst being most unsatisfactory as it was very uneven and full of holes, was processed on both a single card and a tandem card into a web. At each stage tests for mean fibre length (WIRA single fibre length) and amount of vegetable matter (on Shirley Analyser for wool) were made. These are recorded in Table II.

In order to cover as many aspects of the problem as possible it was decided that the first blend wool/cotton 75/25 would be processed via both the single and tandem card routes whilst the second blend 50/50 wool/cotton would be processed through the tandem card and thereafter split into two, one half being processed normally and the other would be combed. It was felt that this would provide an opportunity to check fibre breakage and residual vegetable matter at each operation by each route.

Experiment 2

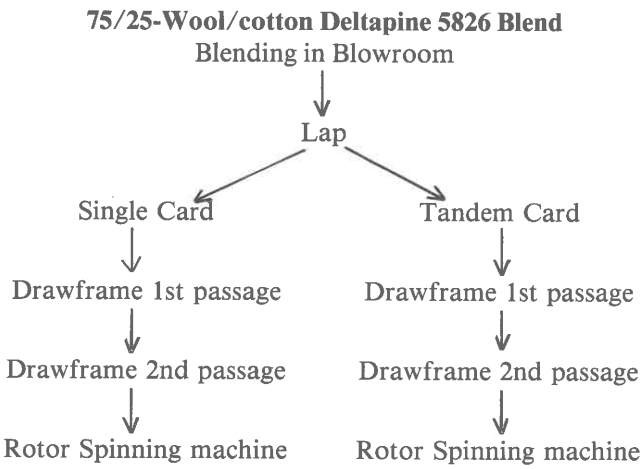

TABLE I

PROPERTIES OF RAW MATERIALS

COTTON	Deltapine 5826	Acala 1517/70	WOOL	Scoured Wool A	Scoured Wool B
2,5% Span Length (mm)	28,3	27,5	Mean fibre length (mm) (WIRA single fibre length)	55,5	50,3
50% Span length (mm)	12,8	12,7			
			CV (%)	41,8	50,8
Uniformity Ratio (%)	45	46	Mean Fibre Diameter (μm) (Projection Microscope)	21,4	20
Maturity Ratio	0,81	0,95	CV (%)	25,3	23,1
Fineness (mtex)	164	156	Dichloromethane Extractable Matter (%)	0,24	0,48
Micronaire	3,7	4,0	Vegetable Matter and impurities in Greasy Wool(%)	2,61	2,01
"0" Gauge tenacity (cN/tex)	34,6	41,4	Vegetable matter* in Scoured wool	4,5	7,8
Pressley (1000 psi)	70	85			
3,2 gauge tenacity (cN/tex)	25,24	23,4			
Extension (%)	7,18	7,1			
Trash (%) Visible	2,26	1,53			
Invisible	2,07	1,37			
Total	4,33	2,9			

*Shirley Analyser for Wool.

TABLE II

WOOL FIBRE LENGTH* AND VEGETABLE MATTER AT EACH PRODUCTION STAGE (LOT A) TRIAL 1

	m.f.l.* (mm)	CV (%)	Vegetable Matter (Shirley Analyser) (%)
Raw material — Scoured	55,5	41,8	4,5
Lap	41,2	49,9	2,48
Single Card Sliver	40,0	46,8	0,29
Tandem Card Sliver	32,6	55,8	0,0004

*WIRA Single fibre length

In the *second* trial a wool containing 7,8% of vegetable matter (lot B) was treated with 0,5% solution of an anti-static (®Bevaloid 4012) calculated on the mass of the wool, diluted with water, in a 3:1 ratio of water/antistatic. The wool was allowed to stand overnight and then made into a *75/25-wool/cotton* (Deltapine 5826) blend by layer or sandwich blending. The blend was processed through the blowroom, using three cleaning points, e.g. porcupine cleaner, two-bladed beater and a Kirschner beater. The laps were then processed by two routes, one through the single card at a rate of 7,0 kg/hr and one through the tandem card at 22,5 kg/hr . Great difficulty was experienced in obtaining an even sliver on the tandem card which was only overcome by processing the blend as if it had been synthetic. In each case the resulting card slivers were given two drawframe passages followed by spinning on the Schubert & Salzer RU 11 rotor spinner. Processing details are listed in Table III and the results of the tests for amount of vegetable matter (on Shirley Analyser for cotton) and 2,5% and 50% span lengths on Fibrograph (330) are recorded in Table IV.

Experiment 3

50/50-Wool/cotton Acala 1517/70 Blend

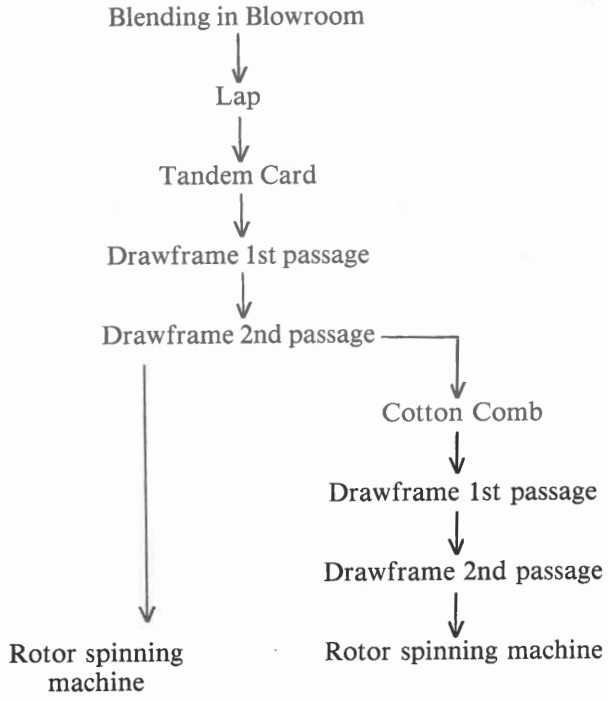

TABLE III

PROCESSING DETAILS FOR 75/25 WOOL*/COTTON DELTAPINE 5826 BLEND (TRIAL 2)

Process	Single Card	Tandem Card
Sliver Linear density (ktex) CV (%) Waste (%)	4,5 4,4 6,8	5,7 4,3 14,0
Drawframe 1st Passage Linear Density (ktex) CV (%)	 4,4 5,6	 4,4 5,8
Drawframe 2nd Passage Linear Density (ktex) CV (%)	 2,5 8,1	 2,5 8,5

*Lot B

TABLE IV

SPAN LENGTHS, PERCENTAGE VEGETABLE MATTER AT EACH STAGE 75/25 WOOL*/COTTON DELTAPINE 5826

PROCESS	FIBROGRAPH (330)		Uniformity Ratio	Vegetable Matter** (%)
	2,5% Span Length (mm)	50% Span Length (mm)		
Lap	48,54	13,39	28	4,3
Single Card Sliver	50,35	14,26	28	0,70
1st Passage Drawframe	40,21	14,20	35	0,59
2nd Passage Drawframe	39,72	15,62	39	0,58
Tandem Card Sliver	49,58	13,51	29	0,T5
1st Passage Drawframe	41,63	13,43	32	0,32
2nd Passage Drawframe	40,78	14,07	35	0,32

*Lot B **Shirley Analyser for Cotton

The *third* trial consisted of processing a blend of 50/50-wool/Acala 1517/70 cotton. The wool was the same as used in the previous experiment and was prepared in exactly the same manner by the addition of the same antistatic in the same proportion. The cotton and wool were blended in the same way and processed through the blowroom using the same cleaning points. The entire blend was processed through the *tandem card* at a rate of 22,5 kg/hr . The resulting card sliver was given two drawframe passages and then split into two: one half was spun without any further processing on the Schubert & Salzer RU 11 rotor spinner whilst the other half was combed on a Platts Century comber. The comb was drawframe sliver fed (positive feed). After combing the sliver was processed through two passages of the drawframe and then spun

TABLE V

PROCESSING DETAILS FOR 50/50 WOOL*/COTTON (ACALA) BLEND (TRIAL 3)

PROCESS	
Carded	
Tandem Card Linear density (ktex)	4,2
Irregularity (CV (%))	4,1
Waste	10,7
Drawframe 1st Passage. Doublings	6
Linear Density (ktex)	4,7
Irregularity CV (%)	4,8
Drawframe 2nd Passage. Doublings	6
Linear Density (ktex)	4,6
Irregularity CV (%)	5,2
Combed	
Combed sliver (ktex)	3,4
Irregularity (%)	6,9
Noil (%)**	21,0
Drawframe 1st Passage. Doublings	6
Linear Density (ktex)	3,2
Irregularity (%)	7,0
Drawframe 2nd Passage. Doublings	6
Linear Density (ktex)	2,6
Irregularity (%)	7,0

*Lot B

**Composition of Noil : Wool (%) 47
Cotton (%) 53

on a Schubert & Salzer RU 11 rotor spinner. Processing details are listed in Table V, whilst the results of the tests for span lengths (Fibrograph 330) and amount of vegetable matter (Shirley Analyser for cotton) at each operation are listed in Table VI.

Table VII records the yarn properties of the 75/25 wool/cotton blend, whereas Table VIII lists the results of the tests on both the *combed* and *uncombed* 50/50 wool/cotton blend yarns.

Both the *single* and the *tandem* card used in these experiments were clothed with the metallic wire normally used for carding cotton. Card settings suitable for carding cotton, were used even though it was realised that the finer wire and the closer card settings in addition to the close drawframe roller setting would almost certainly result in breakage of the longer wool fibres. This was, however, not considered entirely undesirable since it would tend to bring the length of the components in the blend closer together thereby possibly even improving yarn regularity. It was appreciated in the case of these short wools that care would have to be exercised in their selection, particularly with regard to end use of the yarn, as many of these wools are stained and discoloured.

TABLE VI

FIBRE LENGTHS AND PERCENTAGE VEGETABLE MATTER IN WOOL (LOT B)/ACALA COTTON BLEND (50/50) COMBED AND UNCOMBED

PROCESS	FIBROGRAPH		Uniformity Ratio	Vegetable Matter (%)
	2,5% Span Length (mm)	50% Span Length (mm)		
Carded				
Lap	40,4	14,2	35	3,0
Tandem Card Sliver	42,6	13,7	32	1,5
1st Drawframe Sliver	35,8	14,8	41	1,3
2nd Drawframe Sliver	33,9	14,8	44	0,39
Combed				
1st Drawframe sliver after combing	32,2	16,8	51	0,2
2nd Drawframe sliver after combing	33,0	16,5	50	0,2
Noil	22,9	7,8	34	1,2

RESULTS AND DISCUSSION

No real difficulties were encountered in processing the blends containing cotton except at the Crosrol tandem card. Initially great difficulty was experienced in obtaining an even sliver as outlined. No further trouble was experienced once the material was processed in the same way as synthetics and a satisfactory sliver was produced. The irregularity of the final slivers, and this is noticeable in the yarn also (see Tables VII and VIII) was slightly higher than one would experience for all-cotton yarns of similar linear densities. This is probably mainly due to blending two different fibres of differing length and diameter. The number of fibres in the cross section would also be lower for wool/cotton blends and this will be reflected in yarn irregularity also.

In the 75/25-wool/cotton blends the sliver processed via the *tandem card* contained considerably *less vegetable matter* than that processed by the *single card route* as measured on the Shirley Analyser. It is interesting to note that in both the 75/25-wool/cotton and the 50/50-wool/cotton blends the fibres in the card slivers from both the single and the tandem card were marginally longer than the fibres in the lap at both 2,5% and 50% span lengths as measured on a Fibrograph (330) and that a reduction in the 2,5% span length

TABLE VII

YARN PROPERTIES OF CARDED 75/25-WOOL (LOT B)/DELTAPINE COTTON BLEND

PROPERTY	SINGLE CARD				TANDEM CARD			
Linear Density Nominal (tex)	80	70	60	50	80	70	60	55
Actual	80	68,5	58,8	51,2	79,8	73,6	59,3	54,3
CV (%)	1,8	4,4	0,9	2,5	2,0	2,2	3,1	1,3
Twist (turns/m)	535	572	618	677	535	572	618	645
Breaking Strength (cN)	433	369	320	261	394	364	272	248
CV (%)	11,0	12,9	11,9	10,9	11,9	12,6	14,3	16,4
Tenacity (cN/tex)	5,4	5,4	5,4	5,1	4,9	5,0	4,6	4,6
Extension (%)	9,6	9,1	9,1	8,8	9,4	9,7	8,8	9,3
Irregularity CV (%)	15,7	15,6	16,2	17,1	17,6	17,6	18,7	18,2
Thin places/1000 m	9	5	10	24	16	20	31	37
Thick places/1000 m	1	3	3	3	8	2	4	8
Neps/1000 m	104	115	127	163	66	106	106	119
CSP (Ne x lbf)	883	886	859	798	750	717	753	706
Classimat. faults/100 000 m	—	—	—	—	—	—	—	—
Objectionable Faults (B4 + C3 + D2)	12	10	33	36	38	36	24	69
Total Faults	489	289	787	750	297	302	222	344
End breaks/1000 rotor hours	0	0	0	0	0	0	0	0

occurred during the subsequent drawing operations. The fact that during drawing the 2,5% span length decreased considerably whereas the 50% span length remained virtually constant or even increased slightly suggests that only the relatively long fibres were broken. This fibre breakage is undoubtedly due to the close setting of the drafting rollers at the drawframe which was necessary to attempt to control the shorter cotton fibres. Even then a tendency for fibre shedding due to incomplete control of the shorter cotton fibres was still apparent. It is not clear at this stage whether even closer setting with possibly greater fibre breakage would solve the problem of fibre shedding or not.

The results of the combed and uncombed 50/50 wool/cotton blend set out in Table VI were as was expected. The same tendency for increased length in the card sliver, followed by a reduction in length at subsequent drawing operations, is apparent. All the length measurements in Tables IV and VI were made on a Fibrograph 330 as it was felt that, although the 2,5% and 50% span lengths, may possibly be subject to slight error that this instrument was probably the most suitable for wool/cotton blends. The difference in the residual amount of vegetable matter in the combed sliver compared with the uncombed second drawframe sliver is small, so small, in fact, that combing appears to be

TABLE VIII

YARN PROPERTIES OF 50/50-WOOL (LOT B)/ACALA COTTON BLEND, CARDED ONLY AND CARDED AND COMBED

PROPERTY	CARDED ONLY			COMBED				
Linear Density Nominal (tex)	50	40	35	50	40	35	30	25
Actual	50,6	40,5	35,7	50,6	40,2	34,5	29,6	24,0
CV (%)	2,7	3,6	3,8	3,3	1,4	3,8	4,7	3,4
Twist (turns/m)	677	756	806	677	756	806	874	957
Breaking Strength (cN)	354	268	229	433	330	264	218	178
CV (%)	8,2	11,7	9,9	8,0	8,6	9,4	11,4	17,5
Tenacity (cN/tex)	7,0	6,6	6,4	8,6	8,2	7,7	7,4	7,4
Extension (%)	8,9	7,9	8,0	7,9	7,3	7,1	6,7	6,8
Irregularity CV (%)	15,1	15,7	16,2	15,8	16,0	16,2	16,9	17,8
Thin places/1000 m	2	10	10	7	15	12	21	44
Thick places/1000 m	16	18	22	1	3	3	4	8
Neps/1000 m	94	197	132	73	74	118	144	257
CSP (Ne x lbf)	1102	1078	1034	1407	1296	1303	1283	1224
Classimat. faults/100 000 m	—	—	—	—	—	—	—	—
Objectionable Faults (B4 + C3 + D2)	20	16	22	28	37	39	63	36
Total Faults	189	197	438	106	134	189	252	198
End breaks/1000 rotor hours	0	0	833	0	0	0	0	167

unwarranted. In future work it may well be possible to reduce this difference considerably by card setting adjustments.

The amount of noil removed during combing was 21% which is rather high. It is normally 10%—20%. On analysis the noil proved to consist of 53% cotton/47% wool. Attempts were made to *reduce* the percentage of noil but these proved unsuccessful as the closest setting possible was used. It was thought that there might be a tendency to comb out the shorter cotton fibre leaving the wool but this was not the case as the analysis of the noil shows.

The improvement in the uniformity ratio after combing was not reflected in the irregularity (CV%) of the yarn as recorded in Table VIII. That the combed sliver was capable of being spun to finer linear densities is most likely as a result of the removal of the very short fibres or better parallelisation of the fibres. It appears to be fairly conclusive that *without combing* it will only be possible to produce yarns of fairly coarse linear densities. Whilst the 75/25 wool/cotton blend from the single card spun satisfactorily to 50 tex, the end breakage rate was so high for the 45 tex yarns that spinning was considered completely impracticable. For the yarn spun from the sliver processed via the tandem card the finest linear density that could be spun was 55 tex.

The amount of vegetable matter which was carried forward into the yarn was further reduced during spinning on the Schubert & Salzer RU 11 rotor spinner. Visual examination failed to detect any difference in the amount of vegetable matter in either the combed or uncombed yarns in the 50/50 wool/cotton blend; in fact, both yarns appeared practically free from vegetable matter. Chemical examination is ruled out because of the composition of the blend. The amount of the residual vegetable matter is extremely important especially with fabric made from yarn of wool/cotton blends as bleaching or in actual fact any other chemical treatment to either cover up or to remove the vegetable matter is not always possible. Dyeing might be possible with some shades but this would be a very risky procedure as besides the actual shade, the depth of shade required would play a part and as commercially one very often has to dye the shades required by the buyer this could present great difficulties.

By using short merino locks such as type 320 for this work or other short merino locks of which approximately 30 000 bales are produced annually in South Africa alone, there would no longer be any call for fibre breaking machines which are sometimes used to prepare wool for processing on short staple machinery, nor would it be necessary to grow wool specifically of 40 mm in length as has been suggested[4]. A considerable reduction in production costs should result as neither combing or carbonizing appears necessary when relatively coarse linear densities are being spun.

The fact that with chute feed to the cards the problems encountered in producing a lap would probably disappear must not be overlooked. In this

case there would possibly be no need for the addition of cotton and it might be possible to process wool alone without undue difficulties. This aspect is to be studied in due coarse.

SUMMARY AND CONCLUSIONS

Blends of 75/25 wool/cotton and 50/50 wool/cotton containing short wools of relatively inferior style were processed successfully on short staple machinery. It appears that combing the blends is unnecessary for spinning rather coarse linear densities on rotor spinning machinery. A substantial reduction in processing costs as compared with other production routes should result thus increasing the demand for these short inferior wools of which over 30 000 bales are produced each year in South Africa alone.

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