



Modification of the HVI Software as an Essential Step Towards a Global Cotton Standardization System

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ABSTRACT

*Grade and fiber properties are the main cotton quality factors measured on the High Volume Instrument (HVI). The HVI is used in 63 countries around the world but HVI grading is only used in the USA. In order to apply instrument grading, all cotton producing countries should include their own national grades on HVI software so that cotton brokers would be able to grade cotton from any country instrumentally. This paper describes experiments that were carried out by the FAO in Pakistan over a three-year period to include Pakistani grades on the HVI system. Samples were drawn from the Cotton Belt of Punjab and Sind, visually checked and tested for colour and trash content. Results show high correlation between grades and Rd% and non lint content %. On the basis of variations of b+ and Rb% between grades and within the same grade, a colour chart was designed and incorporated in HVI software of Spinlab 900 and MCI 3500 systems, making Pakistan the second country capable of using HVI grading. After modifications of the HVI grading system, it would be possible to adapt a global standardization system for Upland (*G. hirsutum*) and Egyptian (*G. barbadense*) cottons.*

Introduction

The art of cotton classification is thought to have started in England by Liverpool Cotton Exchange in the early 1780s.

Cotton classification has been traditionally based on human inspection by describing the cotton quality in terms of grade and staple length. This process is based on appearance, and it is performed through the sense of sight by integration of the three factors of grade: colour, trash and preparation.

Technological advances in the textile industry have put in consideration the importance of developing new measures for cotton quality.

Invention of instrument for testing fiber length, strength, fineness etc started in the 1920s. Instruments for fiber testing are widely used by textile industry and trade to supplement cotton classification. Instruments for colour grading are used only in the U.S.A.

Colour is considered to be one of the most important element in cotton classing. For over two hundred years, it was used to judge how well the yarn or fabric will dye or bleach, and to control the colour of the cotton blends and mixes in the textile mill.

The classer's eye has been always the fundamental tool for colour measurement, but because of lack in accuracy in judging absolute colour levels, cotton colourimeter and colour charts of Upland and Pima cotton were developed by USDA for colour grade measurement (Figures 1, 2).

As an advanced step, USDA along with some private industrial foundations introduced the High Volume Instrument (HVI) in 1968 for cotton classification.

Realizing the importance of the HVI grading system, FAO assisted two main cotton-producing countries – Pakistan and Egypt, in designing colour charts according to their own grades and preparing their grade standards on a scientific basis.

Procedures

Pakistani cotton

The FAO Cotton Project PAK/86/003 introduced six new grades, super, 1, 2, 3, 4 and 5.

Test results of the established grades showed that colour reflectance (Rd%) and Non-Lint Content (NLC%) had a very high correlation with the visually assessed grades. (Figures 3 and 4). These results were encouraged the development of the following colour grade chart for Pakistan cotton.

The colour chart was designed by using techniques similar to those used by USDA in preparing the colour charts for American Upland and Pima cotton

Hundreds of samples of each grade were plotted separately on the diagram of Nickerson – Hunter. Samples of each grade were selected from ginneries in the Cotton Belt of Sind and Punjab provinces to represent all the cotton areas and variations of colour between grades and within the same grade.

Lint samples from each grade were visually checked for colour and trash. They were then checked in the project's classing room in Karachi under lighting

conditions prescribed by American Society of Testing Materials (Anon a).

The lint cotton samples were then sent to the fiber-testing laboratory and tested for Rd%, NLC% and degree of yellowness (+b). Fiber tests for colour were carried out on Spinlab Colourimeter 830 and Spinlab HVI 900 and for trash content on Shirley Analyzer SDL 102.

Selected samples representing the maximum and minimum values obtained for colour during the testing of each grade were plotted within the different grade ranges. On the basis of this draft colour grade chart, grade standard boxes were prepared as follows:

Increasing of +b and decreasing of Rd% from one portion to another has to remain within the same range of trash content for each grade. The minimum reading of +b and maximum reading of Rd% are represented in the biscuit placed in the upper left corner of the box. The minimum reading of Rd% and the maximum reading of +b are represented in the biscuit placed in the lower right corner of the box. Other four biscuits +b are represented in such way to gradually increase and decrease respectively, while remaining within the maximum and minimum readings.

Test results obtained for colour of each biscuit showed that results plotted on the developed colour chart fell within the range lines of each grade.

All samples were tested using standard procedures.

Egyptian cotton

- Samples were collected from Alexandria Cotton Exchange to represent the range of the cotton grades. The experts of the cotton arbitration and testing general organization classed them.
- Samples were re-graded visually and divided into three groups: white, light creamy and dark creamy and nine grades within each group.
- Procedures used for developing colour chart is based on the same principles used by USDA for establishing U.S. Upland and Pima colour grade charts.

Standards were prepared according to draft colour chart to represent all the range of colour +b and Rd% for the Egyptian cotton varieties between grades and within each grade. Variation in colour has to remain within the same range of trash content for each grade.

Spinlab colourimeter and the developed colour chart were used for measuring colour grade and for preparing the grade standards.

Samples were tested and classed under standard procedures.

The system has not been applied yet on a commercial basis because trials are still under way to adapt it to HVI grading.

Results and discussion

The HVI includes in its software the American Upland and Pima grade. USDA is using the HVI for grading the entire U.S. crop and preparing the grade standards

In 1992 a colour chart for Pakistan's Upland cotton grades was developed and incorporated to the software of both Spinlab 900 and motion control 3500 (Fig 5). Both USDA and Pakistani grades can be displayed on the monitor of HVI (Figures 6 and 7 (not publishable)). Hence, Pakistan became the second country to have its own HVI grading system.

In Egypt, a colour chart for the Egyptian cotton varieties was developed in 1982. (Figure 8).

Other cotton producing countries are unable to use HVI the HVI grading capability fully unless they develop their own colour charts. Developing and incorporating various individual colour charts of the cotton producing countries into HVI software would increase dramatically its efficiency and would broaden the scope of its utilization.

This will be a fundamental step for the researchers in standardizing all colour charts into two global charts, one for Upland (*G. hirsutum*) cotton and another for Egyptian (*G. barbadense*) cotton. International standard boxes for grades could also be prepared.

Standardizing the various grading systems would also enhance and improve HVI utilization as this would enable all countries to grade cotton locally – through the HVI – as well as visually through the global grade standard boxes.

Except for grade, the values given by HVI fiber testing are already calibrated and standardized. Unlimited benefits would be gained by applying the proposed global standardization system in the fields of cotton production, marketing, research and textile industry.

The instrumental testing should be viewed as a supplement for cotton classification and not as a substitute for cotton classers.

Recommendations

More research work should be performed in the field of cotton classification in respect of grade.

The Pakistani model should be set as an example that all countries should follow.

The advantages of the proposed global standardization system should be explained to all countries.

The cotton producing countries should be encouraged to develop colour charts and prepare grade standards on a scientific basis.

Allow a transitional period before all cotton producing countries will be requested to apply the standardization system. (e.g. till the year 2010)

The International Advisory Committee (ICAC), International Textile Manufacturers Federation (ITMF) along with FAO and other concerned international organizations are requested to play a role in this field.

References

- Anon a: American Society of Testing Materials, committee D – 13 on textile Materials, ASTM designations.
- Anon b: Cotton Classification, AMS, Cotton, Cotton division, USDA.
- Anon c: Instruction Manuals of HVI of Motion Control Inc and Zellweger Uster – Spinlab Inc.
- Anon. (1994): Adoption of a new instrumental grading system for Pakistan cotton, International Committee on Cotton Testing Methods, ITMF. Faserinstitut, Bremen..
- Smith H.A. (1963): The use of colour as a measurement of cotton quality., American Cotton Congress, Dallas, Texas.

Figure 1. HVI colour grade chart.

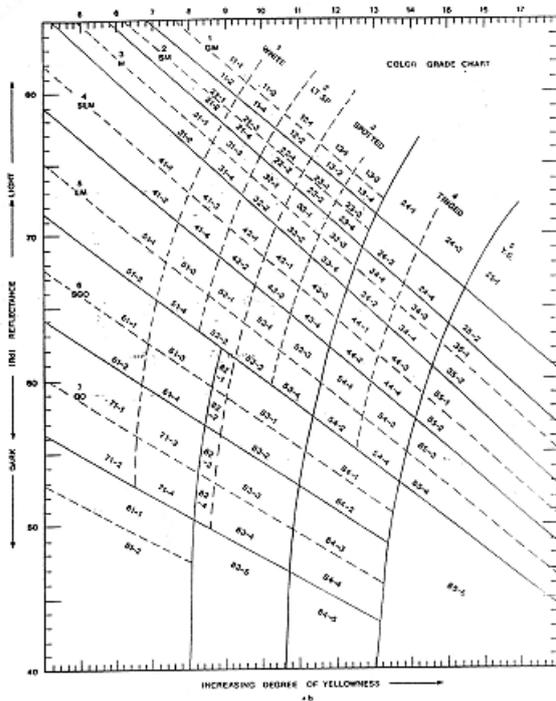


Figure 2. Colour diagramme for Nickerson-Hunter colourimeter.

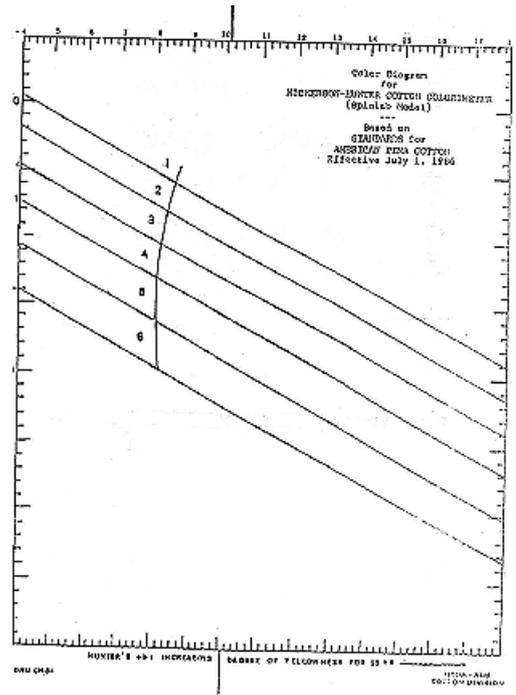


Figure 3. Grades and degree of reflectance (Rd%).

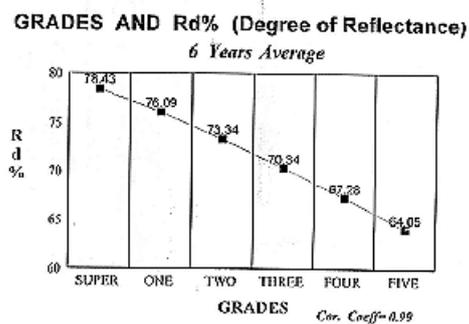


Figure 5. Color diagram for Pakistan's official cotton standards.

Figure 4. Grades and non lint content NLC%).

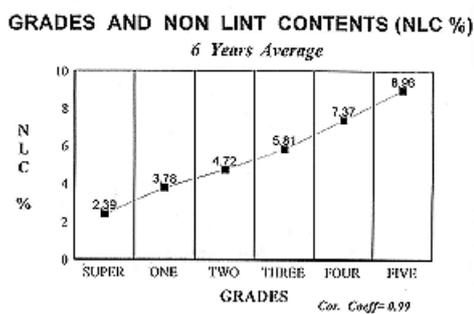
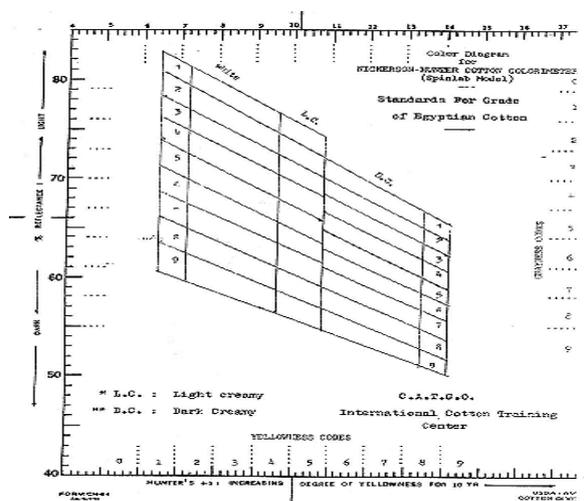


Figure 8. Nickerson-Hunter cotton colourimeter standards for Egyptian cotton grades.



Figures 6. Photograph of HVI monitor showing grade SUPER.

Figure 7. Photograph of HVI monitor showing sample readout.

