



## FIBER/YARN STRENGTH RELATIONSHIP

It seems there is no end to the interest in spun yarn strength, along with the contribution made by the fiber being used. As industry places more emphasis on higher production and increased efficiency, the need to utilize a fiber that will give the best possible yarn strength becomes more apparent. While many of our friends in industry are seeking high strength cottons, cotton producers are also interested in the same thing, for in many cases a cotton measuring above 25 grams/tex can be marketed at a premium price.

In response to the June 1990 issue of *Textile Topics* (Vol. XVIII, No. 10) in which we included fiber and yarn spinning test results, we received a letter from a friend in Egypt who pointed out an interesting aspect of yarn strength, both count-strength-product and single-strand tenacity. Dr. Galal A. H. Daabis of Alexandria wrote to point out that these two yarn strength measurements can be used as an indication of the preparation of the fiber being spun. The following is quoted from Dr. Daabis' letter:

"With reference to the Annual Texas Cotton Quality Report given in Vol. XVIII, No. 10 of the *Textile Topics*, it is noted that your special interest is evaluating the cotton spinning quality. Among the yarn quality measures given, an extra measure may be added: namely, the Preparation Index which is the direct ratio between the count-strength-product and the tenacity (yarn strength in grams/tex) with no change in dimensions.

"This ratio has been subject to many previous discussions. It is supposed to be independent of the yarn twist and is also independent of the fiber tenacity. It reflects the effect of the yarn irregularity spectrum and is essentially a derivative of the preparation and processing parameters. This implies a review of the spinning quality."

After studying the letter from Dr. Daabis, we asked John Price, assistant director of the International Center, to comment on it. The following is taken from a memo prepared by Mr. Price after he studied Dr. Daabis' comments:

"The letter . . . from Dr. Daabis in Egypt reminded me of some work which was published in the 1981-82 report to the Natural Fibers and Food Protein Commission of Texas. The study showed that the relationship between count-strength-product and yarn tenacity is good. Correlation coefficients between the two strength measures range from 0.81 up to 0.99. Regression equations demonstrate that the relationship is of the form  $CSP = a + b$  (tenacity).

"Dr. Daabis essentially proposes a simpler relationship of the form  $CSP = b$  (tenacity), in which there is no constant term and the slope of the line (b) he calls the Preparation Index. The work reported in the Natural Fibers Report used different fibers and blends, and we can agree that the Preparation Index is independent of fiber tenacity.

"As finer yarns are spun, they become more irregular, implying more weak points. Since CSP is supposed to reflect the strength of weaker points along the yarn length than tenacity, which is derived from the average of all single-yarn strength values, then the ratio of CSP to tenacity can be expected to decrease, and so it does. This confirms Dr. Daabis' statement that the Preparation Index will reflect the irregularity of the yarn, hence the success of preparatory processes in providing the best feedstock for the spinning frame as well as the condition of the spinning machine itself."

Related to this subject, an evaluation of fiber strength and its contribution to yarn strength has been underway here at the International Center for some time. Taking information from the Texas Cotton Quality Evaluation, Crop of 1989, we made a study of two different measures of fiber strength and related these to count-strength-product and single-strand yarn tenacity. Our report on the 1989 crop included fiber test results by the Spinlab Stelometer and the Pressley instrument, along with the results coming from an HVI system. Utilizing the values from the two individual instruments (Stelometer and Pressley), we compared both of these with the two systems of measuring yarn strength. That is, we determined the correlation between Pressley values

and count-strength-product and single-strand yarn tenacity, and then we used the Spinlab Stelometer measurements and correlated these to the same two yarn strength values.

Table I (right) gives the values taken from the 1989 Texas Cotton Crop Evaluation and used in our analysis. We would like to mention that each count-strength-value shown is an average of ten 120-yard skein tests. Single-yarn tenacity is the average of 100 tests, and both Pressley and Stelometer fiber strength values are the averages of six individual tests.

We realized many years ago that the Pressley instrument ("0" gauge) does not give a fiber strength value that correlates well with yarn strength. On the other hand, we have observed that the results from the Stelometer and the two HVI systems (1/8-inch gauge) correlate much better with yarn strength expressed in either count-strength-product or single-strand tenacity. Using the 18 cottons in the 1989 report, we thought it would be interesting to re-evaluate our earlier findings. We began by determining the coefficient of correlation between Pressley "0" gauge and the Spinlab Stelometer 1/8" gauge measurements. This was followed by establishing correlations between each fiber test method and the two yarn strength values, and then finally determining the relationship between count-strength-product and single-yarn tenacity. For this, we used the results obtained from testing the Ne 22/1 ring-spun yarns produced from the same cottons.

Table II below presents the coefficients of correlation that were obtained from these results. It will be seen that the correlation between Pressley "0" gauge measurements and other values was relatively low. However, the coefficients of correlation when utilizing the Spinlab Stelometer grams/tex values were higher for both the count-strength-product and the single-yarn tenacity. Also, it should be noted

TABLE II  
Coefficients of Correlation

Strength Measurements	"r" Value
Pressley "0"-Gauge Fiber Strength vs. Stelometer 1/8" Grams/tex	0.55
Pressley "0"-Gauge Fiber Strength vs. Yarn Count-Strength-Product	0.57
Pressley "0"-Gauge Fiber Strength vs. Single-Yarn Tenacity (g/tex)	0.66
Spinlab Stelometer 1/8"-Gauge G/tex vs. Yarn Count-Strength-Product	0.80
Spinlab Stelometer 1/8"-Gauge G/tex vs. Single-Yarn Tenacity (g/tex)	0.80
Yarn Count-Strength-Product vs. Single-Yarn Tenacity (g/tex)	0.97

TABLE I

Fiber and Yarn Strength Values

Lot No.	Fiber		Yarn (22/1 Ring-spun)	
	Pressley	Stelometer (g/tex)	CSP	Tenacity (g/tex)
1	83.8	25.1	2172	13.80
2	89.4	23.6	1872	12.96
3	85.4	21.8	1897	12.72
4	88.3	25.0	2365	16.11
5	95.6	27.7	2882	18.49
6	93.6	26.5	2404	16.29
7	86.0	23.6	2140	14.18
8	84.0	23.2	1822	12.46
9	86.6	25.8	2112	14.22
10	86.5	22.5	1503	11.70
11	83.9	23.4	1943	13.60
12	83.0	24.2	2078	13.88
13	85.5	24.7	2126	13.97
14	83.2	23.6	2228	14.37
15	81.9	25.0	2205	14.64
16	84.7	23.6	2293	15.31
17	83.4	24.5	2024	13.62
18	94.9	24.8	2419	16.12

Pressley Value x 1,000

that the correlation between CSP and yarn tenacity was very high, as was mentioned by John Price in the memo that we quoted previously.

In the next issue of *Textile Topics* we will present similar information using the Ne 22/1 rotor-spun yarn from the same eighteen cottons.

We trust the information given in this report will be of interest to our readers. We appreciate Dr. Daabis' correspondence, and we will be pleased to hear from others about this same subject.

Our study of fiber and yarn strengths is sponsored by the Texas Food and Fibers Commission (formerly the Natural Fibers and Food Protein Commission of Texas). We are grateful for the support given by that agency.

## TWO-DAY CONFERENCE FOR TURKISH DELEGATION

On August 8 and 9, the staff of the International Center conducted a conference for six cotton researchers from Turkey. Subjects presented were the growth and development of the cotton fiber, sugar and other contaminants on cotton, instrument testing to determine fiber properties, relating fiber quality to yarn and fabric quality, processing of cotton into yarn and fabric, and the chemical finishing of cotton products.

Participating in this conference were Dr. Alaettin Civaroglu, fiber technologist and cotton physiologist; Attila Sahin, agronomist; Mustafa Kucuker, agriculture mechanization/harvest cultivation; Gurgun Tosun, cotton breeding; Abraham Naza, cotton breeding, pest & disease; and Ali Eker, agronomist and cotton physiologist.

Accompanying these six researchers were Dr. Uel Stockard, retired from the Texas A&M University Extension Service; and Ishmail Eksi, who served as translator for the group.

## "TALL" GROUP VISITS CENTER

Twenty-six members of the Texas Agricultural Lifetime Leadership (TALL) visited the International Center on August 30. The TALL program is part of the Texas Agricultural Extension Service commitment to develop leadership for the future. The time spent at the Center was used to discuss the three natural fibers produced in Texas (cotton, wool and mohair) and the value of these fibers to the state's economic base. A tour of our research facilities was also part of the visit.

TALL members (all from Texas) participating were David Burrus, Tornillo; Michael Cain, Ennis; Charles Cammack, San Antonio; Scott Campbell, San Angelo; David Chapman, Happy; Gordon Clark, Dumas; David Cleavinger, Wildorado; Barry Evans, Canyon; Stephen Fortenberry, Abernathy; Brian Gilbert, Houston; Kirk Hansen, Chilton; Juan Hernandez, Waco; Joe Bob Huddleston, Stephenville; Robert Hughes, Dumas; Jerry Kidd, Christoval; Timothy Laws, Sulphur Springs; Mike Mann, Cleburne; Jim McAdams, Huntsville; Terry Moren, Longview; Don Renchie, Austin; Glenn Schur, Plainview; Cindy Swanberg, McAllen; Susan Tortello, Woodville; Janet Tregellas, Booker; James Wedel, Muleshoe; and Jennifer Yezak, Bremond. Accompanying the group were Dr. Bill Pope, TALL Program Coordinator, Texas A&M University, College Station; and Dr. Ken Denmark, Extension Staff Development Specialist, also of Texas A&M University, College Station.

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## TEXCELLANA DEVELOPMENT PROGRESSING

We have mentioned from time to time that we have been seeking a manufacturer to produce commercial quantities of the TEXCELLANA fabric developed here at the International Center. This fabric is made of blends of Texas cotton and wool, the cotton content ranging from 70% up to 80%.

With contacts made through Mr. George Lenox of Lenox Fabrics, Dallas, Texas, we are currently working with three textile companies that may be interested in producing TEXCELLANA on a fairly large scale. Preliminary studies of the fabric by two of these companies apparently were positive, for they have asked for sufficient quantities of yarn spun here at the Center to be used in mill-scale trials. We will give additional information about the progress of this development in future issues of *Textile Topics*.

The research required for the development of TEXCELLANA blends has been sponsored by the Texas Food and Fiber Commission.

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We were pleased to have the TALL group with us, and we look forward to the next opportunity to work with tomorrow's Texas agricultural leaders.

## VISITORS

In addition to the visitors already mentioned, eight textile executives from Indonesia came to the Center on August 9. This group was sponsored by Cotton Council International and included Husein Aminuddin, P.T. Textra Amspin, Jakarta; Djon Wono, P.T. Dasatex Spinning Mills, Jakarta; Yashroop Mal Lodha, P.T. Bitratex Industrial Corp., Semarang; Nancy Wan, P.T. Eratex Djaya Ltd., Jakarta; Madan Singh Rathore-Rapporteur, P.T. Indo Rama Synthetics, Kav.; Philip Young, P.T. Young Indonesia Textile Industries Ltd., Jakarta; Hang Yip Yao, P.T. Daya Sama Textile Co., Jakarta; and Jimmy Sumitro, P.T. Panca Citra Wira Brothers, Jakarta. They were accompanied by Ismet Fanay, Diplomatic Language Service, Arlington, VA; Frank Waddle, Cotton Council International, Hong Kong; and David B. Collins, Cotton Council International, Washington, DC.

Other visitors were Roger Bolick, Allied Fibers, Hopewell, VA; John T. Childers and Seburn Crocker, Henkel Corporation, Charlotte, NC; Chuck Holmes, Somet of America, Spartanburg, SC; Mr. & Mrs. J. A. Jackson, Lancaster Vocational Center, Lancaster, SC; Joe Yankee, Uster Technologies, Inc., Knoxville, TN; and Annette Sprawls, Knippa, TX.