Update on HVI Measurements

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ABSTRACT

A pre-production model Premier Automatic HVI instrument from Premier Polytronics was evaluated on a wide range of cotton samples. Its performance is very promising.

Introduction

A first evaluation of a pre-production Automatic High Volume Fiber Tester (HVFT) 9000A from Premier Polytronics was done at the International Textile Centre in Lubbock, Texas. The objective was to independently evaluate the performance of this new instrument and recommend improvements and modifications where appropriate.

The succession of operations with the Premier Fiber Tester is the following:

1. Weigh 8.5 to 11.5 grams of fiber for the micronaire test.
2. Insert the fiber in the Micronaire tester.
3. Divide the sample in two parts and place each of them in the Colour/Trash trays.
4. The trays move automatically to the colour and trash module.
5. The trays move on to the sampling station for length and strength.
6. The trays are positioned above a perforated plate and a pressure plate comes down from above.
7. Two combs move under the perforated plate and acquire a sample of the cotton lint.
8. The combs "lock" the sample into the needles, move to the brushing/combing station, where a brush with metallic clothing removes the loose fibers and a vacuum sends them to the trash disposal. A soft brush parallels the fibers clamped on the combs
9. The combs move to the Length and Strength station, where the two fiber beards are analyzed sequentially.

Evaluation using standard cottons

A first evaluation was done using USDA-AMS (United States Department of Agriculture – Agricultural Marketing Service) cotton standards and ICCS (International Cotton Calibration Standards) cotton standards. The table shows that the correlation between the standard values and the actual readings of the Premier HVFT are very good. This was repeated several times to check the stability of the instrument. Satisfactory results were obtained.

As the cotton standards do not reflect the overall variability of cotton, additional experiments were done to test the HVFT on a wider range of fiber properties and fiber preparations.

Micronaire evaluation

Sixty samples representing a wide range of international cottons were selected to evaluate the micronaire readings (4 micronaire readings for each cotton). Figure 1 shows results of regressing HVI Zellweger 900A values from the HVFT Premier 9000A. The coefficient of correlation is extremely high ($r = 0.994$) and the slopes and offset of 0.992 and –0.104 respectively are very close to 0 and 1. These results were confirmed on other sets of samples. These results show that the Premier HVFT 9000A readings for micronaire are satisfactory.

Trash and Colour evaluation

Forty eight samples were selected from the same stripper-harvested cotton field, with and without field cleaning and with different ginning treatments. These samples represent a wide range of trash content and were used to evaluate the trashmeter in comparison with the Zellweger HVI 900A and the Zellweger AFIS Multidata Autojet. Four readings were taken with each of the high volume instruments and five replications with the AFIS. Figure 2 shows the relationship between the percent Area readings. The coefficient of correlation between the Zellweger HVI 900A and the Premier HVFT 9000A reading of 0.864 is good, keeping in mind that the Lab-to Lab reproducibility of classing results for the % Area is just 66% (The Classification of Cotton, USDA-AMS, Agricultural Handbook 566, 1993). Nevertheless, the slope is very different from one (0.362), the percent area with the Premier trashmeter having the lower reading. The same observation can be made for the particle count as shown in Figure 3, but the coefficient of correlation of 0.921 is very good for this measurement, given that the trash size and count distributions are much more variable than for the other fiber properties.

The trash counts from both the high volume instruments are highly correlated with the AFIS trash

count (Figure 4), with r = 0.937 and 0.925 for the Premier HVFT 9000A and the HVI Zellweger 900A, respectively.

These results are promising, although the difference of levels between the two high volume instruments needs to be reconciled.

Regarding the reflectance and the yellowness, a set of 57 samples representing a wide range of colours was tested (4 readings). Figures 5 and 6 show a good correlation between the two instruments with r = 0.868 for reflectance and r = 0.882 for yellowness. However, the slope and offset values are different from 1 and 0, with the Premier HVFT 9000A giving higher reflectance and lower yellowness readings.

Length and strength evaluation

Length readings were obtained using 10 replications per sample on the sample set used for the micronaire evaluation. Figures 7 and 8 show that for the Upper Half Mean length and the Mean Length the correlation coefficients are very good (respectively r = 0.987 and r = 0.982). However, slope and offset values are quite far from 1 and 0.

For the strength readings (Figure 9) the correlation between the two instruments is quite low (r = 0.790). This was determined to be due primarily to failure of the Premier sampling device to adequately control variations in the amount of fibers caught by the comb.

Conclusion

Performance of this pre-production HVFT from Premier is very promising. The measurements of micronaire, trash, colour and length correlate well with the other instruments tested. The strength tester itself seems to be accurate; improvements in the automatic sampler appear to be all that are needed to enable accurate and repeatable measurements of the strength. For all the measurements, however, the level shifts between the Premier and the Zellweger devices must eventually be addressed.

Premier is working on modifications to the HVFT, that are expected to be completed by early in 1999.

Table 1. Correlation between the standard values and the actual readings of the Premier HVFT.

Parameter	Sample Type	Number of cottons	Number of replications	Correlation with standard values
UHML	USDA Standards	8	8	0.992
ML	USDA Standards	8	8	0.991
UI%	USDA Standards	8	8	0.970
Strength	USDA Standards	8	8	0.985
Micronaire	ICCS Standards	7	1	0.999
Reflectance	USDA Standard	6	2	0.999
Yellowness	USDA Standards	6	2	0.996
Area%	USDA Standards	6	1	0.998
Count	USDA Standards	6	1	0.994

Figure 1. Micronaire: Zellweger 900A vs Premier 9000A.

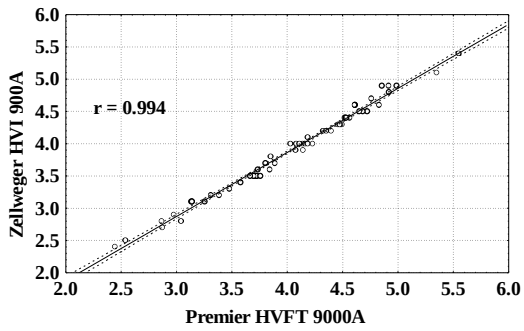

Figure 2. Percent Area: Zellweger 900A vs Premier 9000A.

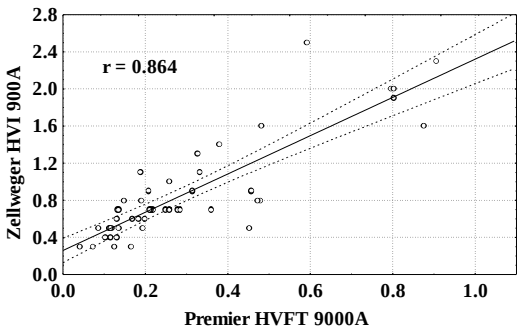

Figure 3. Count: Zellweger 900A vs Premier 9000A.

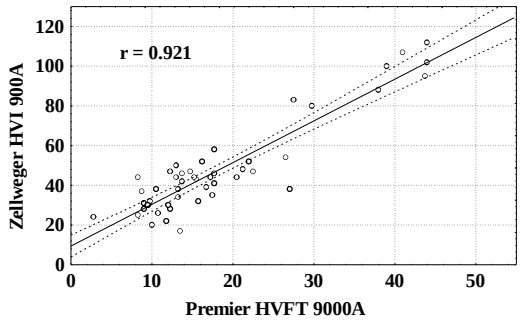

Figure 4. Trashmeter count vs AFIS trash counter.

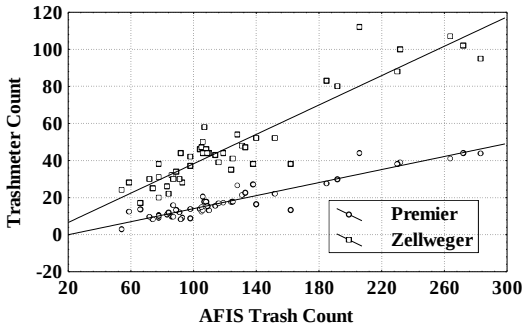

Figure 5. Reflectance: Zellweger 900A vs Premier 9000A.

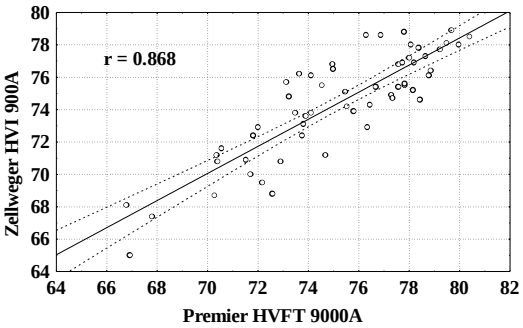

Figure 6. Yellowness: Zellweger 900A vs Premier 9000A.

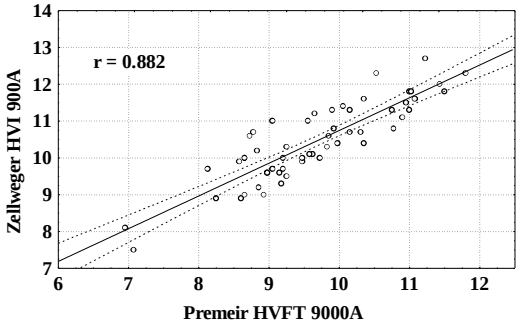

Figure 7. UHML: Zellweger 900A vs Premier 9000A.

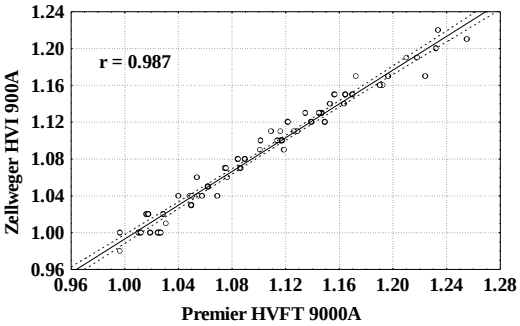

Figure 8. ML Zellweger 900A vs Premier 9000A.

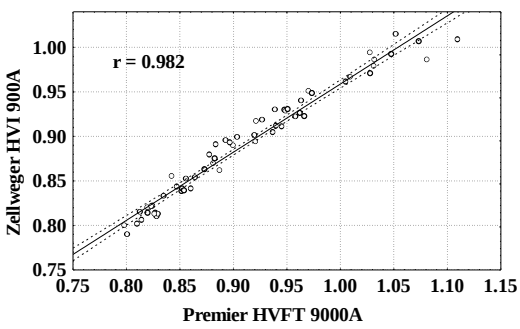

Figure 9. Strength: Zellweger 900A vs Permier 9000A.