# The effect of cotton fibre characteristics on the measurement of their resistance to rupture. Contribution to the study of the quality of measurements made using high volume instruments (HVI)

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Of all textile fibers, cotton (Figure 1) is the market leader with about 20 million tonnes produced and processed annually. The sale price of the fiber is established on the basis of its quality which is evaluated either traditionally (manually and visually) or by instrumental techniques that are automated to varying degrees. Although the traditional method continues to be employed in certain production areas, High Volume Instruments (Figure 2) are used increasingly frequently. These machines characterize about ten technological criteria that reflect the intrinsic properties of the cotton fiber, and knowledge of which is essential for the subsequent processing operations (Figure 3).

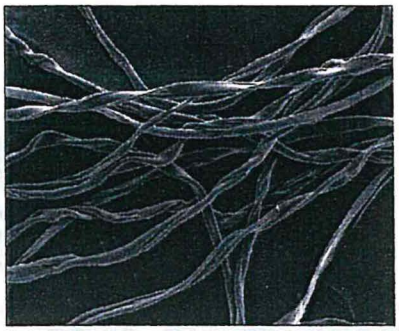

Figure 1. Cotton fibres by electronic microscopy (Picture by Gourlot J.P. and Drean J.Y.).

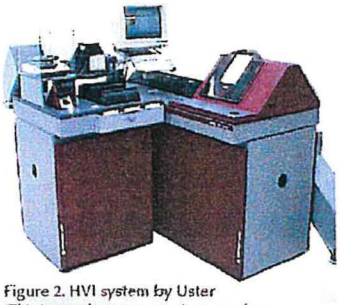

Figure 2. HVI system by Uster (This image does not constitute any form of recommendation for that measuring device, picture by Zellweger Uster).

In an effort to establish price/quality rules, industry organizations have standardized the instrumental methods used to measure the main fiber parameters: micronaire, colorimetric criteria, foreign matter content and the characteristics relative to fiber length and resistance to traction. Absolute measurement methods based on quantifiable, physical parameters are now being sought to establish standard values for each characteristic in order to calibrate the HVI lines.

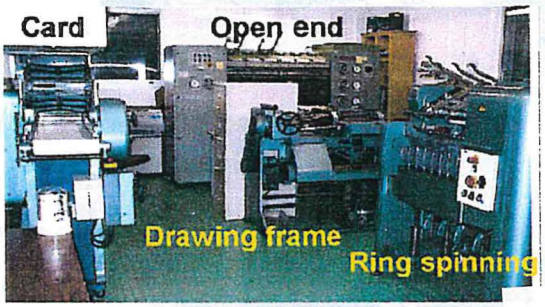


Figure 3. Micro-spinning room in Cirad (picture from Cirad).

The aim of this study was to analyze the different types of bias in HVI measurements of fiber strength (specific resistance to rupture force / linear mass, Figure 4) related to other fiber properties (color, maturity, fineness, length), and assess their statistical distribution and any interactions or combinations.

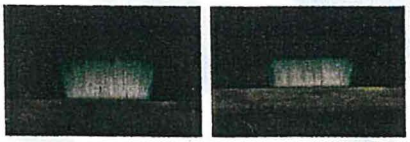

Figure 4. A bundle of 'parallel' cotton fibres before (A) and after (B) a dynamometric test on HVI (pictures by Gourlot J.P.).

Specific studies were conducted to confirm the effect exerted by each of the above criteria. A set of cottons covering a range of the major characteristics was also used to study the combined effects exerted by all these fiber properties.

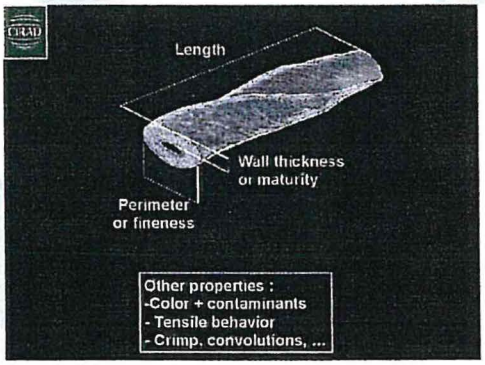


Figure 5. Major cotton fibre characteristics (drawing by Gourlot J.P.).

The results of this novel study indicate that the methods used to measure the characteristics tested lead notably to an incorrect assessment of the ruptured fiber mass during the dynamometer test. The importance of this bias should be considered in the light of the magnitude of other errors and the overall precision of the measurements. Unless substantial improvements are made to the equipment, HVI lines will prove to be unsuitable as the reference method for the measurement of strength on the basis of measurable physical parameters. From a scientific standpoint, a measurement of the major intrinsic properties of each fiber (Figure 5) would be required to gain a full understanding of the phenomena observed. In commercial use, the confidence limits of the results produced by HVI lines nevertheless remain acceptable.

## Summary

Cotton fiber strength as measured by HVI is the results of a calculation taking into account the results from a mechanical test and from an optical characterization of the number of broken fibers. This poster presents the general conditions that were used to check the precision and the accuracy of the strength measurement on a set of cotton covering a wide range of characteristics.

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