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THE EFFECTS OF LINT CLEANING ON FIBER AND YARN QUALITY: Supplement

In three previous issues of *Textile Topics* (Vol. XX, Nos. 4, 5 & 6), we introduced and reported results from one year's work of a three-year study. The study is devoted to assessing the influence of lint cleaning.

Lint cleaning is a term which is commonly used in the ginning industry to describe the process of trash removal from fiber which has been separated from the seed. The process is continued in the textile mill, primarily in the blowroom and at the card. The design of the study, therefore, was extended to include variations in the intensity of opening and cleaning in the blowroom as well as the cardroom.

A popular opinion is that more cleaning should be performed in the textile mill than at the gin. The feeling is that reduced cleaning at the gin would leave larger particles of trash in the cotton. The lower throughputs permissible in the blowroom of the textile mill would provide more effective cleaning, large trash particles being ejected rather than shattered into smaller fragments to persist into the feedstock of the spinning process with deleterious effects upon operational efficiencies.

We stated in the first part of this series that new blowroom equipment was used to provide three levels of cleaning. This was compounded by the use of two cards, thus providing two levels of carding intensity. In this supplemental article we are reporting the influence of blowroom machinery and carding treatment.

Influence of Blowroom Machinery

Reference to Figure 2 in Part 1 (*Textile Topics*, Vol. XX, No. 4, Dec. 1991) shows the sequence of preparation machinery (predominately of Rieter manufacture) utilized in the study. Each lot of cotton was processed with one, two or three major cleaning points as provided by Monocylinder, Monocylinder with one ERM B5/5 machine and Monocylinder with two ERM B5/5 machines.

The Monocylinder is an "in-flight" beater in which stock, entrained in air, travels in a helical fashion around a rotating pegged horizontal roller. The ERM machines function differently in that the stock is gripped by feed rolls and proffered to a rotating cleaning roller. In the first machine, the so-called nose beater was used, which is a description for a roller essentially wound with a very coarse wire. The second ERM utilized an R10/10 cleaning roll, which is descriptive of a more conventional saw-tooth wire. In all cases, trash is ejected via grid bars beneath the rollers. Specifications were used which were optimised for the general quality of fibers being processed.

Two carding treatments were applied to each lot, one which could be considered normal, the other aggressive. The normal carding was performed by a single card running under conditions optimised for the quality of fiber being processed. Since the study was to be conducted with cotton from three crop years with no guarantee of consistency of cleanliness, Tandem carding was performed under conditions to provide maximum cleaning although running at commercial specifications.

Table IX below shows the influence of mill cleaning points on the properties of fiber samples taken from the batt supplied to the card. The data presented are for Part 1 (Influence of lint cleaning) and Part 2 (Influence of seed cotton cleaning).

Increasing the number of cleaning points (machines) from one to three produced the expected reduction in trash content. The improvement in cleanli-

TABLE IX

EFFECT OF MILL CLEANING POINTS ON FIBER PROPERTIES

		PART 1			PART 2		
		NO. OF CLEANING POINTS			NO. OF CLEANING POINTS		
PROPERTY	SAMPLE	1	2	3	1	2	3
STELOMETER:							
Tenacity (%)	Batt	29.92	25.64	25.84	25.94	25.86	25.85
Elongation (%)	Batt	5.67	5.70	5.74	5.67	5.72	5.63
DIGITAL FIBROGRAPH:							
Length (2.5% Span)(in)	Batt	1.036	1.035	1.025	1.063^{a}	1.058^{ab}	1.054^{b}
Uniformity Ratio (%)	Batt	48.3^{a}	47.6^{b}	47.2^{b}	48.4^{a}	48.0^{a}	47.0^{b}
Short Fiber Content (%)	Batt	1.88^{b}	2.26^{ab}	2.63^{a}	1.21^{b}	1.51^{b}	2.47^{a}
FIBRONAIRE							
Micronaire	Batt	3.86	3.87	3.85	3.81	3.80	3.80
SHIRLEY ANALYZER							
Non-lint Content (%)	Batt	3.27^{a}	2.73^{ab}	2.55^{b}	3.54^{a}	2.78^{b}	2.89^{b}

Mean values with the same letter are not significantly different ness, however, was obtained at the expense of fiber length characteristics, particularly uniformity ratio. The trend, visible in both sets of data, was somewhat of a surprise since blowroom machinery is considered to be relatively gentle in action.

An indication of the waste extracted from each of the cleaning points when processing via the single card is shown in Table X. As might be expected, an increase in the number of blowroom cleaning points increased the total waste produced there while reducing the waste removed at the card. Nevertheless, the overall trend was for increased cleanings to produce increased trash. Yarn properties, as shown in Table XI, showed no consistent significant changes as the number of cleaning points varied. The same was almost true of spinning performance (as shown in Table XII), the only anomaly being the high breakage rate experienced when using cotton that had been processed through three cleaning points in Segment 2 of the study.

Influence of Carding Treatment

Contemporary models of a single and a Tandem card were used, both set to produce sliver of 60 grains/yard at 100 lbs/hour. The cylinder speed of the single card was 450 rpm; whereas the rear and front cylinder speeds for the Tandem card were 500 and 770 rpm, respectively.

With both cards being new at the time of commencing the study, some fiber damage was expected, particularly when operating the Tandem card under aggressive conditions to maximize cleaning potential. Table XIII indicates that fibers were shortened in both studies.

Table XIV shows the influence of carding treatment on yarn properties. Tandem-carded yarns were weaker but the reduction in yarn strength with prolonged spinning was lower, presumably the result of cleaner rotor grooves. Imperfection frequencies were greater in single-carded yarns.

The act of Tandem carding produced a reduced number of breaks arising from trash-related causes

TABLE X

EFFECT OF MILL CLEANING POINTS ON WASTE EXTRACTED (%)

	PART 1			PART 2		
	NO. OF CLEANING POINTS			NO. OF CLEANING POINTS		
LOCATION	1	2	3	1	2	3
Monocylinder	1.183	1.087	1.187	1.469[a]	1.265[b]	1.299[b]
ERM 1	---	1.222	1.246	---	1.421[b]	1.593[a]
ERM 2	---	---	0.731	---	---	0.829
Total Blowroom Waste	1.18[c]	2.31[b]	3.16[a]	1.47[c]	2.69[b]	3.72[a]
Lickerin	1.017[a]	0.767[b]	0.633[b]	2.314[a]	1.600[b]	1.329[c]
Filter (Flats, Exhaust Air)	3.724[a]	3.407[ab]	3.293[b]	2.597	2.525	2.436
Total Card Waste	4.74[a]	4.17[b]	3.93[b]	4.91[a]	4.12[b]	3.77[c]
Total Waste Extracted	5.92[c]	6.48[b]	7.09[a]	6.38[c]	6.81[b]	7.49[a]

Mean values with the same letter are not significantly different

TABLE XI

EFFECT OF MILL CLEANING POINT ON YARN PROPERTIES

		PART 1			PART 2		
		NO. OF CLEANING POINTS			NO. OF CLEANING POINTS		
PROPERTY	SAMPLE	1	2	3	1	2	3
Count-Strength-Product	Initial	1903[a]	1893[ab]	1882[b]	1975	1976	1980
	Final	1864	1867	1856	1936	1926	1921
Tenacity (%)	Initial	11.60	11.62	11.62	12.23	12.11	12.16
	Final	11.48	11.52	11.47	11.88	11.89	11.75
Elongation (%)	Initial	5.97	6.00	5.98	6.11	6.09	6.14
	Final	5.91	5.96	5.92	6.04	6.05	6.04
CV% Non-Uniformity	Initial	14.38	14.39	14.42	14.42	14.45	14.46
	Final	14.79	14.72	14.81	14.87	14.89	14.86
Total Imperfections (per 1000 yds)	Initial	104	103	105	127	131	131
	Final	135	130	142	169	166	161
Hair Count (Per 100 yds)	Initial	560	562	552	540	538	533
	Final	1345	1356	1332	1339	1327	1348

Mean values with the same letter are not significantly different

TABLE XII

INFLUENCE OF MILL CLEANING POINTS ON ROTOR SPINNING PERFORMANCE

	PART1			PART2		
	NO. OF CLEANING POINTS			NO. OF CLEANING POINTS		
PARAMETER	1	2	3	1	2	3
Break Rate/1000 Rotor hrs	175	182	179	133[b]	130[b]	152[a]
% Trash Related	4.8	4.0	5.4	10.2	10.7	7.1
% Entanglement-Related	89.9	90.1	88.8	83.2	83.6	83.8
% Unknown	5.3	5.9	5.9	6.7	5.7	9.2

Mean values with the same letter are not significantly different

TABLE XIII

INFLUENCE OF CARDING ON FIBER LENGTH DISTRIBUTION IN SLIVER FORM

	PART 1		PART 2	
	FINISHER DRAWFRAME SLIVER		CARD SLIVER	
PARAMETER	Single	Tandem	Single	Tandem
Upper Quartile Length (in)	1.039[a]	1.005[b]	1.069[a]	1.025[b]
Mean Length (in)	0.857[a]	0.799[b]	0.889[a]	0.817[b]
CV% of Length	33.6	34.2	32.0	33.0
Short Fiber Content (%)	10.46[b]	17.16[a]	8.32[b]	15.01[a]

Mean values with the same letter are not significantly different

TABLE XIV

INFLUENCE OF CARDING TREATMENT ON YARN PROPERTIES

PROPERTY	SAMPLE	PART 1 Single	PART 1 Tandem	PART 2 Single	PART 2 Tandem
Count-Strength-Product	Initial	1926a	1859b	1976a	1897b
	Final	1866	1858	1926a	1880b
Tenacity	Initial	12.02a	11.21b	12.11a	11.66b
	Final	11.66a	11.32b	11.89a	11.68b
Elongation (%)	Initial	6.09a	5.88b	6.09	6.12
	Final	6.01a	5.85b	6.05	6.11
CV% Non-Uniformity	Initial	14.39	14.39	14.45a	14.28b
	Final	14.79	14.75	14.89a	14.52b
Total Imperfections	Initial	115a	93b	131a	83b
	Final	148a	124b	164a	108b
Hair Count	Initial	530b	586a	538b	577a
	Final	1394a	1295b	1327	1318

Mean values with the same letter are not significantly different

TABLE XV

INFLUENCE OF CARDING TREATMENT ON ROTOR SPINNING PERFORMANCE

PARAMETER	PART 1 Single	PART 1 Tandem	PART 2 Single	PART 2 Tandem
Break Rate/10^3 Rotor hours	180	177	130b	160a
% Trash-Related	8.6a	0.8b	10.7a	0.5b
% Entanglement-Related	81.3b	97.9a	83.6	97.0b
% Unknown	10.1a	1.3b	5.7a	2.5b

Mean values with the same letter are not significantly different

but this advantage was offset by a higher proportion of entanglement-related breaks, contrary to results obtained in other studies. The data are presented in Table XV.

This concludes the series of four articles devoted to the subject of cleaning cotton. The first of three annual replications, it is intended to provide a more complete overview of the study at some time in the future. The work in its entirety has been sponsored jointly by the Texas Food and Fibers Commission and the Agricultural Research Service of the United States Department of Agriculture.

The research was conducted under the supervision of John B. Price, Assistant Director of ICTRD, who prepared this report.

ABOUT THE AUTHOR

John B. Price, Assistant Director of the International Center, has 22 years' experience as a textile engineer. He has been involved in developing and evaluating various types of high tech spinning machines including water jet looms, friction spinning and rotor spinning machines.

Price graduated from Leeds College of Science & Technology, Leeds, England in 1969 and before coming to the U.S. he was employed by Carringtron & Dewhurst, Eccleston Nr. Chorley, England; E. Scragg and Sons Ltd., Macclesfield, England; and Spindelfabrik Suessen, Suessen, Germany.

Spindelfabrik Suessen loaned Price to Barber Colman Company of Rockford IL, to train installers, commission a prototype rotor spinning machine at their mill, and perform development trials. When Barber Colman Company moved to Gastonia NC, John joined that company as Senior Laboratory Engineer. He performed R&D trials to improve productivity and range of application of the machines and introduced modifications to improve versatility.

Price joined the Textile Research Center, Texas Tech University, in 1981 as Head of Processing Research. In this position, he conducted studies to identify relationships between rotor spinning machine variables and yarn quality and performance. Using data provided by traditional fiber testing instruments and those under development, he established relationships between fiber properties and yarn properties, performance and dyeing characteristics.

Since 1981 John has written and published numerous research reports and articles on open-end spinning and the cleaning and carding of cotton. He is currently involved in the processing of naturally colored cotton, organically grown cotton, and cotton and wool blends.

In 1987 Price was named Assistant Director of the International Center and organized the move to the new facility. He is responsible for planning and scheduling research projects, their statistical design and analysis of project test data.

VISITORS

Several textile executives from Hungary visited the International Center on May 7 as part of the itinerary for the Cotton Council International Special Trade Mission. Members of the group were Tomás Bodosi, Masterfil, Kaposvár; Robert Wieland, Kistext, Budapest; Andras Simon, Masterpiece Ltd., Vac; Ferenc G. Barth, Suprafil Kft., Papa; Katalin Kaszás, Dunamarket Ltd., Budapest; Tibor Pintér, Latex, Szombathely; István Bártfai, Patex, Budapest; and István Csomortány, Secotex, Budapest. They were accompanied by Geoffrey Audas, Cotton Council International, London, England and Vaughn Jordan, CCI, Washington, DC.

Then on May 19, sixty members of the Cotton Foundation Producers Steering Committee visited with us. We were pleased to have this group come, for many of them had not visited the Center before.

Also visiting were several members of an organization which provides research scholarships for college students. The group, known as ARCS (Achievement Rewards for College Scientists), was holding its national meeting in Lubbock. We were pleased to explain to this group some of the research which is conducted at the Center.

Other visitors included Glenn Reynolds, Wesco, Loraine, TX, who brought nine members of a ginning cooperative in Greece for a tour of the Center; eight 4-H club members from Ackerley, TX; Carl Cox, Texas Food and Fibers Commission, Dallas, TX; Harry R. Cox, Elf Atochem, Prairie Hill, TX; and A. A. (Tony) Ball, Schubert & Salzer Maschinenfabrik AG, Ingolstadt, Germany.