HVI Single Beard Variations

by

Novizar Aminuddin

Cotton Incorporated

Introduction

Cotton Incorporated's latest addition to its Engineered Fiber Selection™ Cotton fiber management system is Calibration Network (CALNet). CALNet is a computer-based network interconnecting HVI lines and a central calibration data collection and analysis facility located at Cotton Incorporated's Fiber Research Center.

The primary purpose of this paper is to demonstrate the ability of CALNet as a tool in collecting and analyzing HVI data on a real-time basis. A second objective is to determine the minimum subset size at which the difference between he between variance and the within variance is small enough to accurately represent a population of data test points from a cotton sample. This paper will present an experimental observation of the variation between HVI beards of short and long calibration cotton.

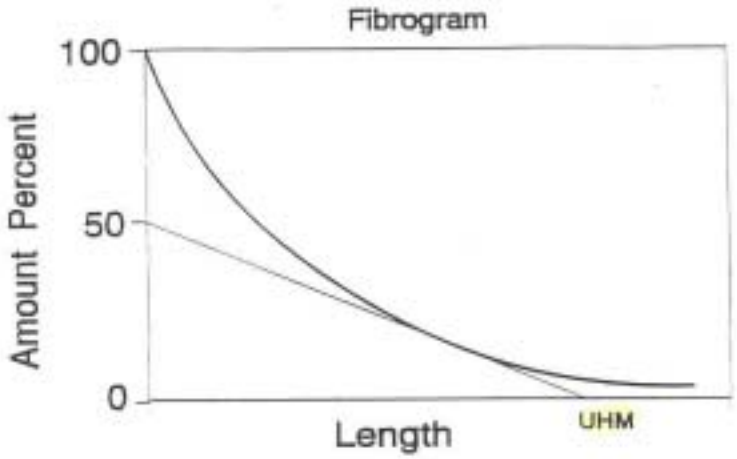
Data Collection

For this particular experimental work, the data from two sets of 200 beards of the same calibration cotton were collected from a Spinlab 900B instrument. The two sets of data were analyzed separately since each set collect was based on two different procedures. The first set of data (beards 1 through 200) was collected over a 24-hour period (one day). The second set (beards 201 through 400) was collected over the period

of a month. This method of data collection is currently possible only through CALNet which automatically stores the data to a personal computer. At this time we will be examining fibrograms.

Upper-Half-Mean Length

As described by Hertel (1) a fibrogram is the geometrical interpretation of the resulting curve measured form an optical instrument using a photovoltaic cell to scan samples of parallel fibers. the upper-half-mean length was computed form each fibrogram using Hertel's theoretical method. the upper-half-mean is defined as the mean length by number of the longest one-half of the fiber weight. the curve that gives this length was a line drawn tangent to the fibrogram through the midpoint of the vertical axis as shown in

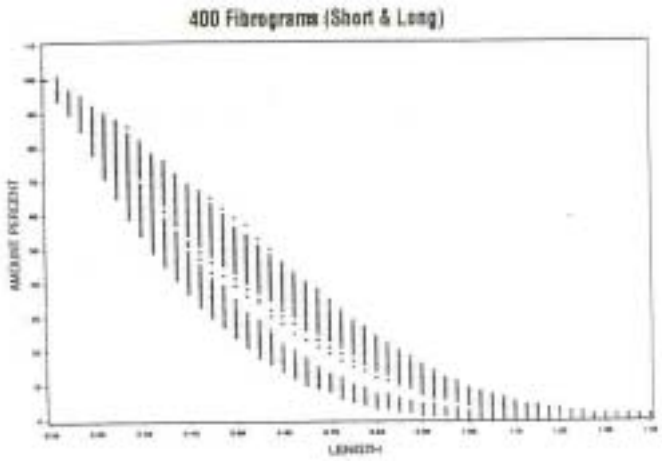


< Figure 1 >

Discussion

Figure 2shows the collection of 400 fibrograms which are plotted simultaneously for both short and long cotton. A single point may represent more than two fibrograms,

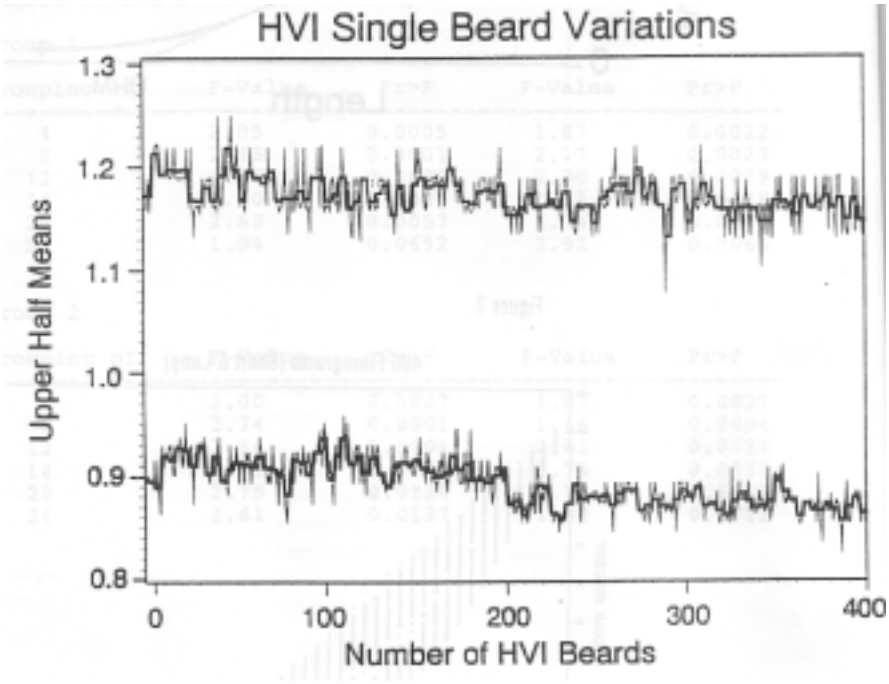
ranging form the lowest vertical point to the highest vertical point. This figure shows the comparison of fibrograms between short and long cotton. Observing these fibrograms the long cotton is larger vertically than short cotton on the certain points of the fibrograms. However this is not the case for the values of the upper-half-mean lengths since they are computed form a small section of those fibrograms. The value of standard deviation of short cotton is greater than the long cotton when both sets of data are compared (Table 1). The average upper-half-mean length is lower on the second set. The shift in the average of upper-half-mean length is more apparent of the short cotton as shown in Figure3. The thicker lines represent the value of the average of four beards: the thinner lines, the single HVI beard values.



< Figure 2 >

< Table 1 > Average Upper-Half-Mean Length

	First 200		Second 200	
	Mean	Std	Mean	Std
Short	0.909	0.0184	0.874	0.0147
Long	1.181	0.0223	1.163	0.0204



< Figure 3 >

After looking at the overall set of data let's look at the individual groups. there is less variation within each set of groups. Now, we can look at the variation between groups of 4 beards. For both sets of data, each set is grouped into its consecutive 4 beards, so there are 50 sets of 4 beards. One-way analysis is applied to check whether there is a difference between "BETWEEN variance" and "Within variance". The result of this one-way analysis is shown in Tables 2 and 3. The result shows that the difference between the "BETWEEN variance" and "Within variance" is significant: therefore the grouping of 4 beards at a time may not be sufficient. This is why HVI users perform a multiple of 3 or 4 groups of four HVI beards during a calibration test.

A one-way analysis was repeated for the next group of 8,12,16, 20 and 24 beards for both 200-beard sets of data. The result of the F-Test is shown in Table 4. For the particular sets of data, the size of groupings form group-1 and group-2 data is varied.

The grouping of 24 was indicated from the test for short cotton. Grouping of 8 to 20 was found from the analysis of long cotton. However, the data may be statistically too small to justify the number of groupings. A further investigation is needed using a larger number of data groupings.

< Table 2 >

HVI SINGLE BEARD VARIATIONS

First Group: 1-200 Beards

Analysis of Variance Procedure

Dependent Variable: SHORT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	49	0.02712518	0.00055358	2.05	0.0005
Error	150	0.04057400	0.00027049		
Corrected Total	199	0.06769918			

R-Square	C.V.	Root MSE	SHORT Mean
0.400672	1.808898	0.016447	0.90921000

Dependent Variable: LONG

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	49	0.03761632	0.00076768	1.87	0.0022
Error	150	0.06163600	0.00041091		
Corrected Total	199	0.09925232			

R-Square	C.V.	Root MSE	LONG Mean
0.378997	1.716820	0.020271	1.18072000

< Table 3 >

HVI SINGLE BEARD VARIATIONS

Second Group: 201-400 Beards

Analysis of Variance Procedure

Dependent Variable: SHORT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	49	0.01697070	0.00034634	2.00	0.0007
Error	150	0.02591125	0.00017274		
Corrected Total	199	0.04288195			

R-Square	C.V.	Root MSE	SHORT Mean
0.395754	1.504194	0.013143	0.87376500

Dependent Variable: LONG

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	49	0.03150101	0.00064288	1.87	0.0021
Error	150	0.05144575	0.00034297		
Corrected Total	199	0.08294676			

R-Square	C.V.	Root MSE	LONG Mean
0.379774	1.592780	0.018519	1.16271500

< Table 4 > Number of HVI beards in a Group

Group 1

Grouping of	F-Value	Pr>F	F-Value	Pr>F
4	2.05	0.0005	1.87	0.0022
8	2.65	0.0001	2.17	0.0023
12	2.66	0.0020	2.30	0.0079
16	3.10	0.0005	1.73	0.0628
20	2.69	0.0057	2.74	0.0050
24	1.94	0.0652	2.92	0.0064

Group 2

Grouping of	F-Value	Pr>F	F-Value	Pr>F
4	2.00	0.0007	1.87	0.0021
8	2.74	0.0001	1.46	0.0884
12	3.64	0.0001	2.61	0.0024
16	3.73	0.0028	1.75	0.0657
20	2.75	0.0134	0.76	0.6511
24	2.61	0.0137	1.90	0.0712

Conclusion

The collection and manipulation of raw HVI data for the production of accurate local statistics was successfully performed using CALNet. In an analysis of single beard variation in the UHM length of 200 beards taken from the same calibration cotton sample it was found that the difference between the between variance and the within variance of a 4-beard subset remains significant. Moreover larger subsets of 8, 12, 16, 20 and 24 tests still failed to achieve a reduced significance based on the relatively small population used in this experiment. A further investigation using a larger total population is needed in order to determine a viable minimum number of groupings required to accurately represent a cotton sample.

Two separate sets of 200 fibrograms were collected from a calibration cotton sample. The first set was collected within a 24-hour interval. The second set was collected over a period of one month. theoretically the sample with the month-long data-gathering interval should better simulate actual mill data-collection conditions. Again the total population was found to be too small to determine if the longer sampling interval was more statistically representative.

References

(1) Hertel, K.L., "Method of Fiber-Length Analysis using the Fibrograph", Textile Research Journal, 10 (1940) pp 510-525

(2) Montgomery, C. Douglas, "Design and Analysis of Experiments", 2nd Edition pp 43-122.