TEXTILE topics

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International Textile Center | Texas Tech University Lubbock, Texas USA

MATERIALS EVALUATION LAB RECOGNIZED FOR OUTSTANDING SERVICE

Texas Tech University officials recognized five members of the Materials Evaluation Lab at the International Textile Center. They were recognized and rewarded for their efforts in supporting the Quality Service Philosophy of the Texas Tech System.

Recipients of the award included: **Connie Herrera, Aurora Rodriguez, Marty Smalley, Lydia Cruz** and **Mary Beard**. They are responsible for operating the machinery and instruments that evaluate fibers, yarns, and fabrics.

MEL Employees (L-R) Connie Herrera, Aurora Rodriguez, Marty Smalley, Lydia Cruz and Mary Beard.

M-E-L Manager Pauline Williams has this to say about her staff:

"My team members take pride in knowing their work is important to many different individuals and groups involved in the textile industry. They often work extra hours and on weekends to meet deadlines and assist clients and

Continued... See "Award" on page 8

Sharing current research information and trends in the fiber and textile industries.

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NEW TESTING INSTRUMENT INSTALLED

Technicians install a new weathering instrument at the ITC.

Installation is nearing completion on a new Accelerated Light Stability and Weathering Tester. This instrument was made possible thanks to a generous grant from The <u>CH</u> Foundation.

This new instrument will be able to test the reaction of textile products (garments, curtains, upholstery etc.) to light and humidity, thereby predicting the effects of sun or weather on the material. The instrument will also allow for "indoor" photo-stability testing by exposing textile products to fluorescent light, halogen, or other general lighting lamps found in retail outlets.

This new instrument will extend the fabric testing capabilities at the ITC and will provide opportunities for new areas of textile research including work with special finishes on fabrics and other textile substrates. It will be used interactively with both the Quickwash Plus and the Tearing Tester already in place at the center.

ITC TRAVEL

- Dean Ethridge to Memphis, TN. to attend The Committee on Cotton Quality Measurements (CCQM), March 3-7.
- Eric Hequet to Bremen, Germany to attend the International Committee on Cotton Testing Methods and the International Cotton Conference, March 21-28.

Continued... See "Travel" on page 8

RENEWED FOCUS ON NEPS

M. Dean Ethridge and James Simonton

INTRODUCTION

The global cotton industry was chagrined by China's announcement in 2002 that, effective April 2003, a nep count would be included in its national standard for imported cotton [12]. The test method they proposed to use was GB/T6103-1985, which is identified as a test for "raw cotton trash." China let the deadline for initiating this test lapse and has not yet begun to use it; however, the regulations enabling its use remain in place.

This episode has brought two facts to the forefront:

1. No high-volume, repeatable measurement of either of these properties is currently available.
2. Textile manufacturers treat neps as "contaminants" within the useful cotton fibers.

The inability to measure undesirable properties of fibers does not prevent the market from discriminating against them. Typically the textile manufacturers will come to the opinion that these properties are likely to be present in the cotton from a particular source, then they will either avoid purchasing cotton from this source in the future or require a price discount to purchase it. Thus, the production sector will find that it has lost access in certain markets that are very sensitive to neps and been relegated to the status of a discount cotton. Without doubt, this does occur for cottons with elevated levels of neps.

NATURE OF NEPS

According to the American Society for Testing and Materials, a nep is "a tightly tangled knot-like mass of unorganized fibers" [1]. Exhibit 1 shows a magnified picture of a nep in raw cotton.

In a study by Hebert et. al., it was determined that in most cases fiber neps are made up of five or more fibers with the average number of fibers approximating 16. Furthermore, "Ninety-six percent of the fiber neps studied contained immature fibers, yet only 50% of all neps contained 100% immature fiber" [9].

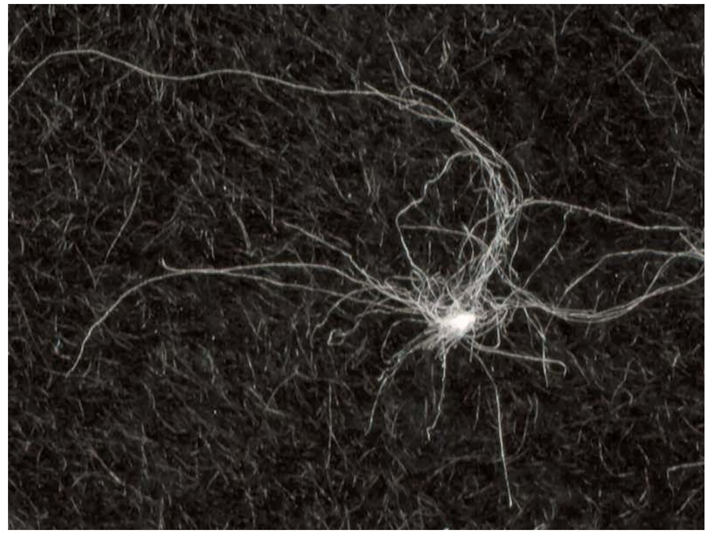

Exhibit 1: A Nep in Raw Cotton
Source: International Textile Center

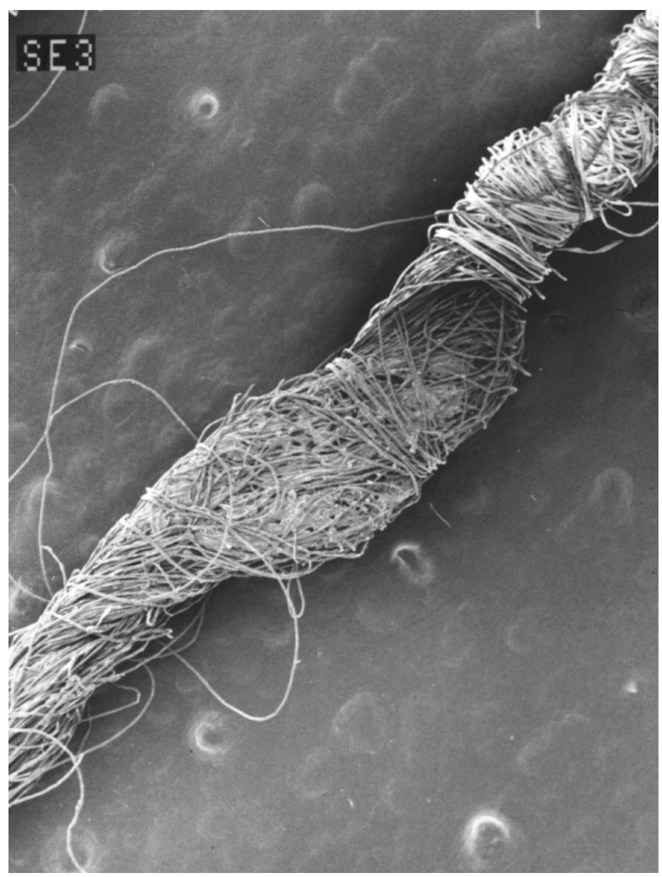

Exhibit 2: A Nep in Yarn
Source: International Textile Center

The appearance of common neps on yarns and fabrics is shown in Exhibit 2. Two distinct categories of neps are "seedcoat neps"—which have a piece of the seedcoat attached to the fibers (Exhibit 3)—and "shiny neps"—which consist of dead fibers, with insufficient cellulose to even absorb dye (Exhibit 4). These two subclasses of neps comprise a very small portion of all neps; however, when they do occur they present very serious quality problems.

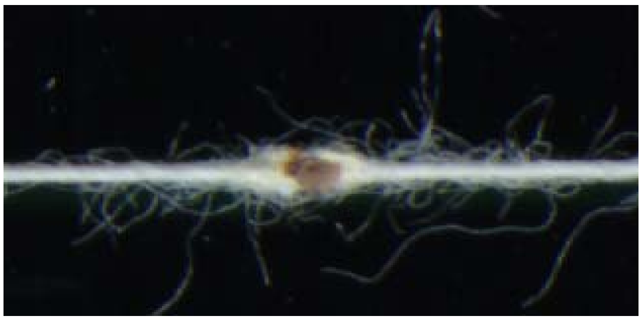

Exhibit 3: A Seedcoat Nep in Yarn.
Source: M. Krifa

A small portion of observed neps may exist in the unprocessed cotton, with the majority of neps caused by handling and processing [2]. Almost any mechanical process can cause the formation of neps, but the most likely ones include harvesting, ginning, and opening/cleaning in the textile mill. Neps are generally removed from the cotton fibers at only two places in the textile mill: at the carding machine and the combing machine. Since the vast majority of cotton is not combed, the carding machine usually has to do this task. A state-of-the-art, well-adjusted carding machine can remove about 90% of the neps that are fed into the machine [5, 14, 15]. Thus, if the cotton feeding into the carding machine has 300 neps/gram, then the count for cotton coming out in the card sliver may, under the best of circumstances, be reduced to the vicinity of 30 neps/gram. Subsequent mechanical processes involved in making yarn (e.g., drawing, roving, spinning) may elevate the nep count slightly [11, 18].

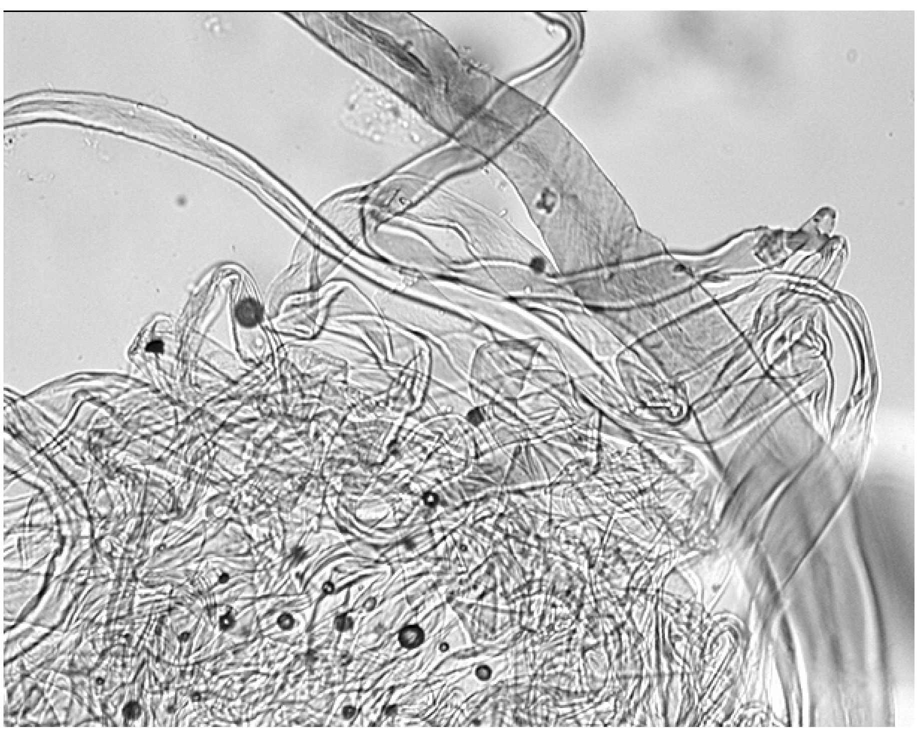

Exhibit 4: White Speck Nep (highly magnified) Attached to Mature Fiber
Source: International Textile Center

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While mechanical processes are the chief cause of neps, some cotton fibers are more susceptible to nep formation than others. Genetically determined physical characteristics are known to play a role. For example, longer and finer fibers are inherently more prone to forming neps when subjected to stressful mechanical processes. Also, stress caused by environmental conditions (e.g., drought, heat, etc.) and by competition (e.g., insects, weeds, etc.) may result in immaturity, weak places, or other problems that predispose the cotton toward nep formation [3, 4].

Mechanical neps may result if cotton is ginned with a moisture content that is either very high or very low. Also, the more trash the cotton contains, the more the fibers must be cleaned, which will result in the formation of more neps [10].

A careful study of neps requires that they be divided into sub-classifications of biological and mechanical. As implied above, biological neps a most likely to occur when elevated amounts of immature fibers are present. Elevated levels of mechanical neps follow from problems in the processing of the fibers. Research by Hebert et al. demonstrated the problem textile cleaning and processing equipment has with immature/dead fiber removal [9]. In the card sliver, it was determined that neps were distributed as follows: 35% biological, 64% mechanical and approximately 1% "other" (which were designated as "flattened pancake type" neps).

As yarns become finer the probability of neps appearing on the surface increases. Work by Van der Sluijs and Hunter demonstrated a relationship between yarn count and the probability of neps appearing on the surface of a yarn [18, 6].

Regardless of the types of neps, if they are incorporated into the yarns, it is likely that a portion of them will be visible on the fabrics made from the yarns. However, the *proportions* of different categories of neps may be different among card slivers versus yarns versus fabrics. Thus, when Herbert, et. al. followed through to fabrics from the carded cotton mentioned above, the visible distribution of neps shifted to 30% biological, 24% mechanical, and 46% "other" [9]. The very large increase in the proportion of "other" neps (from 1% in fiber to 46% in fabric) reveals why cotton containing dead and/or immature fibers is a primary concern for textile dyers of high-quality goods [8]. In dark shades of dyeing, the presence of immature/dead fiber in moderate quantities almost certainly will produce off-quality finished goods.

It is estimated that even in fabric with severe contamination, the percentage of immature/dead fibers (by weight) is less than 0.1% of the total fibers [19]. These amounts would be too small to have significant effects on the average fiber properties, as measured by current commercial instruments, but are substantial enough to negatively impact the commercial value of the fiber to the end user [7].

MEASUREMENT OF NEPS

There are several instruments widely used by the global textile industry to measure neps on yarns, with the most widely used being the Uster® Evenness Tester. These instruments typically use capacitance sensors to detect yarn neps and to measure yarn evenness, thick places, thin places, and hairiness.

Modern yarn spinning mills are increasingly trying to monitor neps. For example, yarn quality at each spinning position is monitored by "yarn clearers," such as the Uster® Quantum Clearer [20]. Also, the carding machines of the Trützschler Company may be equipped with an instrument that monitors neps in the card web [17].

While advances in on-line monitoring of quality are useful, the focus of this article is on measurement of the raw fibers, before yarn formation and preferably before the textile manufacturing process begins. The best solution to nep and short fiber problems is prevention; i.e., find ways to reduce the occurrence of these problems in the raw fibers delivered to textile mills.

The AFIS® Instrument

The only commercial instrument in global use for measuring neps in raw cotton is the Advanced Fiber Information System (AFIS®), made by Uster Technologies (Exhibit 5). It also distinguishes between seedcoat neps and regular neps. Furthermore, it measures other fiber properties; e.g., fineness, maturity, trash and dust. The AFIS® obtains measurements on fibers that have been individualized, rather than by evaluating bundles of fibers.

While the AFIS® instrument is being successfully utilized within textile plants, it is neither high-volume enough nor repeatable enough for use in the cotton marketing system. However, great care with protocols for sampling and measuring make it a useful tool in:

1. breeding and biotechnology programs aimed at developing fibers that are less susceptible to nep formation, and
2. harvesting and ginning evaluations to reduce the nep formation in such processes.

Exhibit 6 is a reproduction from the Uster® Statistics on the Internet [20]. It shows worldwide quality levels with respect to neps as measured with the AFIS® instrument. The chart reveals, for example, that for 1-inch cotton, approximately 300 neps/gram is the 50th percentile level for neps. (Thus, 300 neps/gram is a "normal" level for 1-inch cotton.) For 1.25-inch cotton, the 50th percentile level is approximately 200 neps/gram.

Exhibit 5: Advanced Fiber Information System (AFIS®)
Source: International Textile Center

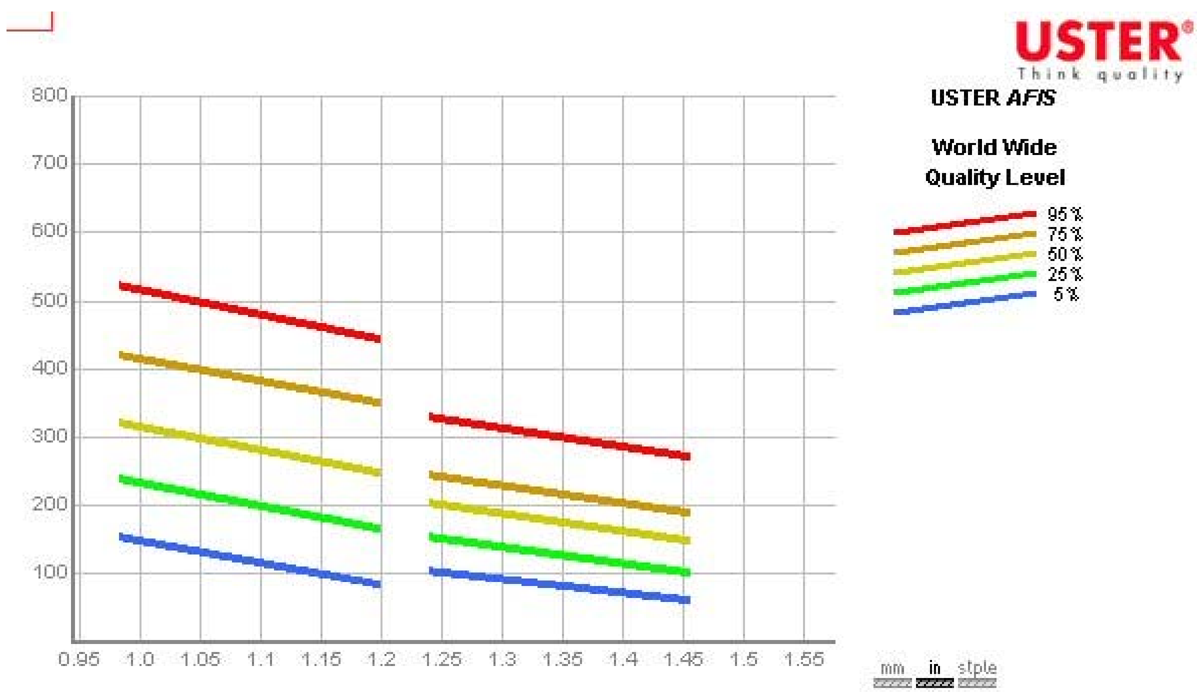

Exhibit 6: Uster Chart of World Wide Quality Levels for Yarn Neps
Source: [20]

Other Instruments for Raw Cotton

The measurement of neps by image analysis of a cotton web is part of the design of the Lintronics Fiberlab™ (Exhibit 7) [13], while the Premier aQura™ individualizes the fibers prior to measurement (Exhibit 8) [16]. Widespread testing of these instruments has not yet been done; therefore, their usefulness is not yet established.

Exhibit 7: Lintronics Fiberlab 2.0
Source: [13]

CONCLUSION

The research program at the International Textile Center includes a focus on the measurement and alleviation of neps in cotton. Clearly, measures that are sufficiently high volume and repeatable for use in international marketing are not likely to be available for at least several years. But existing measures can be utilized to evaluate fibers and adjust mechanical processes in harvesting, ginning and textile manufacturing. Moreover, they can be employed to improve the genetics of cotton fibers, in order to provide the global textile industry a raw material that contains less neps.

Exhibit 8: Premier aQura
Source: [16]

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TEXAS INTERNATIONAL COTTON SCHOOL - CLASS OF MAY 2004

FRONT ROW (L-R): Sheranette Martin, Parmer County Cotton Growers; Omega Ray, TICS Assistant Coordinator; Mandy Howell, TICS Executive Coordinator; Kelli Boyter, TICS Assistant Coordinator; Joanna Frith, Queensland Cotton.

BACK ROW: Chris Braden, Graduate Student, Texas A&M/Cotton Inc.; Chuck Senter, Wells Fargo Bank; Arwin Johnson, Queensland Cotton; Rodney Lord, Cargill Cotton; William Reifer, Key Bridge Financial; Kyle Vaughn, Queensland Cotton; Jiun-Jie (Rick) Wu, Yuh-Shen Fiber Co., Ltd.; Matt Pearson, Texas Department of Criminal Justice.

"Award" Continued from page 1

researchers. Many of the students who come to the Center are from other countries and they leave our university with a positive attitude about the staff, the Center, Texas Tech, and West Texas because this team is so willing to teach and help these students. The teamwork shows in the quality and quantity of work they are able to produce while assisting the textile industry, cotton breeders and researchers from Texas, other states, and other countries."

In honor of their achievement, the employees were awarded $500, a lapel pen, and an engraved marble desk clock. Congratulations!

"Travel" Continued from page 1

- Dean Ethridge to San Antonio, TX to attend the 93rd annual Texas Cotton Association's Annual Convention, April 28-30.
- Eric Hequet & Mourad Krifa to New Orleans, LA to attend the Cotton Fiber Breakage Workgroup, May 28.
- Dean Ethridge to Greenville, SC to attend the Engineered Fiber Selection Conference (EFS), June 6-10.