Textile Technology :: "Spinning" By M.H.Rana

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  COTTON FIBRE-1

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- HVI-FIBER TESTING
- COTTON LENGTH PROPERTIES
- EFFECT OF FIBER LENGTH ON YARN QUALITY
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COTTON LENGTH RELATED PROPERTIES

The "length" of **cotton fibres** is a property of commercial value as the price is generally based on this character. To some extent it is true, as other factors being equal, longer cottons give better spinning performance than shorter ones. But the length of a cotton is an indefinite quantity, as the fibres, even in a small random bunch of a cotton, vary enormously in **length.**

Cotton is the shortest of the common textile fibers, hence, other things being equal, it makes the most irregular yarns and fabrics. Accordingly the market pays a premium for good length.

The various methods of measuring length may be classified according to whether they

- measure the staple length only, or other parameters
- work by aligning the fiber ends, e.g comb sorters,
- measure only length, or use the tuft for other measurements, such as strength etc

The importance of fiber length to textile processing is significant. Longer fibers produce stronger yarns by allowing fibers to twist around each other more times. Longer fibers can produce finer yarns to allow for more valuable end products. Longer fibers also enable higher spinning speeds by reducing the amount of twist necessary to produce yarn.

The variability in fiber length can be explained 70-80 percent by genetics , so variety selection is very important. Fiber elongation begins at bloom and continues for about 21 days. Moisture stress during the fiber elongation period will reduce fiber length in all varieties. Starting with a variety that has better genetic potential for fiber length will minimize the probability of producing fiber length in the discount range. Severe weathering after bolls have opened can reduce fiber length because more breakage can be expected in the ginning process. Besides variety, water management and maintaining good plant-water relations is probably the most important factor affecting fiber length

Length Uniformity and Short Fiber Content. Length uniformity is now part of the premium/discount valuation of cotton. Short fibers within a process mix of cotton cannot wrap around each other and contribute little or nothing to yarn strength. Short fibers are virtually uncontrolled in the manufacturing process, indirectly causing product defaults and directly contributing to higher waste and lower manufacturing efficiency.

Since short fiber content and length uniformity are derived from length, they are influenced by the same factors as length.. Length uniformity can be more influenced by environment than effective length because temperature is involved in the regulation of genes, which cause epidermal cells to differentiate into fibers. Crop management practices that influence where bolls are located on the plant can impact short fiber content levels. Uniform fruit retention patterns encourage better length uniformity. Disruption to the natural length distribution is most often caused by mechanical damage, so maintaining recommended moisture levels at the gin is important.

SHORT FIBER

The original theory of the fibrogram as developed by Hertel more than fifty years ago has served as the basis of all subsequent cotton length measurements. The major assumptions Hertel made in deriving the theory of the fibrogram are embodied in the statement "The fiber is to be selected at random and every point on every fiber is equally probable." This statement translates to:

- A sampled fiber is held at a random point along its length.
- The probability of sampling a particular fiber is proportional to its length.

Since the longer fibers have a greater probability of being sampled, this results in the length distribution in the fiber beard becoming biased toward the longer fibers.. Using Suter-Webb data and assuming uniform fiber fineness, it is possible to calculate the distributions for the length biased samples.

To investigate the validity of the second assumption, we measured the length distribution of a few fiber samples in their original forms and of fiber beards made from these samples. The selected samples for the experiment were two staple standard cotton samples (SS28 and SS40). Length measurements were performed on the samples in their original forms using standard Suter-Webb Array (SWA) methods and the Advanced Fiber Information System Length and Diameter module (AFIS-L/D) made by Zellweger Uster, Inc. In addition, the AFIS was used to measure the length distributions of fiber beards prepared using a model 192 fibrosampler with and without allowing the beards to pass over the carding section of the fibrosampler. All AFIS-L/D results are the averages of three repetitions with three thousands fibers were measured in each repetition. The experimental results along with the calculated results based on a length biased sample are listed in Table 1..

Table I. Suter-Webb Array (SWA) and AFIS Length data.					
Sample: Staple Standard 28					
	SWA Raw	SWA Expected	AFIS Raw	AFIS Uncarded	AFIS Carded
By Weight					
Mean Length in.	1.19	1.27	1.10	1.09	1.08
Length CV%	29.9	23.7	32.7	31.5	29.9
Short Fiber %	14.2	6.6	13.6	13.6	13.3
Upper Quartile in.	0.92	0.96	0.89	0.89	0.88
By Number					
Mean Length in.	0.63	0.75	0.64	0.64	0.65
Length CV%	44.7	29.9	43.1	41.8	39.3
Short Fiber %	31.6	14.2	28.7	28.3	26.7
Upper Quartile in.	0.84	0.92	0.81	0.81	0.81
Sample: Staple Standard 40					
	SWA Raw	SWA Expected	AFIS Raw	AFIS Uncarded	AFIS Carded
By Weight					
Mean Length in.	1.19	1.27	1.10	1.09	1.08

Length CV%	25.7	19.5	31.2	31.4	31.2
Short Fiber %	4.0	1.1	4.6	4.9	4.6
Upper Quartile in.	1.41	1.44	1.31	1.31	1.3
By Number					
Mean Length in.	1.0	1.2	0.9	0.9	0.9
Length CV%	44.0	25.7	40.3	40.3	38.9
Short Fiber %	17.3	4.0	14.0	14.3	13.0
Upper Quartile in.	1.34	1.41	1.22	1.21	1.19

A comparison of the Suter-Webb array data and the AFIS data for the raw stock show good agreement between the methods with small differences characteristic of this version of AFIS. Of more importance is a comparison of the AFIS data between the raw, uncarded and carded samples. The mean lengths and length distributions as indicated by the coefficient of variation are almost identical to those in their original forms. Even if some fiber damage occurs in the AFIS, the damage would be very similar for a given sample and allow us to detect differences in the samples due to the sampling or carding process. Since the differences of the length distributions and the calculated mean lengths between fiber beards and the original fiber samples are small, this would indicate that the second assumption should be modified such that each fiber in the original sample has equal probability to be caught in forming the fiber beard. This in turn would indicate fibers are sampled in clumps rather than individually. Thus the fibrogram theory derived by Hertel should not be applied to the fiber beards prepared from the fibrosampler. However, his theory appears to apply to those fiber beards prepared from sliver by using sliver clamp.