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CONFERENCE ON COTTON AND NEW SPINNING TECHNOLOGIES The Textile Research Center and the American Schlafhorst Company sponsored a conference on "The Role of Cotton in New Spinning Technologies" in Lubbock on February 22 and 23, 1984. It originally was intended that approximately forty persons (half from textile manufacturing and half from cotton production) would be invited to participate in a workshop on the subject. However, information about the meeting became known to others, and more than eighty ultimately attended. We were pleased with this interest.

Speakers at the conference were Howard Baker, Milliken & Company, Spartanburg, SC; Helmut Deussen, American Schlafhorst Company, Charlotte, NC; L. C. Unfred, Plains Cotton Cooperative Association, Lubbock, TX; Wilton E. (Sandy) Carter, Jr., American Truetzschler, Inc., Charlotte, NC; Robert Hale, American Cotton Growers, Inc., Littlefield, TX; and John Gannaway, Texas Agricultural Experiment Station, Lubbock, TX.

The information in the presentation given by Mr. Deussen was found to be closely aligned to research in progress at the Textile Research Center, and we asked permission to reproduce a portion of this in *Textile Topics*. We are pleaed that this is agreeable and feel the following excerpts from Mr. Deussen's paper will be of interest to our readers. We regret that space does not permit carrying the entire speech.

"The history of cotton as a textile raw material can be traced back more than 3000 years when cotton was first reported to be used in luxury garments for ancient royalty. Today, cotton constitutes the most widely used textile fiber the world over.

"After Arkwright's invention of the 'Spinning Jenny' in 1769, the industrial revolution in the 19th century produced two types of power-driven spinning machines: the mule spinner and the ring spinning frame. In the first half of this century, the costlier mule spinning method was replaced by faster and easier-to-operate ring spinning machines, even though the mule spinner delivered superior yarn. The pressure of having to lower manufacturing costs with constantly rising labor cost was greater than the desire to maintain yarn quality differentials, so that by about 1940 the superior mule yarn was entirely replaced by ring yarn.

"This economic pressure continued and will continue with the search for even faster and more automated production methods of converting fiber into yarn. We are now witnessing the second example of this revolution, whereby large areas of cotton ring spinning are displaced by the rotor spinning method. The 1990s may well repeat this process when friction and/or airjet spinning may be added to the rotor and ring spinning methods."

Figure 1 (on the following page) "puts into perspective the total spinning cost per pound of a 30's cotton yarn in constant 1983 dollars:

- by about 1950 spinning a pound of 30's yarn on a non-automated ring spinning frame cost only 72% of producing the same yarn on a mule spinner;
- by about 1975 making a pound of 30's yarn on an automated, high-speed ring spinning frame was 25% less expensive than on a slower ring frame without automatic doffer,
- by 1979 a second-generation rotor spinning frame lowered the spinning cost by another 29% as compared to the best ring frame;
- today, fully automated rotor spinning . . . brings the cost/pound down to 54% of that of the most modern ring frame;
- by the year 2000 it is likely that yet another spinning technology, possibly friction spinning, reduces the cost/pound to 72% of that of fully automated, high-speed rotor spinning.

"The point is that lower-cost yarn making systems will conquer even larger market shares, even

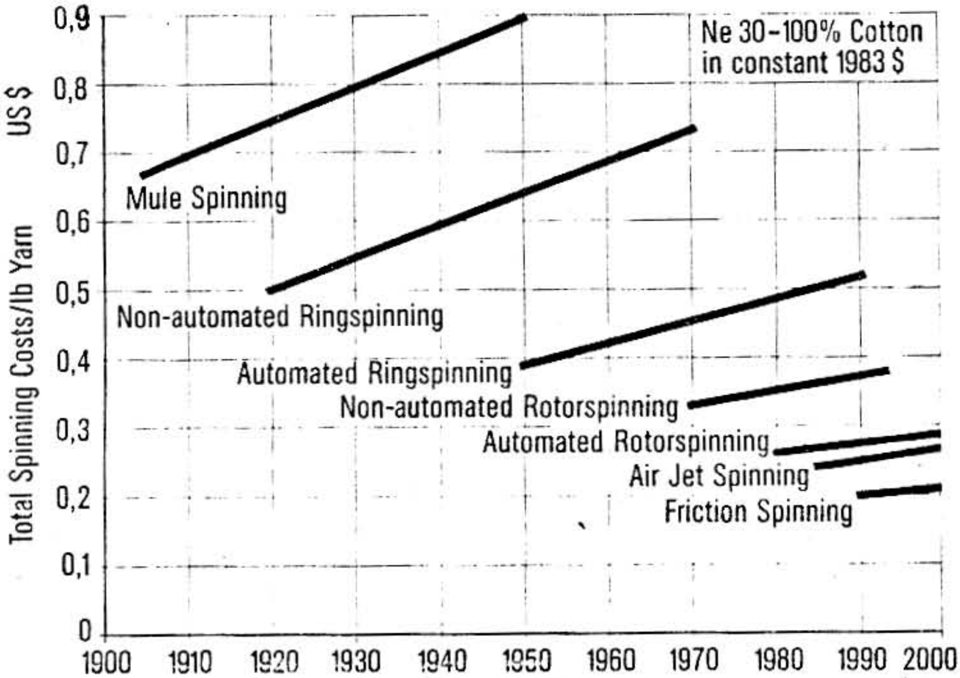

FIGURE 1

though the new yarn may not have the same attributes as the one it replaces.

"If one would continue the lines in this chart, it becomes clear that the ever-widening disadvantage in terms of cost/pound, for instance between non-automated ring spinning and fully-automated rotor spinning, by the year 2000 simply eliminates those mills from competition which have not chosen to use the new yarn-making technologies.

"Yarns made by new systems are no exact substitutions for existing products. They have to be engineered differently to meet the same end-use in a woven or knitted fabric. This recognition is important, because the open-end spinning system as well as the rotor, airjet or friction spinning method assemble and twist fibers in a different manner and create yarn structures with properties different from that of ring yarn. Some of these properties are superior, some are inferior to ring yarn; but by correct manipulation of raw material and machine, rotor yarns can be spun today which are as good or better than ring yarn. Accepted ring spun standards are being displaced by better rotor yarns in terms of quality and processing performance. This effort of raising quality and performance levels along with lower production costs will be repeated with every new commercially successful, economical and flexible spinning method.

"The role of the raw material in this evolution is most important; and that brings us to the purpose of this discussion: to assess the impact of fiber properties, in particular cotton, on the new spinning systems.

"In the **ring spinning system** the yarn properties as well as spinning performance are determined by these fiber properties, and in this order of importance: 1) Fiber length and uniformity ratio; 2) Fiber strength; 3) Fiber fineness.

"In **rotor spinning** this order of importance is quite different: 1) Fiber strength; 2) Fiber fineness; 3) Fiber length and uniformity ratio; 4) Cleanliness.

"It appears that in **airjet spinning** the sequence of importance changes slightly and adds another value, which is fiber friction (fiber-to-fiber, fiber-to-air, fiber-to-machine surfaces): 1) Fiber fineness; 2) Cleanliness; 3) Fiber strength; 4) Fiber length and uniformity ratio; 5) Fiber friction.

"In the emerging technology of **friction spinning** we expect these parameters in this order to determine yarn properties, although many facets of **friction spinning** are not as yet fully understood. 1) Fiber friction; 2) Fiber strength; 3) Fiber fineness; 4) Fiber length and uniformity ratio; 5) Cleanliness.

"It can be seen that fiber length plays a secondary role in all new spinning systems, whereas fiber strength and fiber fineness are the primary contributors to the desired yarn and fabric properties. This is the basic difference to the ring spinning technology.

"Therefore, in our opinion, it will be far more important, and also more profitable, to grow cotton varieties with high strength and greater fineness than to strive for greater staple length."

At this point Mr. Deussen gave a thorough discussion of each of the fiber properties given above and related them to the quality of yarn produced on the various spinning systems. The summary of his presentation included the following:

"In the foregoing paragraphs I have tried to discuss cotton fiber properties important to new spinning technologies, such as rotor, airjet and friction spinning. We have seen that these fiber properties affect both the spinning performance and the end product quite differently from the conventional ring spinning method.

"If - from the standpoint of the machinery developer and the spinner as user of this new technological hardware - we are allowed to establish a wish-list of what objectives we would like the cotton producers to pursue, then we would define these suggestions as follows:

Micronaire:	2.7 or less to 3.50
Fineness:	100 or less to 125 mtex
Percent Mature Fibres:	72% to 88% or more
(Maturity Ratio)	(0.8 to 1.0 or better)
Strength:	25 to 30 g/tex
Length:	7/8 to 1-1/16 inches
Uniformity Ratio:	45% or better
Shirley N.L.C.:	less than 1.5%
Microdust Content:	Minimal

We believe the portions of Mr. Deussen's paper reproduced here will be of interest to our readers. Those who would care to have the complete text should write to him at the American Schlafhorst Company, P. O. Box 240828, Charlotte, NC 28224.

RESEARCH ON FLAME RESISTANT FABRICS Research has found that wool and mohair in upholstery fabrics are generally sufficiently flame resistant to meet moderate flammability tests such as the DOCFF 1-70, DOCFF 2-70 and the Motor Vehicle Standard number 302. These fibers can be ignited, however, if they are exposed to a high temperature heat source, and they do support combustion under bone dry conditions. Consequently, fabrics composed of wool and mohair do not pass the flammability test for children's sleepwear, nor do they meet Federal Aviation Authority (FAA) standards for airworthiness of upholstery fabrics. Since wool and mohair are relatively flame resistant as compared to cellulosic and some man-made fibers, it would seem that these fibers would require very low add-on of flame-retarding agents to meet the above mentioned flammability standards. However, it has been found that these fibers need significant amounts of flame-retarding agents to attain this.

Considerable efforts to enhance the flame resistance of wool have led to the availability of effective flame-resistant treatments for this fiber. At the Textile Research Center, wool has been rendered flame resistant through intimate blending with Cordelan, a highly flame resistant fiber. The advantages of this procedure are that the hand and aesthetic properties of wool are not affected and the flame-resistant treatment will withstand multiple washings and/or dry cleanings. Also, the fabrics are dyeable in union and heather shades.

As for mohair, very little information on its flame resistance has been found in published literature. A recent study at TRC involving a blend of 50% mohair (cut top, 1½", 30's) and 50% Cordelan (1½", 2.0 denier) utilized a 12/1 N_e yarn for producing a single-knit jersey fabric, and this was used for a preliminary investigation of the blend's resistance to flaming. Physical properties of the yarn and knitted fabric are shown in Table I (next page). The fabric exhibited excellent hand and smooth appearance.

Shrinkage data given in Table II indicate that initially the greige fabric had a fairly high relaxation shrinkage. However, the relaxed knit after five washing and tumble drying (WTD) cycles shrank 8.3% in the wale direction and 6.8% in the course direction. When dyed with neutral premetalized dye, the fabric attained a relaxed state and exhibited only 1.1% shrinkage in the wale direction and 2.2% shrinkage in the course direction after five WTD cycles (approximately 5.0% shrinkage is considered normal for single-knit fabrics). It is worth mentioning that even though both wool and mohair are keratin fibers, mohair has no tendency to felt.

Utilizing the vertical flame test, the 50%/50% mohair/Cordelan fabric survived the three-second and twelve-second ignition tests under bone dry conditions, both initially and after a four-hour boil test (Table III). The four-hour boil test approximates fifty home launderings and is used as a screening test for

50 washings. These vulnerability results show that the 50%/50% mohair/Cordelan fabric would pass both the DOCFF 3-71 test for children's sleepwear and the FAA standards for compartment interiors.

This study was sponsored by the Natural Fibers & Food Protein Commission of Texas (NFFPC) and was conducted by Dr. R. D. Mehta, manager of special finishes research at the Textile Research Center.

TABLE I

50/50 MOHAIR/CORDELAN

SKEIN TEST		SINGLE-YARN TENSILE TEST	
Actual Yarn Number (N_e)	12/1	Tenacity (g/tex)	8.46
CV% of Yarn Number	2.64	Mean Strength (g)	393
Count-Strength-Product	1208	CV% of Strength	12.7
CV% of CSP	3.81	Elongation (%)	13.2
USTER EVENNESS TEST		**KNIT CONSTRUCTION: SINGLE JERSEY KNIT**	
Non-Uniformity (CV%)	16.35	Wales per Inch	17.4
Thin Places/1,000 yds	59	Courses per Inch	12
Thick Places/1,000 yds	72	Ball Bursting Strength (lbs)	66.2
Yarn Appearance Grade	A		

TABLE II

SHRINKAGE TEST OF 50/50 MOHAIR/CORDELAN BLEND SINGLE JERSEY KNIT

	Direction	Relaxation Shrinkage (%)	Shrinkage After 1 WTD Cycle (%)	Shrinkage After 5 WTD Cycles (%)
Greige	Wale	16	5	8.3
	Course	14 (+)	3.9(+)	6.8(+)
Dyed	Wale	1.4	1.5	1.1
(With Premetalized Dye)	Course	1.3	0.9	2.8

TABLE III

FLAMMABILITY OF 50/50 MOHAIR/CORDELAN BLEND SINGLE JERSEY KNIT

		Vertical Flame Test			
		3 Second Ignition		12 Second Ignition	
Fabric	Index Values	Char-Length (cm)	AFT (sec)	Char-Length (cm)	AFT (sec)
Initial	27.6	1.6	Nil	5.5	Nil
After 4-Hour Boil Test	26.5	Nil	Nil	6.7	9.2

MOHAIR COUNCIL DIRECTORS VISIT TRC The Directors of the Mohair Council of America visited the Textile Research Center on March 22. The purpose of the visit was to study the various research programs at the Center that are utilizing mohair produced in Texas. Present for this visit were Robert Pfluger, President; Joe David Ross, Vice President; Perry Bushong, Secretary/Treasurer; Herman Moore, Immediate Past President; Directors Mark McLaughlin, Jeff Sutton, Willie Willimann, Robert Allison, James Greer, and Jesse Lockhart; and Robert Paschal, Executive Director.

We were pleased to have these Mohair Council officers and directors see first hand the research on mohair that is being conducted here.

VISITORS Other visitors during March included Tokumu Goto, Unitika Ltd., Kyoto, Japan; Mr. Kimura, Unitika Ltd., New York, NY; Michele Whalen and Karen Hamilton, Cotton Incorporated, Raleigh, NC; Roger Bolick and Bonnie Steptoe, Allied Plastics & Fibers, Hopewell, VA; Kurt Masurat, George A. Goulston Chemical Company, Monroe, NC; Allen E. Owen, WestPoint Pepperell, West Point, GA; Miroslav Cuculiza, H. C. and B. Corp., Tegucigalpa, Honduras; and Shlomo Peles and Jacov Gutman, The Cotton Production & Marketing Board, Tel Aviv, Israel; plus more than 300 students from area high schools and universities.