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EVALUATION OF SHIRLEY F/MT III

Readers of *Textile Topics* are aware that the International Center has been evaluating a new Shirley Fineness/Maturity Tester (F/MT III) that was installed here in August 1988. Research utilizing the instrument has continued since that time and we have developed some preliminary results that may be of interest.

Harvin Smith, head of ICTRD's materials evaluation lab, has been invited to give a report concerning our studies at the Beltwide Cotton Conference in Nashville, Tennessee on January 5, 1989. He agreed to do this and, with input from John B. Price, our assistant director, prepared the following review. We are printing this thinking it may be of interest to our cotton producing and spinning friends.

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ABSTRACT: Preliminary evaluation of the Shirley Developments, Ltd. model F/MT III instrument for measuring micronaire index, maturity and linear density of cotton fibers indicates that the instrument has the potential speed to be considered as a candidate for inclusion in high volume instrument systems. Although the higher speed was obtained with a slight sacrifice in precision when compared with the slower laboratory models (F/MT Ia F/MT II), test results are meaningful and significant when used as estimates of yarn dye uptake and nep content of dyed fabrics.

INTRODUCTION: A new high speed model of the Fineness/Maturity instrument, designated F/MT III, arrived at the International Center in early August. After a brief period of training and computer program adjustment, it was placed in operation.

The system has four primary components: a fiber blender to clean and prepare the specimen, a sensitive balance to weigh the sample, the test instrument itself, and a computer to control the process and compute the data.

The cycle time of the test instrument is about 12 seconds per specimen. Blending, identifying and weighing increase this time to an average of about 30 seconds per test in a continuous operation using one operator and making two tests per sample. Therefore, the complete test required about a minute on the average. This is a little slow for the HVI system, since we average about 40 seconds per sample on our Motion Control HVI, making four tests per sample for length and strength and two for micronaire.

RESULTS AND DISCUSSION: Test results reported here should be considered preliminary, since they are based on only a few samples and relatively inexperienced operators were employed.

The precision of the instrument is shown below:

	Ind. Test	Avg. of Two
Std. Dev. for Micronaire	.099	.081
Std. Dev. for Mat. Ratio	.034	.032
Std. Dev. for Pct. Mat.	2.40	1.86
Std. Dev. for Fineness	7.11	5.36

These data were based on eleven samples of cotton, two operators and ten replications. Each operator made two tests per sample for each replication, making a total of forty tests per sample.

The standard deviation for the micronaire test appears to be a little high, as this number is usually about .06 for the standard mic instrument. On the plus side, the standard deviations quoted in the ASTM Manual for the early models of F/MT instruments is 3.2 for maturity and 8.0 for fineness. The precision shown here (2.4 and 7.1) is considerably better.

There was no bias between operators on this series of tests.

Test results on samples from bales previously processed through the Center revealed the following correlations:

For Measures of Micronaire Index:

F/MT III vs Std. Mic	.983
F/MT III vs Var. Wt. Mic*	.975
Std. Mic vs Var. Wt. Mic*	.973

*Variable Weight Micronaire

Although there are some small differences in these data, we do not attach any significance to them at this time.

For Measures of Maturity:

F/MT III vs F/MT Ia	.986
F/MT III vs F/MT II	.988
F/MT Ia vs F/MT II	.990

Again, the differences are small and in the third decimal place, although the two laboratory models seem to agree with each other slightly better.

For Measures of Fineness:

F/MT III vs F/MT Ia	.957
F/MT III vs F/MT II	.959
F/MT Ia vs F/MT II	.991

The correlation coefficients indicate some advantage toward the laboratory models in measuring fineness.

For F/MT III Measures with Micronaire Index:

F/MT Mic vs Std. Mic	.983
F/MT Maturity vs Std. Mic	.889
F/MT Fineness vs Std. Mic	.873

This shows the close agreement between F/MT mic and the standard mic and also the usual interrelationship between maturity, fineness and micronaire index.

The geometric properties of these test samples were also determined by our friends Thibodeaux and Evans, with the USDA at the Southern Regional Research Center in New Orleans. They measured the perimeter and cross-section area by use of an Image Analyzer.

The relationships between the computed values from these measurements with those of F/MT III are as follows:

Geo. Mic vs F/MT III Mic	.943
Geo. Mic vs Std. Mic	.942
Geo. Maturity vs F/MT III Mat.	.932
Geo. Fineness vs F/MT III Fineness	.881

Since these geometric measures are entirely independent of airflow and represent basic physical properties, it appears that the F/MT is providing very good estimates of mic, relative wall thickness (maturity) and linear density (fineness). Laboratory F/MT models showed correlations slightly higher than those shown here.

The real proof of a test measurement is in its utility as a predictor of end-product quality or processing performance. Micronaire and maturity measures are usually related to dye uptake and to nep formation.

The relationship of F/MT III values to dye uptake were assessed as total color difference (ΔE). **Based on a 2% dye solution on ring and rotor yarns we obtained the following correlations:**

	Ring	Rotor
Standard Mic	.857	.938
F/MT III Mic	.850	.936
F/MT III Maturity	.761	.833
F/MT III Fineness	.770	.859

With dye uptake, our research has shown a higher correlation with micronaire measurements than it has with either maturity or fineness. These data are no exception. Note that the F/MT value of mic is about the same as the standard mic in this comparison.

The following correlations were computed for neps in dyed fabrics made from ring and rotor yarns:

	Ring	Rotor
Standard Mic	−.711	−.399
F/MT III Mic	−.655	−.365
F/MT III Maturity	−.750	−.452
F/MT III Fineness	−.447	−.242

This shows a better relationship using F/MT maturity than with mic or other F/MT values. Relationships with laboratory models of the F/MT showed slightly higher values than for the F/MT III.

SUMMARY REMARKS:

In summary, the F/MT III provides repeatable and useful numbers at a speed potentially fast enough for use in marketing. The numbers are not quite as good as our slower laboratory instruments, but neither are the other HVI measures now being reported.

The speed is not quite what we hoped for, but we are confident that with a faster blender and a modified computer program, we can shave valuable seconds off the present cycle time.

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COTTON FIBER TESTING INTENSIFIES

In September each year, the HVI evaluation of cotton at the International Center begins to increase, and this activity continues with high intensity through the winter until late March or April. Cotton samples for this evaluation are shipped to us from many points in the United States, and occasionally even from other countries. Recent testing has been performed on samples from California and across the cotton belt to Georgia. A good portion of this is done in conjunction with spinning tests, but much of it is simply testing samples to determine the quality of the cotton that has been produced in a given area.

After this busy period, fiber testing slacks off considerably. There are weeks during the summer when only a moderate amount of testing is conducted. This makes organization somewhat difficult, both in equipment and personnel. Presently all our HVI testing is conducted on a single Motion Control system, which is totally adequate during the summer but very limiting from September until April. During the months of intense testing, we would like to have additional equipment. As it is, we use the one unit twelve hours each day, beginning at 5:00 in the morning and continuing until 5:00 p.m.

Plans are underway to acquire a new 4000 HVI

from Motion Control, Inc. Unfortunately, this will not arrive in time to help very much this season, but we should be well prepared for the peak fiber testing during the latter part of 1989 and into 1990. We look forward to having the new system, for not only will it increase our capacity for testing, it will also afford us state-of-the-art instruments for our overall research.

All fiber evaluations at ICTRD are conducted by ten experienced fiber technicians under the supervision of Harvin Smith, head of materials evaluation, and Pauline Williams, his assistant.

NEW RIETER EQUIPMENT ORDERED

We are pleased to announce that an order has been placed with the Rieter Corporation for a new opening and cleaning line and a new card. Installation of this machinery is scheduled for early 1989. The need for additional equipment in our laboratories has become increasingly evident as the Center's evaluations of U. S. cotton have increased.

The state-of-the-art blowroom machinery consists of the latest designs from Rieter and will provide excellent cleaning and fiber preparation for yarn production. The cleaning line includes a metal extractor, a Monocylinder cleaner model B 4/1, and two ERM cleaners model B 5/5. These machines can be used in various arrangements which will provide different levels of cleaning for our evaluations. In addition to the cleaning machinery itself, we have also ordered an Aerofeed-U chute system to be used in conjunction with a new high production model C4 card.

We plan to use this equipment in an extensive program to determine the best cleaning procedure for various qualities of cotton. Evaluation of these cottons will continue through ring and rotor spinning.

VISITORS

Recent visitors at the International Center included Olin Wilson, Burlington Industries, Wake Forest, NC; George Blomquist, Parkdale Mills, Inc., Lexington, NC; Lynne Jordan Bowers, Texas Higher Education Coordinating Board, Austin, TX; Greg Wortham, Senate Offices, Austin, TX; Christopher J. Lupton, Texas A&M University, San Angelo, TX; J. D. Cook, Mertzon, TX; Edwin Gerik, G&P Seed Company, Whitney, TX; Dan Pustejovsky, G&P Seed Company, Hillsboro, TX; J. William Lauderbach, Gary King, Phil Brewer and Cole Morvan, Texas Department of Commerce, Austin, TX; Andrew J. Giles, E. I. Du Pont de Nemours & Co., Inc., Old Hickory, TN; Pat Reed, Andy Kupper and Greg Ingham, Levelland Chamber of Commerce, Levelland, TX; James W. Sherman, Manville Corporation, Toledo, OH; Arn Olsen, Manville Corporation, Defiance, OH; Will Leatherman, ContiCotton, Fresno, CA; Curtis Schmedes, A. Lasberg Cotton Co., Dallas, TX; and Suzen Fyffe, S. Harris & Co., Dallas, TX.

Other visitors were Mr. & Mrs. Denis Bowers, Adana, Turkey; W. J. Naarding, Hengelo, The Netherlands; Eric Hequet, Institut de Recherches du Coton et des Textiles Exotiques, Montpelier, France; Murray Taylor, Wool Research Organization of New Zealand, Christchurch, New Zealand; Li Jianxiong and Sha Qihao, China National Textiles Import & Export Corp., Shanghai, People's Republic of China; and Zhang Guo Liang, Shanghai Textile Raw Materials Corp., Shanghai, PRC.

Groups visiting included six members of the Texas Tech University Faculty Newcomers Club; 206 students from elementary schools in the area; 58 high school students; ten graduate students from Texas Tech's College of Home Economics; and a group of forty-four men and women who were attending a mission conference at Trinity Church of Lubbock.