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EFFECTS OF NON-LINT REMOVAL ON SPINNING PERFORMANCE AND THE QUALITY OF COTTON YARNS: Part 1

The value of cleaning cotton at the gin is a topic of recurrent debate between cotton producers and textile manufacturers. The spinner says he can do a better job of cleaning in his mill without damaging the fiber, but the producer usually receives a higher price for his product when it has been cleaned by one or more lint cleaners at the gin. Textile men say gin lint cleaners damage the fiber and result in a higher percentage of short fibers and lower length uniformity. (Some feel so strongly about this that they have bought cotton in modules so they can have it custom ginned to their liking.)

Some research to determine the value of gin and mill-level cleaning has already been conducted. This was designed to determine the best cleaning procedure for processing West Texas stripper-harvested cotton that was grown in three different seasons. Another program is currently underway to evaluate the cleaning of barky cotton.

A third study, related to the two mentioned above, was recently conducted at the International Center for Textile Research and Development. This used a long-staple cotton donated by the California Planting Cotton Seed Distributors (CPCSD) of Shafter, California to investigate the influence of three levels of cleaning at the gin, two different types of carding, and then combing half of the fiber. There were multiple phases of the program, with one extreme having the greatest amount of cleaning where two lint cleaners were used at the gin, followed by tandem carding and then combing. The other extreme featured zero lint cleaning, single carding and no combing. In theory, one would expect the heavily-cleaned cotton to have the shortest length, the lowest uniformity percentage, and the highest short fiber content while the least-cleaned fiber would have the opposite of these, but more trash. The results of the research reveal that part of the expectations were realized, but all results did not fit the theory.

The cotton donated by CPCSD was divided into three lots before ginning. Lot A was ginned with no lint cleaning, Lot B with one lint cleaner, and Lot C with two. When the three lots were received at the Center, all were processed through the same sequence of opening and cleaning. Then each lot was divided, with half being carded on a Rieter C4 single card and the other half on a Crosrol Mk-4 tandem card. The single card produced a 60 gr/yd sliver at 75 lbs/hr. The main cylinder of this machine was run at 450 rpm with the flats moving at 6 in/min. The tandem card produced the same size sliver at the same production rate. Both cylinders were run at 500 rpm. The speed of the flats on the rear cylinder was 8 in/min, while the front cylinder flats operated at 4 in/min.

Each of the six lots of card sliver (three levels of lint cleaning and two cards) was divided into two portions. Half was converted into 53 gr/yd sliver at a breaker drawing frame and further reduced to 45 gr/yd at finisher drawing. This was in preparation for rotor spinning. The excess sliver from rotor spinning was converted into roving to be used at ring spinning. Though there was only a small amount of yarn made from this, it was sufficient for testing purposes.

The portion of the card sliver not prepared for rotor spinning was drawn to 53 gr/yd by one process of drawing and then formed into laps of 885 gr/yd. These laps were combed by a Whitin Model J Comber that was operated at 150 nips/min. The combed sliver was then drawn twice, with 53 gr/yd delivered from breaker drawing and 55 gr/yd from finisher drawing. The roving prepared for ring spinning was 1.8 hank with a twist multiplier of 1.26.

At open-end spinning a Schlafhorst Autocoro machine was operated at a rotor speed of 90,000 rpm to spin Ne 36 yarn with a twist multiplier of 4.84. Samples of the yarn for testing were taken from clean rotors at the beginning of spinning and at the end of the spinning run. At ring spinning, both the combed and carded materials were utilized to produce Ne 50 yarns with a twist multiplier of 3.8.

Ring yarns were spun at a spindle speed of 11,000 rpm. Figure 1 at right gives a flow chart of the processing routes.

Table I on page three gives the results of testing bale samples of the three lots of cotton. It will be seen that the fiber was long and strong but with a lower than expected micronaire. The values for maturity are somewhat surprising in view of the uniform micronaire measurements. Inasmuch as the three lots actually came from the same cotton, we wonder if the measurements of maturity were influenced by the different levels of trash remaining in the sample.

As expected, the non-lint content of the three samples decreased as the number of lint cleaners increased. Without any cleaning at the gin, the non-lint content was typical of a Good Ordinary grade, but this was improved to Strict Low Middling by using one cleaner. Using a second cleaner gave a cotton with a non-lint content equivalent to that of a Strict Middling grade. This shows why cotton producers often request more cleaning at the gin, especially in view of the fact that length uniformity and short fiber content are not included in the marketing structure.

The amount of extracted material produced at each preparatory process is shown in Table II. As the non-lint content of the cotton was reduced, the quantity of material extracted at opening and carding was also reduced. The results show that the card waste was greater at tandem carding when processing the cleanest cotton, but was less than that extracted by the single card when processing the cotton from zero and one lint cleaner. Additionally, the results show the quantity of comber noils increased when tandem-carded stock was used. Length distribution data are presented in Table III.

We find this information quite interesting. The real value of it should be reflected in the spinning performance and quality of the yarn spun from the various lots. Space does not permit us to continue the report in this copy of *Textile Topics*, but we will present the remainder of it in the April issue.

This study was sponsored by the Texas Food and Fibers Commission. We want to express our appreciation to that organization for permitting us to publish results obtained. Also, we would like to mention that the project supervisors were William D. Cole, head of spinning technologies, and Edwin R. Foster, head of mechanical processing. John B. Price, ICTRD's assistant director, prepared the report.

FIGURE 1

MATERIAL PROCESSING ROUTES

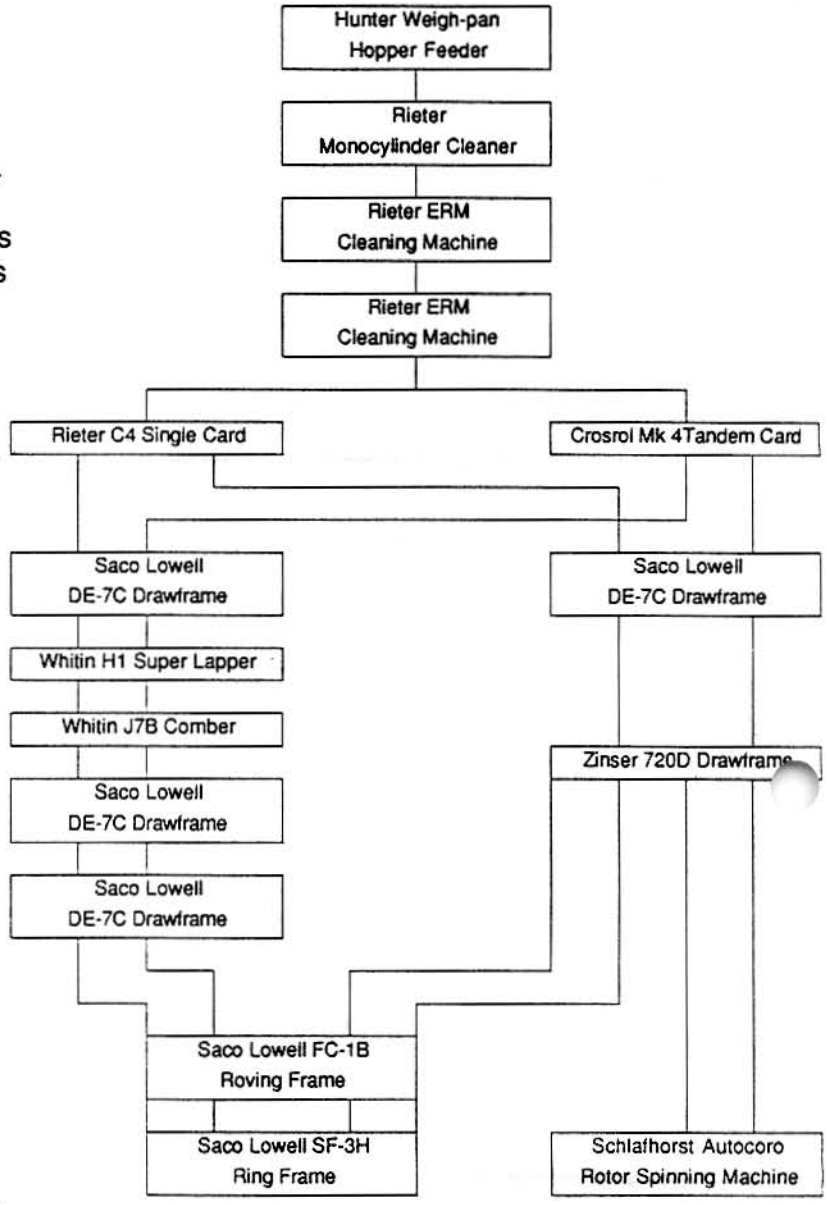

TABLE I

FIBER PROPERTIES

Lot Number No. of Lint Cleaners	A 0	B 1	C 2
Individual Instruments			
Tenacity (g/tex)	32.26	34.02	33.06
Elongation (%)	5.17	5.17	5.67
2.5% Span Length (in)	1.24	1.24	1.27
Uniformity Ratio (%)	48.2	46.8	47.4
Short Fiber Content (%)	0.4	1.5	1.0
Micronaire Value	3.67	3.60	3.60
Non-Lint Content* (%)	8.71	3.20	1.74
Pressley Strength (Mpsi)	107.2	108.1	105.1
Peyer AL-101			
Upper Quartile Length (in)	1.18	1.18	1.20
Mean Length (in)	0.95	0.97	0.98
CV% of Length	33.9	29.8	30.3
Short Fiber Content (%)	11.4	7.0	8.0
ICC/Shirley F/MT			
Micronaire Value	3.5	3.5	3.6
Maturity (%)	74.8	78.5	80.7
Fineness (mtex)	152	143	144
High Volume Instrument data			
Strength (g/tex)	33	32	32
Elongation (%)	6.8	7.0	6.8
Length (in)	1.21	1.21	1.19
Length Uniformity (%)	87	84	84
Micronaire	3.8	3.5	3.6
Leaf 7	4	3	
Reflectance, R_d (%)	73	77	77
Yellowness, +b	8.0	8.2	8.6

*Mean of two determinations

TABLE II

OPENING AND CARDING WASTE (%)

Card	Single			Tandem		
Lint Cleaners	0	1	2	0	1	2
Opening Line						
Monocylinder	2.83	0.82	0.55	3.00	0.78	0.68
ERM 1	3.21	1.58	1.14	2.91	1.41	0.92
ERM 2	1.27	0.63	0.48	1.14	0.63	0.37
Total Blowroom	7.31	3.03	2.17	7.05	2.82	1.97
Card						
Lickerin	1.77	0.92	0.64	---	---	---
Filter	2.03	1.89	1.63	---	---	---
Total Carding	3.80	2.81	2.27	3.17	2.86	2.91
Total	11.11	5.84	4.44	10.22	5.68	4.88
Combing						
Noils	11.90	11.29	11.72	12.70	13.62	13.38
Total Preparation	21.68	16.47	15.64	21.62	18.51	17.61

TABLE III

LENGTH DISTRIBUTION DATA (Peyer AL-101) FROM CARDED FINISHER-DRAWN SLIVER

Card	Single			Tandem		
Lot Number	A	B	C	A	B	C
Property						
Upper Quartile Length (in)	1.25	1.26	1.25	1.23	1.25	1.25
Mean Length (in	1.04	1.04	1.05	1.02	1.03	1.02
CV% of Length	27.2	26.8	25.7	27.3	27.8	29.2
Short Fiber Content (%)	4.3	4.3	3.1	4.1	4.4	5.8
Average Data						
Upper Quartile Length (in)		1.253			1.243	
Mean Length (in)		1.047			1.027	
CV% of Length		26.6			28.1	
Short Fiber Content (%)		3.9			4.7	

DONATION FROM DAVISON PUBLISHING CO.

The International Center for Textile Research and Development recently received a case of *Davison Textile Blue Books* from the Davison Publishing Company of Ridgewood, New Jersey. As many of our readers know, this book has long been recognized as offering the most complete information on textile companies in the United States and Canada.

Bruce W. Nealy, president of Davison Publishing Company, has sent a supply of the *Blue Book* each year for distribution to our students and staff. We sincerely appreciate his generosity. This sort of contribution is very helpful to an academic institution with budget limitations.

VISITORS

Eight textile executives from the Philippines visited the Center on March 13. The group included George T. Siy, Unicol Industries & Manufacturing Corp.; Philip T. Ang, Solid Mills, Inc.; Kong Chip A. Chia, Tri-Union Industrial Corp.; Arsenio T. Tanco, Manila Bay Spinning Mills, Inc.; John Gokongwei, Jr. and Lance Gokongwei, Universal Robina Textile Mills; Johnson Robert Go, Jr., Litton Mills, Inc.; and Hermenegildo C. Zayco, Textile Mills Association of the Philippines, Inc. They were accompanied by Frank Waddle, Cotton Council International, Hong Kong; Buxton Midyette, Cotton Council International, Washington, DC; and S. Dean Pelczar, Cotton Incorporated, Singapore.

Other visitors during the month were Siegfried Prueckel, Schlafhorst Inc., Charlotte, NC; Jerry Jacobson, Hobbs Feather Co., West Liberty, IA; C. Daniel Welch, 3M Protective Chemical Products Div., St. Paul, MN; Roger Bolick, Allied Fibers, Hopewell, VA; Sally Fox, Natural Cotton Colors, Inc., Wasco, CA; Carl Cox, Texas Food & Fibers Commission, Dallas, TX; David Lawford, Texas International Mohair, Inc., Brady, TX; Wei Jin Xuan, Changyi Textile Machinery Plant, People's Republic of China; Bill D. Morton, Lee Ikels and Jerry L. Clark, WestPoint Pepperell Mission Valley Mill, New Braunfels, TX; Harold R. Hoke, Jr. and Alvin Ellison, Zellweger Uster, Charlotte, NC; and Frederick M. Shofner and Edward O. White, Zellweger Uster, Knoxville, TN.

Also visiting were ten extension club members from Spearman, TX; twelve 4-H members and leaders from Hobbs, NM; and 50 members of the West Texas Boiler Safety Association.