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SOURCES OF FABRIC BARRÉ IN ROTOR YARN

From time to time the International Center is asked to identify the cause of knitted fabric barriness. We have observed that this effect is often the result of excessive variation in course length, but the almost universal use of positive-feed devices seems to have eliminated this source of variation.

Many incidences of fabric barré have been related to the constituent fibers. Differences in blend level, natural color, and fiber fineness or cotton fiber micronaire have all been blamed for contrast in the perceived color of the fabric. On the other hand, diversity in fabric appearance can be related to variation in yarn number, although this, like course length variation, is no longer a major cause of barriness among the inquiries we have received.

Occasionally there are problems with fabric appearance which cannot be attributed to variation in course length, yarn number, fiber blend or fiber properties. In such instances it has been thought that variation in bulk between yarns may have been responsible, but no procedure existed for rapidly quantifying such differences. Therefore, it was decided to perform a study in which rotor spinning machinery components and settings were altered while producing yarns from the same cotton. The yarns were then to be knitted and the resultant fabric inspected for barré, particularly after dyeing.

This study has been completed and a report has been prepared for the Texas Food and Fibers Commission, the sponsor of this research. The report records the work performed to determine those different specifications which could be expected to cause barriness in circular knitted fabrics, should yarns produced under these conditions be mixed. The following information was taken from the report.

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The cotton used for this study was in the form of sliver residual from a large evaluation of the influence of gin and mill cleaning on yarn quality and spinning performance. Grown in West Texas, the cotton was fairly typical of the better qualities which may be expected from this growth area.

A 24-unit Schlafhorst Autocoro rotor spinning machine was used to spin the yarns. The range of available exchange components permitted the following specifications to be varied:

Navel height : Using four-grooved ceramic navels, yarn was spun with and without the use of a 1.5 mm packing washer.

Navel type : Using the same packing washers throughout, the navel topography was varied. Yarns were spun at constant twist levels using smooth, four-grooved and eight-grooved ceramic navels. In addition, yarn was produced with four-grooved navels having four ceramic ridges in the bore.

Influence of TM and navel type : In general, when a navel is used which has a rougher surface, then the twist level is reduced to produce a softer yarn more productively. Yarns were spun at the combinations of smooth navel and 4.5 TM, four-grooved navel and 4.0 TM, and eight-grooved navel and 3.5 TM.

Twist Multiplier : To assess the influence of twist level, yarns were spun at the three twist multipliers of 3.5, 4.0 and 4.5. A four-grooved navel was used throughout.

Rotor groove profile : Groove dimensions are known to alter the characteristics of rotor yarns, particularly physical properties. Yarns were spun from both T and G profiles for comparison. Twist, navel height and type were maintained constant.

Rotor speed : As rotor speed varies, so does the centrifugal force acting upon the yarns during withdrawal from the rotor. Yarn properties are changed and it was anticipated, therefore, that the bulk of the yarn would be a function of the force applied to the yarn, also. As rotor speeds were increased, the tension draft was reduced in an attempt to maintain an approximately constant take-up tension.

An N_e 26/1 yarn was spun at each of the 12 different spinning specifications. Thirty-two packages, each weighing about 1/2 pound, were produced at each specification. Samples were tested and a breakage record maintained.

Tables on the following pages give the average properties of the cotton fiber in bale form (Table I only), the spinning specifications and the properties of the resultant yarns (from the first three parts listed above).

Table I (Influence of Navel Height) shows the results for the yarns produced with and without the packing washer beneath the navel. Increasing the navel height may have produced a slightly stronger, more even yarn, possibly at some expense of spinning stability.

The effect of changing the nature of the navel surface upon yarn properties is presented in **Table II** (Influence of Navel Type). The data show that tensile properties and yarn non-uniformity deteriorated as the roughness of the navel increased. The increase in non-uniformity appeared to be due primarily to an increase in nep frequency. The benefit of using a rougher navel was apparent in the spinning performance data, which tended to improve.

Reducing yarn twist and increasing navel roughness caused a decrease in the tensile properties of the yarn, as shown in **Table III** (Influence of Twist Multiplier and Navel Type). Whereas the breakage rate incurred during production was quite high for two of the yarns, it was very evident that the spinning limit of this particular cotton had been exceeded when producing yarn at the lowest twist with the roughest of the three navels.

TABLE I

INFLUENCE OF NAVEL HEIGHT

FIBER DATA (Individual Instruments)		
Tensile: Strength (g/tex)	26.14	
Elongation (%)	5.79	
Length: 2.5% Span (in)	1.025	
Uniformity Ratio (%)	47.9	
Short Fiber Content (%)	2.2	
Micronaire	3.82	
Pressley Strength (MPSI)	86.6	
Non-lint Content (%)	3.85	
SLIVER	56 gr/yd Finisher Drawframe	
Machine	Schlafhorst Autocoro	
Nominal Yarn Number (N_e)	26	
Rotor Type	33G	
Rotor Speed (rpm)	90,000	
Opening Roller Type	OB20	
Opening Roller Speed (rpm)	7500	
Draft	176.5	
Twist Multiplier (a_e)	4.01	
Yarn Speed (yd/min)	122.4	
Navel	4 G + 0 mm/TT	4 G + 1.5 mm/TT
Ambient Conditions	70^{o}F/56% RH	
Test Duration (Rotor Hours)	48	
YARN PROPERTIES		
Skein Test:		
Yarn Number (N_e)	25.81	25.84
CV% of Count	2.0	1.4
Count-Strength-Product	2017	2043
CV% of CSP	2.7	3.1
Single Yarn Tensile Test:		
Tenacity (g/tex)	12.10	12.00
Mean Strength (g)	277	274
CV% of Strength	8.4	8.8
Elongation (%)	6.33	6.39
CV% of Elongation	6.0	5.5
Specific Work of Rupture (g/tex)	0.393	0.389
CV% of Work of Rupture	13.2	13.6
Initial Modulus (g/tex)	167	166
Uster Evenness Test:		
Non-Uniformity (CV%)	14.65	14.32
Thin Places/1,000 yds	40	44
Thick Places/1,000 yds	43	39
Neps/1,000 yds	69	48
ASTM Yarn Grade	B	B
PERFORMANCE		
Number of Breaks	7	10
Break Rate/1,000 Rotor hours	146	208

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The preceding is an excerpt from the report on causes of barré which was prepared for the Texas Food and Fibers Commission by John B. Price, assistant director of the International Center. He was assisted in this study by William D. Cole, manager of spinning technologies, and Richard N. Combs, head of chemical processing at ICTRD. More of the report will be presented in the next issue of *Textile Topics*.

SMITH APPOINTED TO USDA COMMITTEE

We were pleased to learn recently that Harvin Smith, head of the International Center's materials evaluation laboratory, has been selected to serve on the U.S. Department of Agriculture Advisory Committee on Cotton Marketing. Smith has been on our staff since 1984, coming here after 35 years in the cotton division of USDA.

A native of New Home, Texas, he earned degrees from Texas Tech University and the University of Georgia before joining the USDA Ginning Research Laboratory in Stoneville, Mississippi. He later was transferred to University Park, New Mexico where he was in charge of the USDA Cotton Testing Laboratory.

In continuing his work with USDA, he was located in Memphis, Tennessee before moving to Washington where he was chief of the Standards and Testing Branch of the USDA Cotton Division. Because of his extensive background in cotton fiber testing, we believe he will make significant contributions to the work of the Advisory Committee on Cotton Marketing. We are pleased he has accepted this position where he can use his many years of experience to assist with decisions influencing the marketing of US cotton.

TABLE II

INFLUENCE OF NAVEL TYPE

SLIVER	56 gr/yd Finisher Drawframe			
Machine	Schlafhorst Autocoro			
Nominal Yarn Number (N_e)	26			
Rotor Type	33G			
Rotor Speed (rpm)	90,000			
Opening Roller Type	OB20			
Opening Roller Speed (rpm)	7500			
Draft	176.5			
Twist Multiplier (a_e)	4.01			
Yarn Speed (yd/min)	122.4			
Navel	Smooth	4G	8G	4G/4R
Ambient Conditions	70°F/56% RH			
Test Duration (Rotor Hours)	48			
YARN PROPERTIES				
Skein Test:				
Yarn Number (N_e)	25.97	25.84	25.84	25.95
CV% of Count	0.7	1.4	1.4	0.5
Count-Strength-Product	2082	2043	2031	1989
CV% of CSP	3.0	3.1	2.6	2.5
Single Yarn Tensile Test:				
Tenacity (g/tex)	12.31	12.00	12.13	11.51
Mean Strength (g)	280	274	277	262
CV% of Strength	8.8	8.8	7.0	7.9
Elongation (%)	6.35	6.39	6.24	6.07
CV% of Elongation	6.3	5.5	6.2	6.9
Specific Work of Rupture (g/tex)	0.403	0.389	0.389	0.364
CV% of Work of Rupture	14.28	13.57	12.71	13.92
Initial Modulus)g/tex)	175	166	171	175
Uster Evenness Test:				
Non-Uniformity (CV%)	14.09	14.32	14.07	14.55
Thin Places/1,000 yds	38	44	30	36
Thick Places/1,000 yds	24	39	33	43
Neps/1,000 yds	22	48	19	96
ASTM Yarn Grade	B+	B	B+	C+
PERFORMANCE				
Number of Breaks	45	10	21	12
Break Rate/1,000 Rotor hours	938	208	438	250

TABLE III

INFLUENCE OF TWIST MULTIPLIER AND NAVEL TYPE

SLIVER	56 gr/yd Finisher Drawframe		
Machine	Schlafhorst Autocoro		
Nominal Yarn Number (N_e)	26		
Rotor Type	33G		
Rotor Speed (rpm)	90,000		
Opening Roller Type	OB20		
Opening Roller Speed (rpm)	7500		
Draft	176.5		
Twist Multiplier (α_e)	4.49	4.01	3.49
Yarn Speed (yd/min)	109.2	122.4	140.4
Navel	Smooth	4G	8G
Ambient Conditions	70°F/56% RH		
Test Duration (Rotor Hours)	53.7	48	41.8
YARN PROPERTIES			
Skein Test:			
Yarn Number (N_e)	25.74	25.84	25.91
CV% of Count	1.2	1.4	1.3
Count-Strength-Product	2162	2043	1973
CV% of CSP	2.4	3.1	1.9
Single Yarn Tensile Test:			
Tenacity (g/tex)	12.81	12.00	11.16
Mean Strength (g)	293	274	254
CV% of Strength	7.6	8.8	7.6
Elongation (%)	6.72	6.39	5.88
CV% of Elongation	6.2	5.5	6.1
Specific Work of Rupture (g/tex)	0.433	0.389	0.347
CV% of Work of Rupture	12.66	13.57	12.58
Initial Modulus)g/tex)	171	166	179
Uster Evenness Test:			
Non-Uniformity (CV%)	14.05	14.32	13.91
Thin Places/1,000 yds	27	44	30
Thick Places/1,000 yds	31	39	26
Neps/1,000 yds	19	48	19
ASTM Yarn Grade	B+	B	B+
PERFORMANCE			
Number of Breaks	11	10	152
Break Rate/1,000 Rotor hours	205	209	3636

NEW EQUIPMENT ORDERED

An agreement has been made with the Rieter Corporation of Spartanburg, South Carolina to purchase three pieces of equipment that will be used in the International Center's research on Texas cotton. These are an RSB 51 Drawframe, E5/3 Unilap Lapper and E7/6 Comber. The lapper and comber were delivered to the Center recently and it is expected that the drawframe will arrive within a few weeks.

The new machines will replace older models that were made by different manufacturers and were limited in their production rates and capacity in the type of cotton that could be used. The new comber has a much broader range of noil removal and can operate at a much higher rate than the older machine it is replacing.

The primary thrust of our research with this equipment will be to evaluate combing for rotor spinning. Both the amount of noil removal and the cotton fiber length will be studied to determine the influence variations in these will have on rotor spinning performance and yarn quality. We are aware that some textile companies are already combing cotton for rotor spinning. It is intended that our research will include studies that may be helpful to those who wish to produce yarn in this manner.

We appreciate the cooperation extended to us by the Rieter Corporation in making this equipment available.

VISITORS

January visitors to the International Center included Trevor Rowe, Bolton Institute of Higher Education, Bolton, England; Roger Bolick, Allied Fibers, Hopewell, VA; Charles G. (Greg) Dewitt, Henkel Corporation, Charlotte, NC; and Carl Cox, Texas Food and Fibers Commission, Dallas, TX. A class of 12 students from Petersburg High School, Petersburg, TX also visited during the month.