# TEXTILE topics

summer 1999

International Textile Center | Texas Tech University | Lubbock, Texas USA


*Sharing current research information and trends in the cotton and textile industries.*


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## COMPUTER SPECIALIST JOINS ITC

Prashant Urkudey has taken a research associate position at the ITC, managing the computer information systems. He will construct custom software and integrate it with necessary hardware configurations, for both research and administrative applications. He has an undergraduate degree and master degree in chemical engineering, and he recently was granted an MBA from Texas Tech University in Management Information Systems.

## CHEMIST JOINS ITC

Effective September 1, Dr. Noureddine Abidi will join the ITC. His B.S. and M.S. degrees are in Chemistry. His Ph.D. is in Theoretical, Physical and Analytical Chemistry, from the University of Montpellier II (France). His research at the ITC will focus in the arenas of textile and macromolecule chemistry.

## NEW EQUIPMENT

The Materials Evaluation Lab has a new Uster® Lab Expert to link the AFIS, UT3, and Tensorapid testing devices into a central database.

A video editing system has been purchased with funds from the CH Foundation, enabling the production of video projects within the ITC.

## ITC TRAVELS

Dean Ethridge, Eric Hequet, and James Simonton traveled to Paris in June for the International Textile Machinery Association (ITMA) exposition. During the trip, Ethridge attended a meeting of International Textile Academia (ITA) in Paris and visited the Federal Research Institute (ETH) in Zurich, Switzerland. Also, Ethridge and Hequet visited the *Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (CIRAD), Montpellier, France.

S. S. Ramkumar attended and made presentations at (1) The Fiber Society's 58th General Technical Conference, May 3-4, in Pennsylvania, and (2) the Gordon Conference on Fiber Science, July 4-9, in New Hampshire.

Pam Alspaugh attended the International Conference of Agricultural Communicators in Education, June, in Tennessee.

## PROFESSIONAL EDUCATION OPPORTUNITIES

Please read the insert in this issue for information on: a seminar by Prof. Urs Meyer (Sept. 28); a Cotton Fiber Properties Seminar (Sept. 29-30); and the Gulf Coast Sectional Meeting for the American Association of Textile Chemists and Colorists (Nov. 16-17).

# TRASHCAM: A NEW INSTRUMENT FOR COTTON BREEDERS

*Eric Hequet, Assistant Director, International Textile Center*
*Mourad Krifa, Research Assistant, ENSITM, Haute-Alsace University*
*Jean-Paul Gourlot, Head of LTC, CIRAD-CA*

*Appreciation is due to the Texas Food and Fibers Commission for funding the research reported in this article.*

## INTRODUCTION

Seed coat fragments (SCF) are small pieces of cotton seed coats that are torn off during the ginning process. Some cotton lint generally remains attached to these fragments, assuring that ginned lint will be contaminated by them. SCF contamination is a major cause of reduced productivity in textile manufacturing and of lower yarn and fabric quality (Curran 1992).

During the past decade, research has increased into the causes and the measurement of SCF, in order to find ways to alleviate this problem. Anthony (1988) demonstrated the ginning effect on SCF content and Mangialardi (1988) demonstrated that the SCF count was greatly affected by variety and growing location effects. Frydrych (1989) developed a technique for counting SCF on yarn with an existing evenness tester; it required a visual examination to classify defects into the different categories (fiber neps, SCF, sticky neps, etc.).

In 1995, the first generation of the Trashcam was developed at the *Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (CIRAD), Montpellier, France (Gourlot et. al., 1995). It was originally intended to count and determine the sizes of SCF in card webs, in order to predict the tendency for neps at early stages of cotton breeding programs. The technique was further developed (Giner, et. al., 1997; Gourlot, et. al., 1998; Krifa, et. al., 1998). The latest generation of Trashcam also counts and sizes SCF on yarn boards (Frydrych, et. al., 1999). In the current generation of Trashcam, the image of a card web or yarn board is captured by a scanning device, then analyzed by computer to provide the count and the size distribution of SCF.

During a three-year project, the Trashcam was used on card webs in a breeding program (Bachelier, 1998; Krifa, et. al., 1998), resulting in a significant improvement in selection to avoid seed coat fragments in new cotton varieties. Results also indicated that the level of SCF in card webs is a heritable characteristic.
Thus, the Trashcam promised to be an efficient tool in cotton breeding programs.

Since 1998, the CIRAD has been collaborating with the International Textile Center (ITC), in order to validate the usefulness of Trashcam readings on yarn boards and to check the between-machine reproducibility. This article is to report on preliminary results obtained to date.

## PROCEDURES

Variety evaluation tests were performed at the ITC during the 1998-99 crop year. Eighteen U.S. Upland cotton varieties were represented. Each variety was grown in two locations and two replicated samples were taken at each location. Therefore, a total of 72 cotton samples were collected (18 x 2 x 2).

The cotton fibers from each variety were processed through the Short Staple Spinning Laboratory at the ITC and were made into both ring-spun and rotor-spun yarns of different sizes. Exhibit 1 provides an outline of the mechanical process for all the cottons included in the analysis.

After processing, the yarn was wound on a white board. Two yarn boards were made and tested for each sample. Each face of the boards was scanned using a HP Scanjet 4C scanner. After capture of the images, they were automatically processed using the custom software produced by CIRAD. The average of the four readings was calculated and appropriate statistical analysis was done on the averages.

A preliminary experiment was done with an independent set of samples, in order to determine the length of yarn to be wound around the boards. Twenty cotton samples were selected, then 50 Ne ring-spun yarn was produced. Two lengths of yarn were tested: 56 meters and 96 meters. As shown in the Exhibit 2, the correlation between the two lengths of yarn tested is very high ($r = 0.98$). Furthermore, the slope and offset are not statistically different from 1 and 0 (Exhibit 3). The conclusion was that the SCF measurements were the same for the two boards;

therefore, the 56-meter board was selected for use.

## R E S U L T S

A brief statistical summary of fiber and yarn properties (mean, minimum and maximum values) is given in Exhibit 4. A more detailed discussion of results obtained follows.

### Ring-spun Yarns (50 Ne)

Exhibit 5 shows the number of SCF obtained on the ring-spun yarns for the eighteen varieties tested in the two locations. Clearly the number of SCF is repetitive across the two locations. Given that the cotton was harvested in the same manner in both locations and was ginned on the same system, the differences observed are primarily due to the genetic variability across the varieties. As would be expected, statistical analysis of the results (Exhibit 6) shows highly significant effects for both varieties and locations. However, the interaction effects between varieties and locations are not statistically significant.

### Rotor-spun Yarns (36 Ne)

Exhibit 7 shows the number of SCF on the rotor-spun yarns for the eighteen varieties tested in the two locations. As expected, rotor spinning is less sensitive to increased SCF levels; accordingly, variations in SCF counts between the two locations are greater for the rotor-spun yarns than for the ring-spun yarns. Nevertheless, the highly repetitive pattern across the two locations leads to the conclusion that differences observed are primarily due to the genetic variability across the varieties. The statistical analysis of the results (Exhibit 6) shows a highly significant effect for both varieties and locations, with the interaction term again being nonsignificant.

### Relationship between SCF Counts in Ring- versus Rotor-spun Yarns

The data from the two locations with 2 replications per location were averaged to calculate the linear regression between ring and rotor spinning. Since the yarn size of the rotor-spun yarn is 36 Ne while the ring-spun yarn is 50 Ne, we should expect to see a SCF-count difference between the two yarns. Also, as previously indicated, the rotor-spun yarn structure tends to hide the SCF on the inside (due to the centrifugal force applied during the yarn formation); however, the ring-spun yarn structure tends to put the SCF on the outside. Furthermore, it appears that the opening rollers of rotor spinning remove a significant amount of SCF from the fiber, while the ring-spinning technology does not remove this contamination. Therefore, the expectation is to find a high linear correlation between the two sets of results obtained, but not the same level of SCF between ring- and rotor-spun yarns. Accordingly, Exhibit 8 does show a good linear relationship between the two types of yarn with a coefficient of correlation of 0.92.
It will be of interest to compare the size distributions of the SCF for each spinning system, because it may be that the opening rollers of the rotor spinning frame tend to break the large SCF particles into smaller particles. This will be studied in another experiment.

### Relationship between SCF Counts at CIRAD versus ITC

Measurements were taken at both laboratories and the data averaged over locations and replications were used to calculate the linear regression between the two laboratories. Exhibit 9 shows a linear relationship with an excellent coefficient of correlation ($r=0.97$). However, the slope and offset are different from 1 and 0, which means that the prototype instruments are not properly calibrated. This issue must be investigated in the months ahead.

## C O N C L U S I O N

These results corroborate earlier results showing that the number of SCF is highly heritable. For given environments and ginning treatments, SCF is highly related to cotton varieties.

Results to date indicate that the Trashcam is fast, reliable, and simple to use. The level difference between the instruments at the two laboratories needs to be resolved. However, cotton breeders are generally interested in ranking new genetic lines versus a control, rather than using an absolute number. Therefore, the Trashcam could be (and is being) used to guide the variety selection decisions of some cotton breeders.

The SCF problem is an important contamination issue that has received inadequate focus by cotton breeders. The Trashcam offers potential to be a convenient measurement tool that is sensitive enough to guide the variety selection process.

| | |
|---|---|
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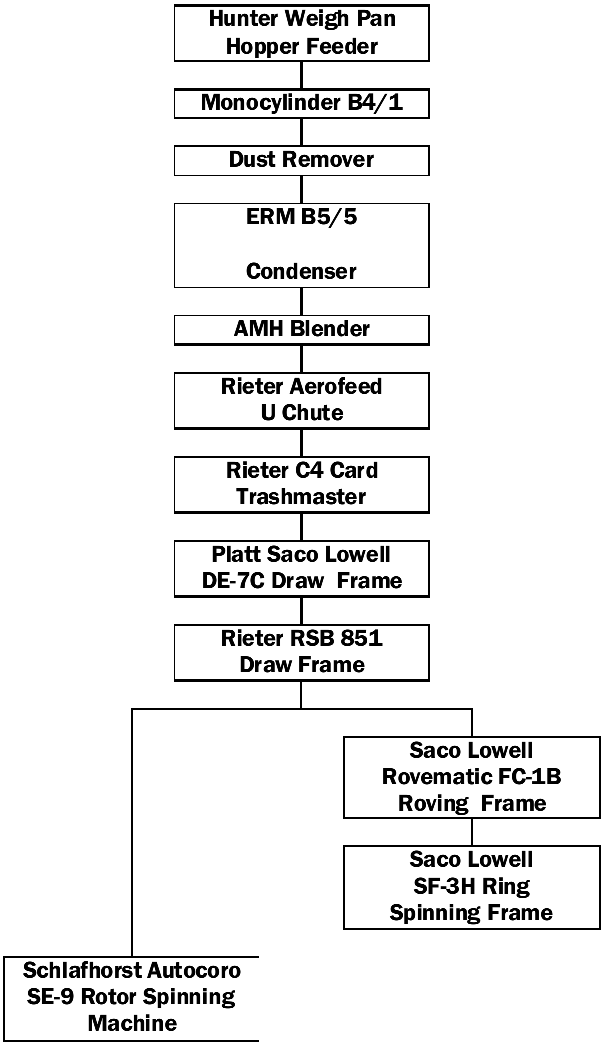
**Exhibit 1: Outline of Mechanical Processes**




Roll Speed = 750 rpm

R20/10 Beater Speed = 850 rpm

Production Rate = 75 lb/hr
Sliver Weight = 60 gr/yd

Delivery Speed = 570 ft/min
Sliver Weight = 55 gr/yd

Delivery Speed = 1320 ft/min
Sliver Weight = 55 gr/yd

Roving = 1 hank

Spindle Speed = 1425 rpm
TM = 3.8

Rotor type = T 231 D
Rotor Speed = 100,000
Opening roller type = B 174 DN
Opening roller speed = 7,400
Novel type = KN-4 + 1.5mm Washer
Torque device = TS-37
TM = 4.80

**Exhibit 2. Influence of the Number of Meters Wound around the Board on the Trashcam Readings**

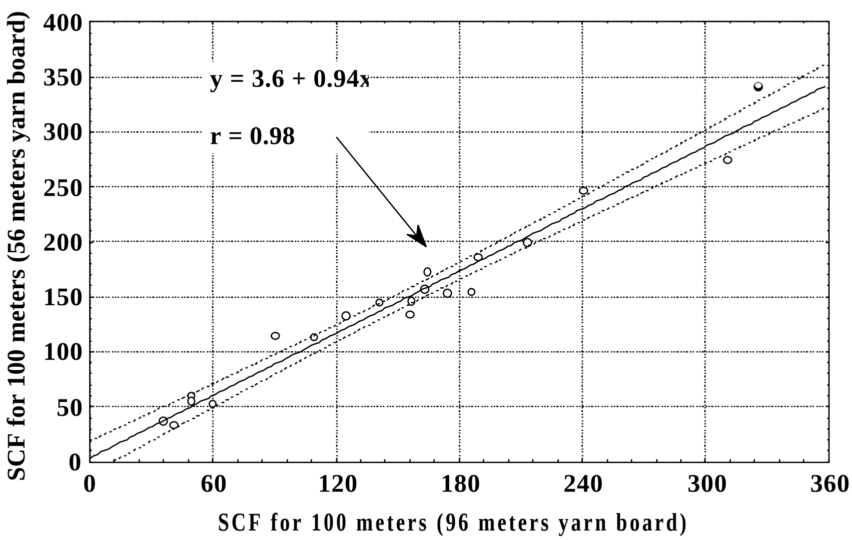


**Exhibit 3. Parameter Estimates – Linear Regression Analysis – 96 Meters per Board vs. 56 Meters per Board**

| Effect | Parameter value | Std. Error | T - test | Probability | 95% Confidence Limits Min. | Max. |
|---|---|---|---|---|---|---|
| Intercept | 3.61 | 7.159 | 0.50 | 0.6199 | -11.43 | 18.65 |
| Slope | 0.94 | 0.042 | 22.42 | 0.0000 | 0.855 | 1.03 |

**Exhibit 4. Raw Fiber Data and Yarn Data for 72 Cotton Samples**

| Instrument & Measurement | Units | Mean | Minimum | Maximum |
|---|---|---|---|---|
| Zellweger Uster HVI 900A | | | | |
| Micronaire | | 4.37 | 3.90 | 5.10 |
| Leaf Grade | | 3.28 | 2.00 | 4.00 |
| Reflectance | % | 75.1 | 72.7 | 77.7 |
| Yellowness | | 7.8 | 7.3 | 8.4 |
| Upper Half Mean Length | in | 1.186 | 1.090 | 1.290 |
| Uniformity | % | 83.8 | 80.8 | 84.8 |
| Strength | g/tex | 35.1 | 30.3 | 37.5 |
| Elongation | % | 5.8 | 5.3 | 6.8 |
| Zellweger Uster AFIS Multidata | | | | |
| Mean Length (w) | .in | 1.082 | 0.990 | 1.160 |
| Short Fiber Content (w) | % | 4.5 | 3.4 | 6.8 |
| Upper Quartile Length (w) | in | 1.273 | 1.190 | 1.380 |
| Maturity Ratio | | 0.96 | 0.92 | 1.01 |
| Immature Fiber Content | % | 5.3 | 3.9 | 6.9 |
| Fineness | mtex | 171 | 157 | 194 |
| Neps | cnt/g | 208 | 98 | 344 |
| Seed Coat Neps | cnt/g | 33 | 16 | 54 |
| Ring-spun Yarn 50Ne | | | | |
| Count Strength Product | . | 2707 | 2034 | 3277 |
| Tensorapid Tenacity | cN/tex | 17.19 | 13.48 | 18.96 |
| Tensorapid Elongation | % | 4.4 | 3.7 | 5.0 |
| UT3 CV% | % | 23.7 | 21.3 | 18.8 |
| UT3 Thin Places | cnt/km | 802 | 392 | 1595 |
| UT3 Thick Places | cnt/km | 1704 | 1104 | 2343 |
| UT3 Neps | cnt/km | 1281 | 735 | 1864 |
| Hairiness | | 3.74 | 3.44 | 4.14 |
| Trashcam Seed Coat Neps | cnt/100m | 323 | 171 | 495 |
| Rotor-spun Yarn 36Ne | | | | |
| Count Strength Product | . | 2299 | 2022 | 2555 |
| Tensorapid Tenacity | cN/tex | 14.70 | 12.85 | 16.40 |
| Tensorapid Elongation | % | 5.4 | 4.9 | 5.92 |
| UT3 CV% | % | 17.1 | 16.2 | 18.3 |
| UT3 Thin Places | cnt/km | 127 | 56 | 278 |
| UT3 Thick Places | cnt/km | 282 | 194 | 383 |
| UT3 Neps | cnt/km | 90 | 46 | 138 |
| Hairiness | | 3.40 | 3.21 | 3.68 |
| Trashcam Seed Coat Neps | cnt/100m | 168 | 90 | 313 |

**Exhibit 5. Seed Coat Fragment Counting at Two Test Sites – Ring-spun Yarns 50 Ne**

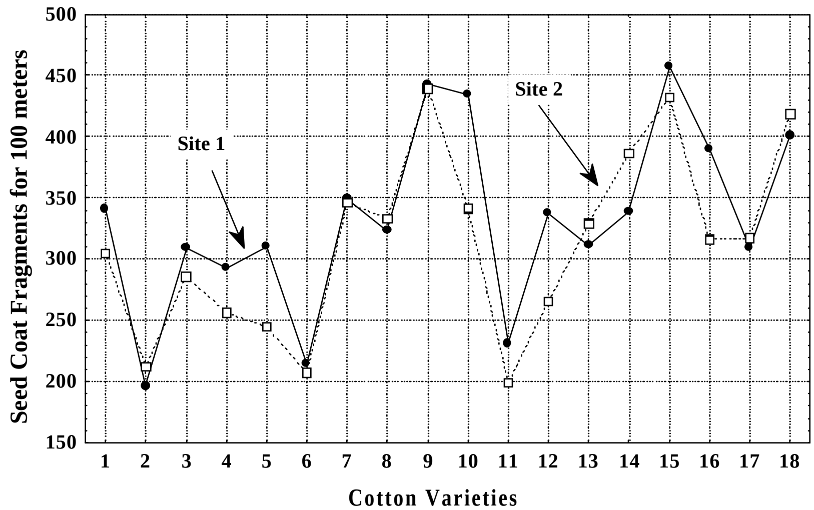



**Exhibit 6. Part a. SCF Analysis of Variance – Visual General Linear Model**
**Sigma-restricted Parameterization**

| Effect | df | Ring SS | Ring F test | Ring Prob | Rotor SS | Rotor F test | Rotor Prob |
|---|---|---|---|---|---|---|---|
| Intercept | 1 | 7,507,812 | 8,428.6 | 0.0000 | 2,039,479 | 2387.7 | 0.0000 |
| Variety | 17 | 349,614 | 23.1 | 0.0000 | 82,921 | 5.7 | 0.0000 |
| Location | 1 | 6,945 | 7.8 | 0.0083 | 17,915 | 21.0 | 0.0000 |
| Var x Loc | 17 | 24,797 | 1.6 | 0.1051 | 13,865 | 0.9 | 0.5237 |
| Error | 36 | 32,067 | | | 30,749 | | |
| Total | 71 | 413,423 | | | 145,450 | | |

**Exhibit 6. Part b. Analysis of Variance – Newman-Keuls Test.**
**Homogeneous Group, Alpha = 0.05**

| Ring-spun yarns 50 Ne | | | | | | | | Rotor-spun yarns 36 Ne | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety | Mean | 1 | 2 | 3 | 4 | 5 | 6 | Variety | Mean | 1 | 2 | 3 | 4 |
| 2 | 204.5 | ** | | | | | | 11 | 110.5 | ** | | | |
| 6 | 210.9 | ** | | | | | | 2 | 111.2 | ** | | | |
| 11 | 215.2 | ** | | | | | | 6 | 115.8 | ** | ** | | |
| 4 | 274.6 | | ** | | | | | 5 | 148.2 | ** | ** | ** | |
| 5 | 277.4 | | ** | | | | | 3 | 150.4 | ** | ** | ** | |
| 3 | 297.3 | | ** | ** | | | | 4 | 150.9 | ** | ** | ** | |
| 12 | 301.6 | | ** | ** | | | | 1 | 151.1 | ** | ** | ** | |
| 17 | 313.2 | | ** | ** | | | | 8 | 160.9 | ** | ** | ** | ** |
| 13 | 320.1 | | ** | ** | | | | 12 | 169.2 | ** | ** | ** | ** |
| 1 | 323.2 | | ** | ** | | | | 17 | 173.0 | ** | ** | ** | ** |
| 8 | 328.1 | | ** | ** | ** | | | 16 | 174.6 | ** | ** | ** | ** |
| 7 | 347.8 | | | ** | ** | | | 14 | 180.8 | ** | ** | ** | ** |
| 16 | 352.9 | | | ** | ** | | | 10 | 185.7 | | ** | ** | ** |
| 14 | 362.7 | | | ** | ** | ** | | 7 | 192.9 | | | ** | ** |
| 10 | 387.7 | | | | ** | ** | | 18 | 193.3 | | | ** | ** |
| 18 | 409.8 | | | | | ** | ** | 13 | 211.6 | | | ** | ** |
| 9 | 440.8 | | | | | | ** | 15 | 221.7 | | | ** | ** |
| 15 | 444.6 | | | | | | ** | 9 | 227.7 | | | | ** |

**Exhibit 7. Seed Coat Fragment Counts at Two Test Sites – Rotor-spun Yarns 36 Ne**

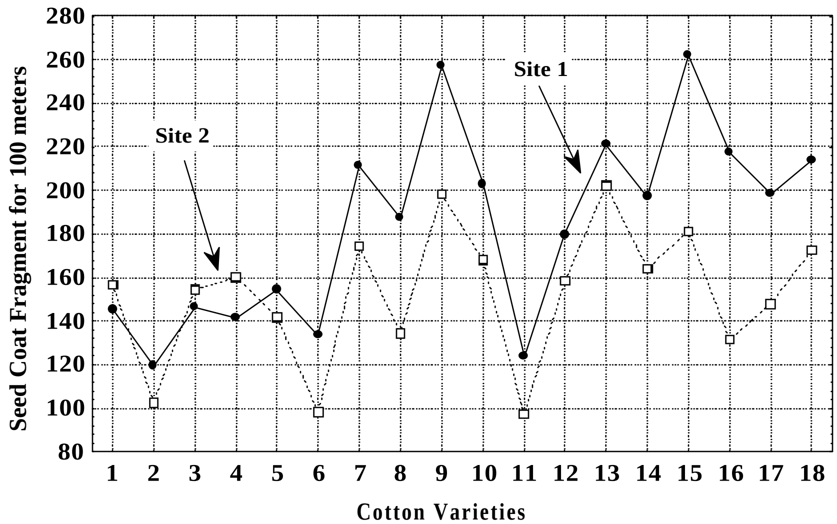



**Exhibit 8. Part a. SCF Count: Ring-spun vs. Rotor-spun Yarns**

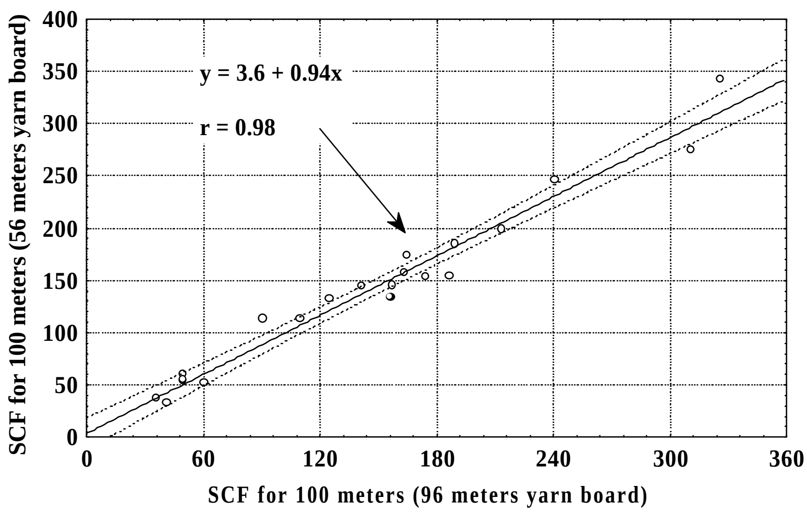



**Exhibit 8 Part b. Parameter Estimates – Linear Regression Analysis – SCF Count in Ring-spun Yarns vs. SCF Count in Rotor-spun Yarns**

| Effect | Parameter value | Std. Error | T - test | Probability | 95% Confidence Limits Min. | Max. |
|---|---|---|---|---|---|---|
| Intercept | 24.42 | 16.23 | 1.50 | 0.1520 | -9.99 | 58.83 |
| Slope | 0.45 | 0.05 | 9.07 | 0.0000 | 0.34 | 0.55 |

**Exhibit 9.Part a. SCF Count in CIRAD vs. SCF Count in ITC – Ring-spun Yarns 50 Ne**

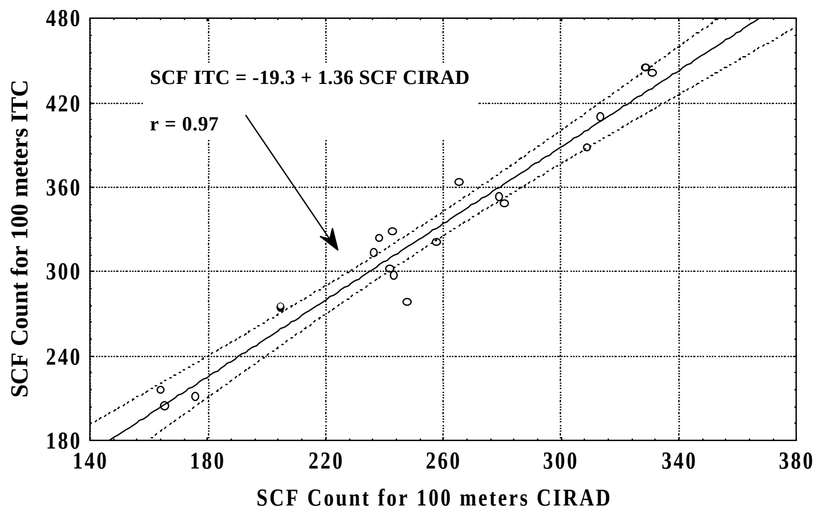



**Exhibit 9. Part b. Parameter estimates – Linear Regression Analysis – CIRAD SCF Count vs. ITC SCF Count – Ring-spun Yarns 50 Ne**

| Effect | Parameter value | Std. Error | T - test | Probability | Confidence Limit -95% | Confidence Limit +95% |
|---|---|---|---|---|---|---|
| Intercept | -19.30 | 20.21 | -0.95 | 0.3539 | -62.15 | 23.55 |
| Slope | 1.36 | 0.08 | 17.26 | 0.0000 | 1.19 | 1.53 |

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# PROFESSIONAL EDUCATION opportunities

**International Textile Center, Texas Tech University, Lubbock, Texas**

## Sept. 28 Textile Seminar with Professor Dr. Urs Meyer

Institute for Textile Machinery and Textile Industry, Swiss Federal Institute of Technology, Zurich

**10:00 Manufacturing simulation & control with Windows 2000**

· Force behind ITMA '99: modern computer technology
· PC as productivity tool for plant design & simulation, production planning
· Engineering software as personal productivity tool on engineer's desk
· Networks for plant monitoring and real-time cash flow analysis

**1:00 Trends in spinning machinery development**

· Choice available for spinning technologies: ring, compact, rotor, airjet, friction
· New players to watch
· Neglected opportunity: combining continuous filament yarn with cotton fiber
· Decisive yarn property: Zero defects in downstream processes

**2:30 Fibers for the future**

· New cellulosic fibers-competition for cotton?
· High-speed processes: What are real requirements for fiber & yarn properties?
· Life-cycle analysis for textile fibers-state of the art
· Potential developments in fiber testing technology

*No Registration Fee–light lunch included. Guests may attend any or all sessions*

## Sept. 29 - 30 Cotton Fiber Properties Seminar

*for anyone who uses data on cotton fiber properties-breeders, mill buyers, merchants*

**Sept. 29 8:30-4:00** Fiber properties & tests, individual, HVI, AFIS, H2SD, demos; evaluating data
**Sept. 30 8:30-3:00** How fiber properties affect textile processing, lectures and laboratory demos

*$250 Registration Fee - lunches and reference notebook included*

## Nov. 16 AATCC (American Association of Textile Chemists and Colorists) Gulf Coast Sectional Meeting

*everyone welcome, members & nonmembers*

**10:00 Lou Protonentis**, Cotton Incorporated, **The Wonderful World of Color Fastness**
**11:00 Dennis C. Scheer**, Dyadic International Inc., **Everything You Always Wanted to Know About Cellulase--But Were Afraid to Ask**
**1:00 Sid Jay**, DataColor International, **New Technologies in Color Measurement & Communications**
**2:00 Warren Perkins**, Univ. of Georgia, **New Slashing Technology for a New Century**

*$25 Registration Fee, lunch included* *Please register early for all events so we can plan for seating and lunch*

**See Back for Hotel & Registration Information**

## Hotel Information

Hotel reservations at Four Points by Sheraton--$55/night with free breakfast buffet and free shuttle for airport and for seminar. Call Shelia Farmer or Lisa Dixon at the Four Points Hotel (806) 747-0171 for reservations. Tell them you will be attending an event at the ITC of Texas Tech University for the special rate.

Call Pam Alspaugh (806) 747-3790 or itc@ttu.edu for additional information or questions or if you would like a transportation to seminar or airport.

Southwest, Continental, and American Airlines serve Lubbock.

More information about the ITC and its services is available at **www.itc.ttu.edu.**
A map is available on the web site.

## Registration Form

Fax (806) 747-3796 or mail registration form to ITC at least two weeks before event

**Name** ____________________

**Company or Agency** ____________________

**Address** ____________________

**City, State, Zip** ____________________

**Phone** ____________________ **Fax** ____________________

**e-mail** ____________________

Please send checks payable to: International Textile Center
Box 45019
Lubbock, TX 79409-5019

**Check events you will attend**

| | | | |
|---|---|---|---|
| **Sept. 28** | **Urs Meyer Seminar** | **no charge** | |
| **Sept. 29-30** | **Cotton Fiber Seminar** | **$250** | ______ |
| **Nov. 16** | **AATCC Gulf Coast Sectional Meeting** | **$ 25** | ______ |
| | | **Total** | ______ |