EVALUATION OF SHORT FIBER CLASSIFICATION Steve Grantham USDA, AMS, Cotton Program Memphis, TN

<u>Abstract</u>

The USDA, AMS, Cotton Program continues to investigate the potential for adding a short fiber measurement to the cotton classification system. Calibration cottons are used to ensure consistent testing levels on all classification instruments in the Cotton Program's 12 classing offices for length, length uniformity index and strength. Recently, values for the Short Fiber Index (SFI) measurement have been established on the same calibration cottons used for length, uniformity index and strength calibration.

The 2004 crop season is the first time for the Cotton Program to evaluate SFI measurement with a calibration routine and official calibration cottons on all classing office instruments. SFI data obtained from the 2004 cotton crop will be collected and analyzed for experimental purposes only. Of interest, is the performance of the SFI measurement on the basis of single bale testing versus module average testing. In addition, the Cotton Program will compare the performance of the SFI measurement to the predicted short fiber measurements (PSF) calculated from the measurements of length and uniformity index. Calculated short fiber measurements continue to show strong correlations to SFI in addition to being considerably more reproducible.

Introduction

The cotton manufacturing industry has requested a measurement of short fiber for several years. The cotton textile manufacturers continue to report that certain bales within a laydown cause problems such as high fiber waste, ends down, and exhibit poor efficiencies in the spinning process. These bales are reportedly not identifiable through the traditional measures of length, uniformity index and other measured properties by the HVI. Therefore, the Cotton Program has pursued the further development of this measurement in conjunction with the instrument manufacturer, Uster Technologies Ag.

Short fiber by definition is the percentage of fibers less than one half inch in length. The Cotton Program utilizes the Uster model 900-U for its testing instrument. The Cotton Program has worked in conjunction with Uster on several studies since the late nineties in an effort to improve this measurement. A brief explanation of the measurement process is described as follows. The fibers are gathered onto two combs from the sampler. The card cloth and a brusher are used to prepare the fiber samples for testing. Once the fiber samples have been adequately prepared, the combs are transported to the actual measurement module where the fiber samples pass through an optical sensor for the measurements of length and strength. As the fiber samples are passed through the optical sensor, a fibrogram is generated from which the measurements of length are gathered. The three length measurements of upper half mean, mean length and short fiber content are all taken from the same fiber samples. A calculation utilizing the measurements of upper half mean length and mean length produce the uniformity index reading.

A proposed major step in the improvement of the short fiber measurement was the development of a calibration procedure (Gibson, 1999). A study was done on a small scale for several years utilizing a small percentage of instruments in selected classing offices in an effort to evaluate its potential. Problems were encountered with the software program that prevented its use on a broad scale. Other factors that prevented its full implementation were the lack of development of standardized calibration cottons.

Short Fiber Calibration

The Standardization and Engineering Branch incorporated the short fiber value establishment into its current calibration cotton studies. The incorporation of this value establishment process for short fiber was unofficial and began in the 1999 cotton season. The calibration values established for this study were for USDA study purposes only. This was done in an effort to further stabilize the variability in the short fiber measurement by creating a constant testing level among all instruments. These studies are conducted on a yearly basis in selected laboratories.

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Selected calibration bales that are chosen according to their fiber qualities are opened and several cotton samples are pulled for further testing and evaluations. Eight to eleven instruments in the designated laboratories are utilized in the testing process. The instruments perform twenty replications per bale per HVI. A minimum of 180 tests are analyzed across two different testing days. These data are analyzed for variability and suitable measurement levels to establish an appropriate calibration range in each measurement.

The short fiber values that were established from these studies were utilized this past season in the operation of all instruments within the Cotton Program. This marked the first year that the USDA fully implemented a short fiber measurement on all instruments with standardized practices of full calibration routines as is practiced with the other official measurements. In addition, this data was transmitted and collected into the non-stop computer system for evaluation purposes only.

The PSF was also calculated in addition to the short fiber measurement for additional comparison. The PSF continues to show strong relationships to the SFI measurement simply due to the fact that all of the length measurements are obtained from the same fiber samples in the comb that are used to generate the length fibrogram as was discussed previously (Knowlton, 2001). The data analyzed was the samples in our Quality Assurance checklot program. The data shown in Table 1 represents checklot data which is a double run test. The classing office data represents a single run test therefore there are differences in the number of test shown in the table. The data represents samples from all of the Cotton Program classing offices.

Results

The results of the study have been separated into regions that can be seen in Table 1. The data continues to reflect that the SFI data is not as reproducible and reliable as the PSF. The data also continues to indicate that measurement variability is directly related to the measurement level and the lengths of the cottons. Cottons that exhibit longer fibers and lower short fiber contents have a tendency towards lower variability. Cottons that exhibit shorter fibers and higher short fiber contents have a tendency towards higher variability (Ramey, 1998). The data shown in Table 1 reflects the SFI measurement variability that has been evident in previous studies. The PSF indicates a much more reproducible measure of short fiber content. A question still remains as to whether true differences exist in the calculated and actual measurement. Although in previous studies, the short fiber measurement appeared to be capable of distinguishing the short fiber contents of cottons with similar length and uniformity index. It could not be determined whether that differentiation was measurement sensitivity or measurement variability.

Table 1. Short F	-iber Results	by Region			
Region	SFI	SFI	PSF	PSF	SFI
	Single	Module	Single	Module	Average
	bale	average	bale	average	value
Southeast	42	49	73	86	11.1
Texas	46	72	55	87	10.7
Mid-South	50	78	58	91	10.2
Far West	65	85	80	92	9.3

Table 1. Short Fiber Results by Region

In addition to the above analysis, some data was evaluated strictly in the Quality Assurance Branch which is essentially a within lab evaluation. The samples in this lab are tested in a slightly different manner regarding the number of repetitions. The samples in the Quality Assurance Branch are tested in the same manner on similar instruments; however, the samples are tested twice and the average of the two tests is compared with the classing office test. The purpose of this analysis is to remove some variables resulting from differences associated with instrument setups, operator, calibration, etc. The samples that were evaluated in a within lab evaluation in the Quality Assurance Branch represent more testing which would provide a more reliable number. The results from the Quality Assurance lab are shown in Table 2 and further support the idea that the same information is being obtained from the PSF and SFI methods. The high reproducibility shown in Table 2 indicates that the information from both methods is being obtained from the same fibrogram as was presented earlier in the introduction. This would further support the fact that there is very little additional information obtained from the SFI measurement than what is currently available in the existing measurements.

Table 2. Short Fiber Index and Predicted Short Fiber Comparisons:

Measurement comparisons:	Percent reproducibility
QA SFI vs. QA PSF	92

Conclusion

At this point in time, the best indication of the short fiber content is obtained through the calculation of the PSF. Although there are occasional occurrences of known differences in the SFI and PSF measurements, the differences are not large enough to be detected in normal classification testing given the high measurement variability in the SFI measurement. A study is underway, that was initiated by the Cotton Program's Standardization and Engineering Branch. This study involved the purchasing of selected bales of cotton with large differences in the SFI and PSF information. These samples were sent to the Cotton Quality Research Station in Clemson, South Carolina for spinning test. The results of this study could possibly provide some additional answers to the many questions regarding the short fiber content in cotton. The USDA Cotton Program will continue in its efforts to obtain a more reliable measurement in the future.

References

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