COTTON FIBER PROPERTIES AND ROTOR-SPINNING PERFORMANCE   Within the past year the Textile Research Center has conducted several projects for the Natural Fibers & Food Protein Commission of Texas (NFFPC) involving the assessment of spinning performance and yarn quality of various Texas cottons. One of these programs specifically dealt with the relationship of length-related fiber properties to spinning performance. The study included an evaluation of the effects of short fiber content (fiber less than ½-inch in length) and the influence of upper-half-mean length or 2.5% span length on yarn quality and spinning performance. It is believed by some that a high percentage of short fibers could be potentially damaging to both quality and performance. It is already known that short fibers are poorly controlled by roller drafting at ring spinning and tend to stay in aggregates, which results in thick places in the yarn. Such defects can be responsible for breaks at spinning and contribute to yarn irregularity and poor appearance. Another aspect of cotton fiber length considered in this study was the uniformity ratio. Since length uniformity is related to short fiber content, it is difficult to determine whether these two measurements create an effect singularly or whether they work together to influence spinning and yarn quality.

This study was an extension of an earlier research program that involved 36 bales of cotton. Samples from each bale had previously been evaluated and spun into yarn. Additional samples from the same bales were tested by the array method (Suter-Webb Sorter), and length distribution characteristics obtained were correlated with length data provided by a Motion Control HVI 3000 system and a Spinlab Fibrograph. Data showing the relationship between short fiber content and length uniformity are given in Graphs 1 through 4 on the following pages.

In addition to the fiber testing, we thought it might be interesting to see what would happen if we removed much of the short fiber and improved the uniformity ratio by combing part of the cotton. The accompanying table of spinning results gives a comparison of the rotor-spinning performance and yarn quality of two yarns spun from the same cotton, one yarn having been produced from combed sliver and the other from carded sliver. It can be seen that the combed sliver carried a slightly higher upper quartile length, a lower length CV%, and a lower percentage of short fibers. Also, the yarn made from the combed sliver was slightly stronger, had fewer neps and gave a better spinning performance. It should be noted at this point that the combing process removes a portion of the foreign matter in a given cotton. This may have contributed to better spinning performance, since rotor spinning is affected by particles of foreign material carried along with the entering sliver.

Spinning was performed at ambient conditions of 72°F and 56% RH on a Rieter m1/1 O-E machine using a 45 mm N rotor operating at 60,000 rpm, a T.52 opening roller revolving at 6,700 rpm, and a six-grooved navel. The twist multiplier was 2.51 and the nominal yarn number was N_e 30.

Rotor Spinning Trial Results

Fiber Data	Combed Sliver	Carded Sliver
Upper Quartile Length	1.23	1.20
C. V. (%)	28.9	33.9
Short Fibers (%)	6.9	11.6
Yarn Properties		
Nominal Yarn Number (N_e)	30/1	30/1
Actual Yarn Number (N_e)	30.02	29.66
CV% of Count	2.4	1.3
Count-Strength-Product	1333	1257
CV% of CSP	3.5	1.8
Single Yarn Tenacity (g/tex)	10.41	9.44
Mean Strength (g)	205	188
CV% of Strength	10.1	9.9
Elongation (%)	4.61	4.40
CV% of Elongation	8.3	9.2
Specific Work of Rupture (g/tex)	0.261	0.228
CV% of Work of Rupture	17.7	17.4
Non-Uniformity (CV%)	15.27	15.24
Thin Places/1,000 yds	47	45
Thick Places/1,000 yds	117	99
Neps/1,000 yds	176	211
Hair Count/100 yds	1350	1445
ASTM Yarn Grade	C+	C
Number of Breaks	12	38
Break Rate/1,000 Rotor Hours	120	415
Test Duration (rotor hours)	8 hr. 20 min. (12 rotors)	8 hr. 20 min. (11 rotors)

SHORT FIBER CONTENT (Array Method) vs.
UNIFORMITY RATIO (Digital Fibrograph)

r = 0.5349

Staple: x = Short, ⊙ = Medium, △ = Long

Short Fiber Content (%)(Array Method)

Uniformity Ratio (%)(50/2.5% Span Lengths)
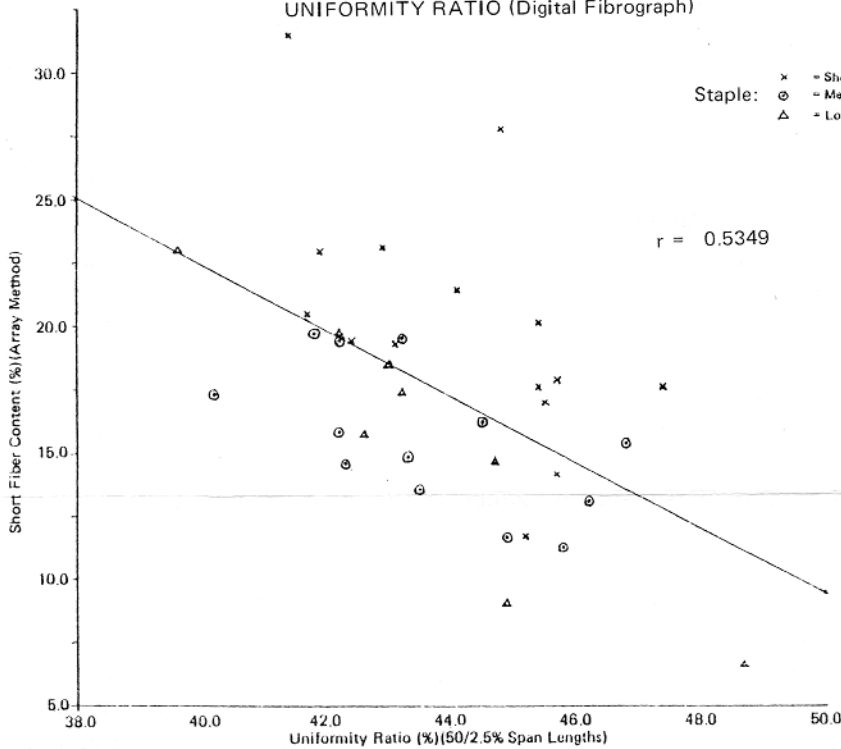
GRAPH 1

SHORT FIBER CONTENT (Array Method) vs.
UNIFORMITY RATIO (MCI 3000)

r = 0.8312

Staple: x = Short, ⊙ = Medium, △ = Long

Short Fiber Content (%)(Array Method)

Uniformity Ratio (%)(Mean/Upper Half Mean Lengths)
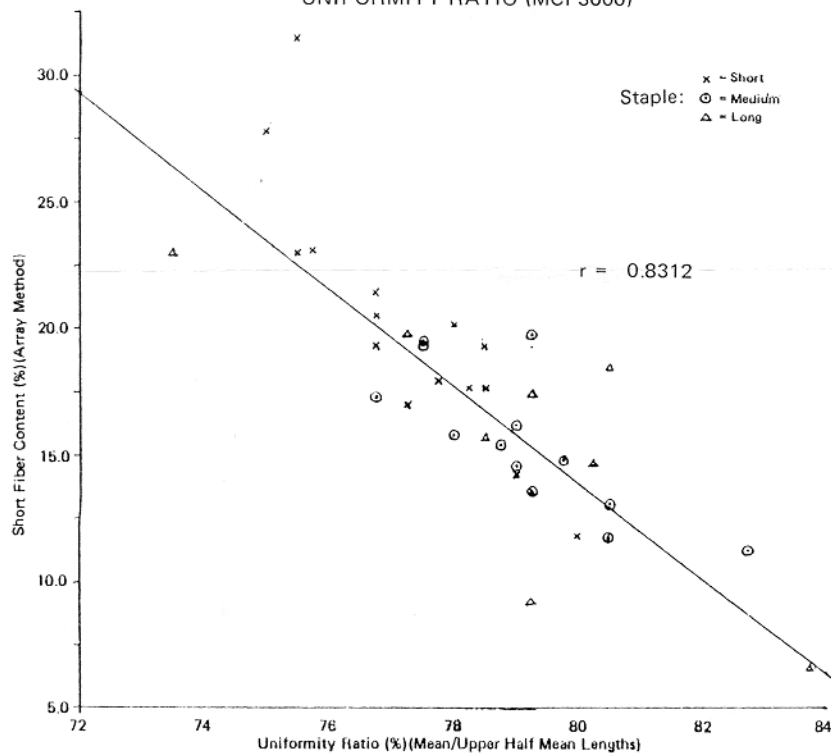
GRAPH 2

It will be noted that neither yarn had high strength as expressed by count-strength-product or tenacity. The reason for this was the low twist multiplier. This was selected in order to accentuate any differences in the yarns, but as it turned out, there were no great differences in physical characteristics. There was considerable difference in the spinning performance, however.

In the report on this program to NFFPC, prepared by John Price, head of TRC's new spinning technologies research, a summary and several conclusions were given. Thinking these will be of interest to our readers, we are reproducing them from the report.

" Very highly significant correlations were detected between upper-quartile length or mean length and the upper-length statistics provided by the three instrument aggregates (Suter-Webb Sorter, Fibrograph and MCI HVI 3000). The coefficient of variation gave the highest values of correlation coefficient with uniformity ratio. The array-determined short fiber content correlated significantly with the uniformity ratio of the Motion Control aggregate. There was no statistically significant correlation between short fiber content (array method) and uniformity ratio of the Spinlab high volume instrument, yet there was a significant correlation with 2.5% span length."

Conclusions coming from this report are as follows:

1. Irrespective of the source of the length data, an upper-length statistic in combination with a fineness-related value were found to provide

the best explanation of rotor-spinning performance. (For ring spinning, a description of short fiber content enters estimation equations, together with length and fineness properties.)

2. There appears to be little advantage to using array-test data instead of Digital Fibrograph results to describe the performance of fibers in terms of yarn strength or breakage rate at spinning.

3. The identification of the influence of short fiber content, per se, cannot be achieved by simple comparative trials unless very careful selection of cottons is made.

We hope this information will be of interest to many of our readers. We have selected this study to be featured in this issue of *Textile Topics* because of several comments and inquiries about short fibers and length uniformity. We wish to express our appreciation to the Natural Fibers & Food Protein Commission of Texas for permitting the publication of these results. As mentioned earlier, the report was prepared by John B. Price. Fiber testing was conducted in TRC's materials evaluation laboratories under the direction of Reva E. Whitt and Harvin Smith.

VISITORS   Visitors to the Textile Research Center during June included Dr. & Mrs. Hans Mark, University of Texas Systems, Austin, TX; Ronald Hagquist, Texas Department of Agriculture, Austin, TX; Lisle Cooper, L'isle Yarns, Austin, TX; F. Charles Swift, Picanol of America, Inc., Greenville, SC; Michele Woodruff, Cotton Incorporated, Raleigh, NC; Roger Bolick and Don Brown, Allied Plastics & Fibers, Hopewell, VA; Kurt W. Masurat, George A. Goulston Co., Monroe, NC; Daniel W. Bopp, Daniel Bopp AG, Kusnacht, Switzerland; and

SHORT FIBER CONTENT (Digital Fibrograph) vs.
UNIFORMITY RATIO (Digital Fibrograph)

r = 0.8718
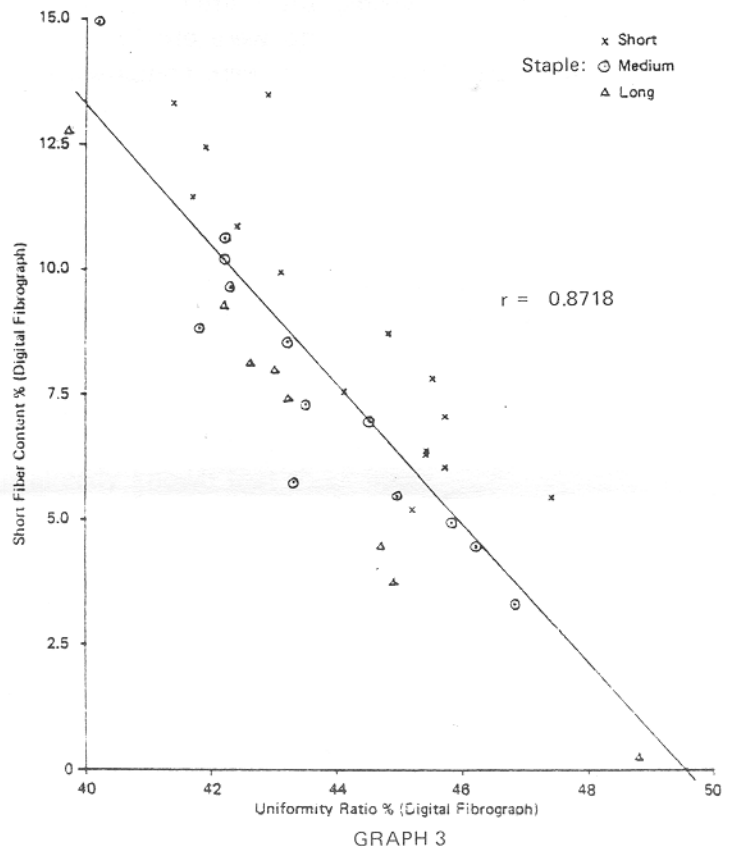
GRAPH 3

SHORT FIBER CONTENT (Digital Fibrograph) vs.
UNIFORMITY RATIO (MCI 3000)

r = 0.7745
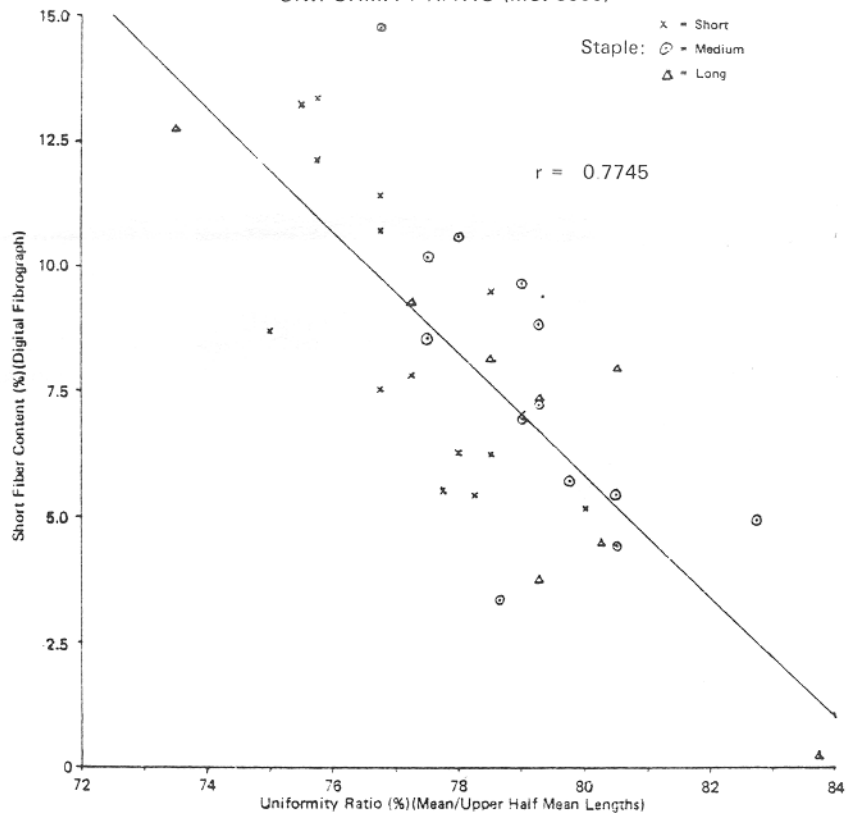
GRAPH 4

Ahmet Cetinbudaklar, TARIS (Cotton) Cooperative, Izmir, Turkey.

Several groups also visited the Center during June, foremost among them being approximately 60 Texas high school counselors who were on the Texas Tech University campus to attend various workshops and seminars. Other groups were composed of young people participating in the "Shake Hands With Your Future" program offered through Texas Tech's Division of Continuing Education.

WE NEED YOUR HELP   Although we attempt to maintain an up-to-date mailing list for *Textile Topics*, it is impossible to keep it 100% accurate. You can help by notifying us when there is a change in personnel or address in your organization. (Naturally, we prefer to add a new name to the 2200 already receiving *Topics*, rather than delete one from the list.)

We will appreciate hearing from you about any changes necessary to keep our mailing list current.