

FUTURE QUALITY MEASUREMENTS
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Abstract

The Cotton Program currently reports seven HVI (High Volume Instrument) fiber quality measurements in the cotton classification process. These measurements are micronaire, length, length uniformity index, strength, Rd color, +b color and percent area of trash. All seven of these measurements have been part of the Cotton Program's HVI classification system since before the Cotton Program went to 100% HVI testing in 1991. Given the potential of additional quality measurements for improving cotton marketing and utilization, the Cotton Program continually evaluates and considers proposed quality measurements that are being developed. In recent years, the Cotton Program has evaluated proposed measurements for short fiber, stickiness and elongation from the cotton classification perspective. In addition to proposed measurements, current measurements are continually evaluated for potential improvement. Changes in HVI color grade determination have resulted in improved agreement between the HVI and the Universal Color Grade Standards. Also, measurement information found within length and length uniformity index measurements has resulted in a promising method for determining short fiber content.

Introduction

Any future HVI quality measurement being considered for addition to the classification system must meet certain criteria (Ramey, 1997). First, the measurement must provide information that is meaningful and beneficial to the utilization of cotton. Second, the measurement must be accurate. From the classification perspective, this means that the measurement must be reproducible within and between instruments. Additionally, a measurement must generally have a coefficient of variability (CV) of no more than five percent. Third, the measurement must have an established calibration reference in order to obtain a common test level that is consistent over time. Finally, the measurement must be economically feasible in regards to instrument cost, speed and reliability which all translate into the monetary cost to our cotton industry customers.

Additional HVI measurements of fiber properties are proposed from time to time. Whenever a proposed measurement shows potential for use in the classification

system, the Cotton Program will give the new measurement a thorough evaluation from the perspective of the classification process. In recent years, various evaluations have been performed on proposed measurements of short fiber, stickiness and elongation. In addition to studying proposed measurements, recent studies have also been conducted on some of the current HVI measurements. These studies have resulted in an improved HVI color grade determination and in a method for determining an accurate estimation of short fiber content from current measurements of length and length uniformity index.

Discussion

Short Fiber Content

The Cotton Program has been evaluating two methods for determining short fiber content on the HVI. The first method utilizes a short fiber index algorithm, developed by Zellweger Uster, to derive a fibrogram-based short fiber index measurement (Riley, 1993). This method has been under evaluation by the Cotton Program for the past three classing seasons (Gibson, 1999). The accuracy of this measurement was improved following the addition of a cotton calibration routine after the first classing season. Over the past two classing seasons, overall average between instrument reproducibility (for cottons from all U.S. growth areas), with a tolerance of 1.0%, has remained constant at approximately 58%. However, the range of short fiber reproducibilities over different growth areas varied from 46% to 69% (1999 crop). High short fiber content cottons consistently have lower reproducibilities while low short fiber content cottons will have higher reproducibilities.

The second method being evaluated utilizes an equation to derive short fiber index from the HVI measurements of length and length uniformity index (Knowlton, 1999). The resulting short fiber estimate is referred to as L/UI short fiber content. The equation, which was developed in 1998, was designed to predict the short fiber measurement provided by the HVI short fiber index algorithm. A thorough evaluation of L/UI short fiber content was conducted during the 1999 classing season. Although complete analysis has not been performed as of yet, preliminary data are very encouraging. Overall average between instrument reproducibility (for cottons from all U.S. growth areas), with a tolerance of 1.0%, was approximately 74%. The range of short fiber reproducibilities over the different growth areas varied from 62% to 82%

Both HVI short fiber measurement methods produce a very similar short fiber measurement level. The main difference between the two measurement methods is in variability, which is reflected in the reproducibility differences. The ultimate test for any new measurement is in its ability to provide information to the textile mill for optimizing processing performance. Plans are being made for such a test

on each of the short fiber measurement methods in a mill-processing environment.

HVI Color Grade

Another important issue that is under evaluation by the Cotton Program is the consideration of using the HVI color grade as the official color grade. During the 1998 season, the Cotton Program conducted a pilot project in conjunction with the National Cotton Council of America's Quality Task Force with the goal in mind of improving the HVI color grade determination (Boyd, 1999). This project's objective was to implement an adjustment to the conversion of the reflectance measurement, R_d , and the yellowness measurement, $+b$, to match the Universal Cotton Standards used by classers for official grade determination. The locations of the 1986 Universal Standards for color (which serve as the reference for all standards produced since that time) plotted on the Nickerson-Hunter color diagram provided the basis for the adjustment. Once the adjustment was made, the Cotton Program evaluated its impact by analyzing all white and light spotted grades assigned during the 1998 season and then again for the 1999 season. Results for both years have shown a color grade assignment that more closely matches the Universal Cotton Standards for color. The adjusted HVI color also resulted in an improved agreement between the HVI color grades and the classer color grades.

Stickiness

The Cotton Program has been active in stickiness testing for several years. Although a measure of stickiness is not part of the official USDA cotton classification system, the Cotton Program performs limited stickiness testing for purposes of evaluation and maintaining proficiency in recognized measurement methods. The only stickiness methods utilized by the Cotton Program up to this point have been the SCT Thermodetector and the Perkin's Sugar Test. In 1997, the Cotton Program had the opportunity to evaluate a Lintronic's FCT (Fiber Contamination Tester). The FCT was the first commercially available high speed stickiness testing instrument. Although the repeatability of the one FCT instrument was good, without a standardized method for calibration, achieving good repeatability between FCT instruments looked doubtful (Knowlton, 1998). Recent developments by the CIRAD company in France have resulted in a commercially available high speed stickiness tester named the H2SD (High Speed Stickiness Detector). The Cotton Program has not made any plans to evaluate the H2SD. However, if positive developments continue to be made on the H2SD, an evaluation may be planned.

In the event that a successful high speed stickiness testing instrument is developed, a major criteria for classification implementation is cost. Assuming large-scale classification implementation, current designs would require construction of new classing facilities to contain currently available

instruments that are as large as an HVI. The only foreseeable way to economically justify a large-scale cotton classification stickiness measurement is to develop a measurement that can be integrated into the current HVI system.

Elongation

Over the years, textile manufacturers have expressed varying degrees of interest in an HVI elongation measurement. A good HVI elongation measurement would complement HVI strength data by providing valuable mill performance information; especially to textile mills where high speed processing pushes cotton to its breakage limits. Early attempts at an HVI elongation measurement utilized a displacement transducer mounted on the breaker mechanism. Unfortunately, the use of a displacement transducer did not provide enough measurement precision for accurately detecting fiber elongation during the HVI breaking cycle. A second HVI measurement method counts the precise steps of the stepping motor that powers the breaker stroke. Early HVIs using this method were unsuccessful due to deflection in breaker components which resulted in a mix of deflection and elongation displacements. In 1995, a method was developed for the Zellweger Uster HVI system that would "calibrate out" the displacement caused by deflection (Bragg, 1998). This development has potential for improving the elongation measurement. However, a cotton elongation reference, which would probably require a cotton standard, has yet to be developed.

The Cotton Program has recently acquired an HVI software release with the new elongation measurement. An evaluation of the latest elongation measurement method is scheduled to get underway in the near future.

Conclusion

Evaluating proposed cotton quality measurements and improving current measurements is an ongoing task at the Cotton Program. Although no new measurements have been added to the classification system in recent years, progress by researchers and instrument manufacturers on new and improved cotton quality measurements are showing increased potential for implementation. Of all the new HVI measurements being evaluated by the Cotton Program, the L/UI short fiber content is the closest to meeting classification measurement acceptance criteria. The HVI short fiber index algorithm measurement is also close. Measurements of stickiness and elongation will require further study. The success of the HVI color grade project has solidified the Cotton Program's position that the HVI color grade accurately reflects the color in accordance with the Universal Grade Standards and could be used as the official color classification.

References

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