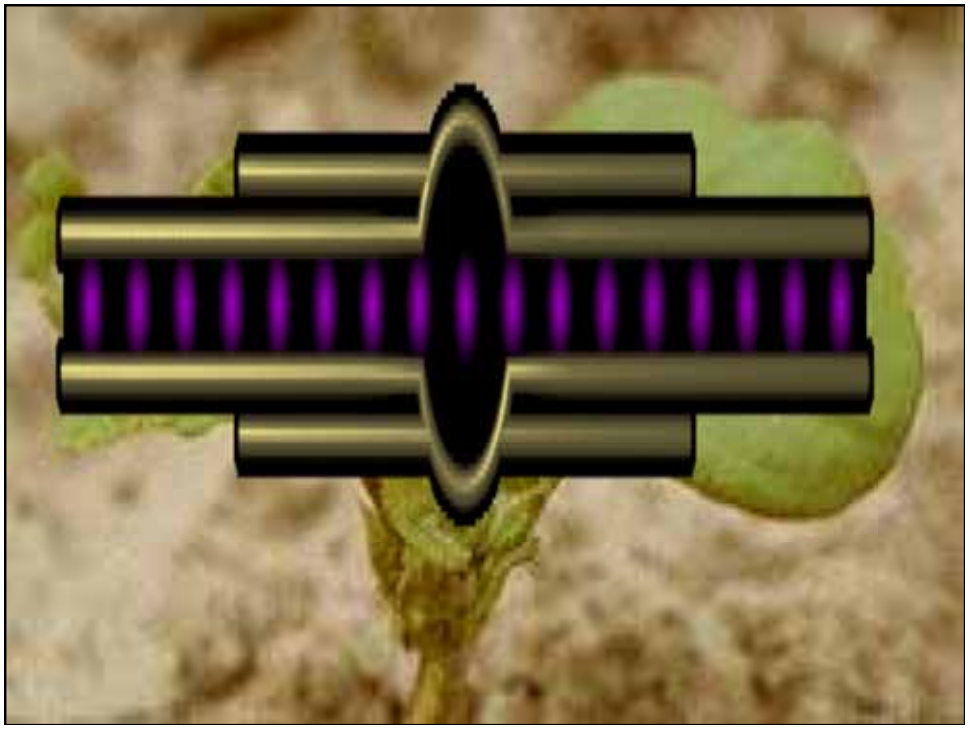

Calibrating the Micromat instrument using high volume instrument (HVI) output data

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Introduction

Cotton fiber maturity is a very important fiber characters because it controls dye uptake and nep formation. Also, fineness is important because it controls yarn count and strength.

Because of the importance of both characters scientists developed a lot of instruments to measure them. The most famous one is micronaire instrument which depends on the air permeability. Through the cotton fiber were tested fineness and maturity get it in one reading (Thibodeaux & Evans 1996), (Thibodeaux & Rajasekaran1999), and (Heap 2000)

but the combination of both characters in one reading is confused, in fact micronaire instrument reading express the sample specific surface area according to (Abd El Salam 1999) and (Montalvo 2005) who explain that low reading express fine or immature fibers and Vice-versa. So, it was a need to incorporate fineness and maturity tests to high volume instrument (Montalvo 1999) as well as, developing the SDL Micromat tester which is a double compression air flow that measure fineness and maturity separately

Daily calibration is required to have accurate results .As this calibration involves the use of a limited stock of standards cotton, the standards described by two values called PL and Ph (Montalvo, *et al*., 2002) and (Gawrysiak 2007). So, it's an easy way to calculate PL and Ph back using the micronaire and maturity ratio readings from HVI instrument to use them in the calibration when the standard one is not available.

During the routine work in cotton fiber Res. Department in cotton res. Institute we keen to calibrate the Micromat instrument every day to attain accurate results. But during the last few years the instrument became age and needs calibration at the every group of samples (the group contains 12 samples as a maximum). The calibration sample is very expensive and not available under our needs. So, we thought to have fast and dependable calibration sample to be used between groups The main purpose of this investigation was to verify the validity of using the HVI output data to make a calibration sample for Micromat instrument.

Materials and Methods

Sixteen different genotypes were used each genotype representative by four homogenized specimens to cover wide range of micronaire and maturity readings, as possible as, we can to be tested for micronaire and maturity by HVI instrument. The same specimens were subjected to be test on Micromat to get the output printed sheet containing micronaire (mic), maturity ratio (MR) readings, fineness in millitex (Fin) and Ph and PL readings.

Statistical analysis

Simple correlation coefficient, regression equation and T-test were performed using SPSS 11.0 software. T-test was performed to test the “equal means” of cotton fiber fineness and maturity parameters obtained from Micromat instrument vs. and HVI instruments. The null hypothesis was that the mean values of a certain fiber parameter from two treatments were equal. All tests were conducted under the significant level of 99%.

Results and dissections

It's well known that Micromat instrument software based on the Lord's equation to estimate micronaire, fineness and maturity as follows:

Mic= (850/PL+40) +0.6..... 1

$MR=0.247*PL^{0.125}$ $(PL/Ph)^{2}$…….2

$Fin= (60000/ PL)*(Ph / PL)^{1.75}$……..….3

We used the micronaire and maturity ratio readings produced from HVI instrument to calculate back the PL and Ph values which used mainly to calibrate the Micromat instrument as follows:

PL =(1)/(mic-0.6)*(850/1)-(40)…….4

$Ph=SQRT (0.247*PL^{0.125}/MR)$...……...5

Means of micronire values obtained by Micromat and HVI of different genotypes are shown in Table 1, its clear that the T-test values did not reach the significant level in both seasons. This is logic and reasonable because the mean values of micromaire readings of both Micromat and HVI instruments are typically equal. This also, are indicated by the excellent correlation r = 0.9907 aforementioned in Figure 1.

Table 1, *comparison between micronaire readings obtained from Micromat instrument and HVI instrument*

Sample	mic (MICR.)		mic (HVI)	
	2011	2012	2011	2012
C 1	2.6	-	2.6	-
C 2	2.8	-	2.8	-
G 77×P	3.1	3.2	3.1	3.2
G 87	3.3	-	3.3	-
G 92	3.7	3.8	3.7	3.8
G 88	3.8	3.8	3.8	3.8
B 1	3.9	-	3.9	-
G 70	4.0	4.1	4.0	4.1
10229×G86	4.2	3.9	4.2	4.0
G 90	4.3	4.1	4.3	4.1
G89×G86	4.4	4.5	4.6	4.5
G 86	4.5	4.3	4.5	4.4
B 2	4.6	-	4.7	-
C 3	4.7	-	4.7	-
90×Aus.	5.0	4.5	5.0	4.6
C 4	5.3	-	5.3	-
mean	4.01	4.01	4.03	4.06

t :not significant

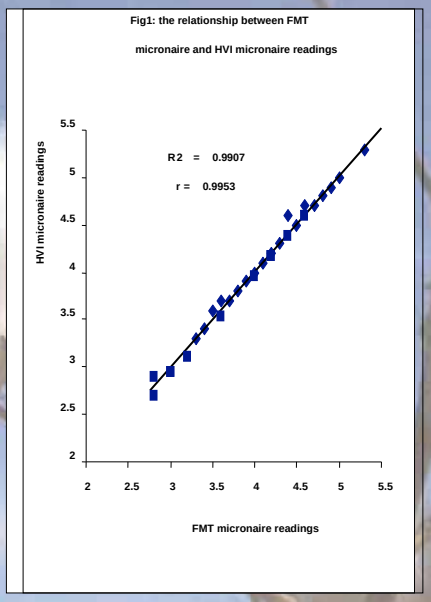
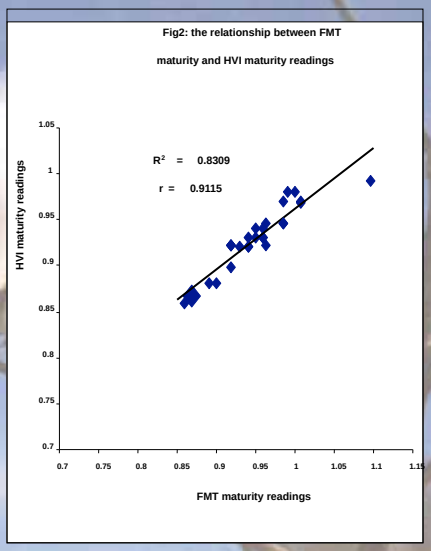


Table 2, indicated that the maturity readings of Micromat instrument were slightly higher than that of HVI instrument across 10 genotypes. While, the other 6 genotypes the maturity reading were the same in 2011 season. But in 2012 season the maturity reading of HVI instrument was higher than the maturity reading of Micromat by 0.01 in most the genotypes. This is reasonable because the maturity test principles of both the instruments are different. Nevertheless the correlation and the determining factor between them are high r = 0.8309, R2 = 0.9115 as shown in Figure 2. Also the difference between the two means is within the acceptable range.

Table 2, comparison between maturity ratio readings obtained from Micromat instrument and HVI instrument

Sample	MR (MICR.)		MR (HVI)	
	2011	2012	2011	2012
C 1	0.86	-	0.86	-
C 2	0.88	-	0.87	-
G 77×P	0.95	0.98	0.94	0.97
G 87	0.94	-	0.94	-
G 92	0.96	0.98	0.94	0.98
G 88	0.96	0.96	0.95	0.96
B 1	0.88	-	0.86	-
G 70	0.93	0.94	0.93	0.93
10229×G86	0.98	0.95	0.98	0.94
G 90	0.95	0.93	0.94	0.92
G89×G86	0.99	0.97	0.98	0.96
G 86	1.1	0.98	0.99	0.97
B 2	0.87	-	0.87	-
C 3	0.88	-	0.87	-
90×Aus.	0.96	0.90	0.96	0.89
C 4	0.95	-	0.94	-
mean	0.94	0.95	0.93	0.95

t :not significant

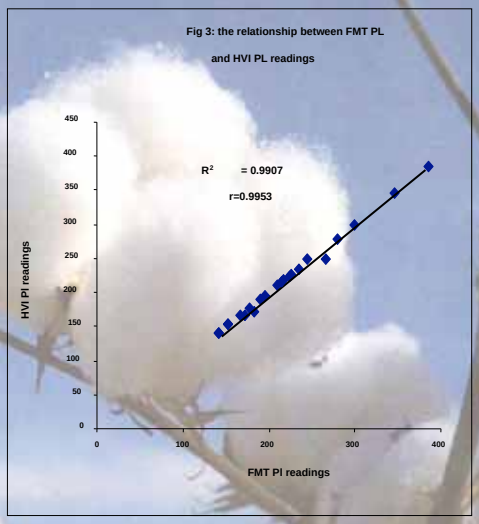


No significant difference was observed between the means of PL in both seasons as shown in Table 3, all the genotypes had the same value expect for the genotype G89 × G86 and B2 sample in 2011 season. This result explained the very high correlation r = 0.9953, and the excellent determining factor R2=0.9907 mentioned in Figure 3, this is because of that micronaire readings are calculated from the PL readings using the Micromat instrument, Since the two micronaire means of both instruments give the same value, Consequently, the actual PL of the Micromat instrument and the calculated back form the HVI instrument should be the same (formulas no. 1, 4)

Table 3, *comparison between PL readings obtained from Micromat instrument and PL reading calculated back using HVI instrument*

Sample	PL (MICR.)		PL (HVI)	
	2011	2012	2011	2012
C 1	385.0	-	385.0	-
C 2	346.4	-	346.4	-
G77×P	300.0	286.9	300.0	286.9
G87	274.8	-	274.8	-
G92	234.2	225.6	234.2	225.6
G88	225.6	225.6	225.6	225.6
B 1	217.6	-	217.6	-
G70	210.0	202.9	210.0	202.9
10229×G86	196.1	217.6	196.1	210.0
G90	189.7	202.9	189.7	202.9
G89xG86	183.7	177.9	172.5	177.9
G86	177.9	189.7	177.9	183.7
B 2	172.5	-	167.3	-
C 3	167.3	-	167.3	-
G90x Aus.	153.2	177.9	153.2	172.5
C 4	140.9	-	140.9	-
mean	223.4	216.1	222.4	210.0

t :not significant

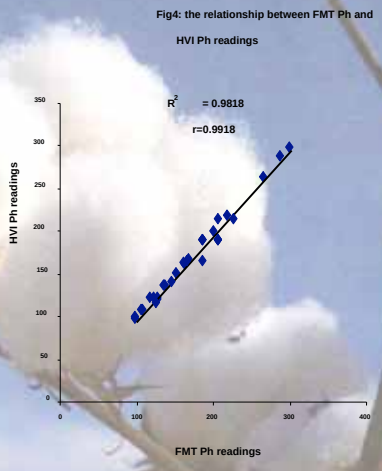


It's understandable from Table 4, that there wasn't any significant difference between the Ph means of both the two instruments, nevertheless, there is a relatively difference between the genotypes readings. This results were also, indicated by the correlation and regression results shown in Figure 4, this ascribed to that the Ph calculated back using HVI data depended on the PL (formula no. 5) data which calculated from the micronaire data (100 % right) in addition to maturity data. So, the difference in Ph readings was slightly narrow.

Table 4, *comparison between Ph readings obtained from Micromat instrument and Ph reading calculated back using HVI instrument*

Sample	Ph (MICR.)		Ph (HVI)	
	2011	2012	2011	2012
C 1	299.3	-	299.3	-
C 2	264.5	-	266.0	-
G77×P	218.5	205.2	219.6	206.2
G87	200.1	-	200.1	-
G92	167.1	158.9	168.8	158.9
G88	160.6	160.6	161.4	160.8
B 1	161.4	-	163.2	-
G70	151.2	145.0	151.2	145.7
10229×G68	136.9	155.3	136.9	150.4
G90	134.3	145.7	135.0	146.5
G89×G86	127.1	124.2	120.7	124.8
G 86	116.6	132.2	122.9	128.4
B 2	126.1	-	122.8	-
C 3	122.1	-	122.8	-
G90×Aus.	106.4	128.9	106.4	125.4
C 4	97.8	-	98. 9	-
mean	161.9	150.7	169.6	149.7

t :not significant



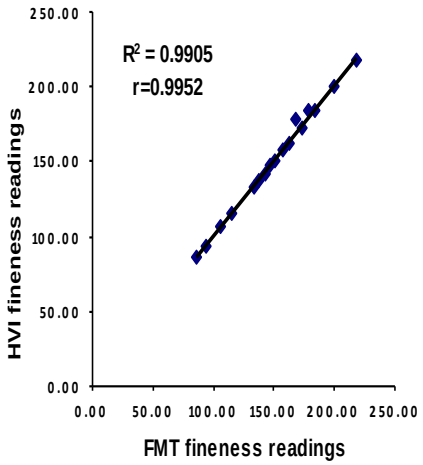
Data presented in Table and Figure 5, indicated the reliability of our calibration, science the fineness is calculated using PL and Ph values (formula no. 3) and there was not any significant between the mean values of the Micromat fineness and the calculated ones using HVI instrument adding to that the excellent correlation between them. Then the PL and Ph produced by HVI is successful to calibrate the Micromat instrument.

Table 5, *comparison between* Fineness *readings obtained from Micromat and* Fineness *readings calculated back using HVI instruments*

Sample	Fin (MICR.)		Fin (HVI)	
	2011	2012	2011	2012
C 1	100.3	-	100.3	-
C 2	109.1	-	109.1	-
G77×P	115.9	116.3	115.9	117.3
G 87	126.5	-	125.3	-
G 92	144.5	144.0	144.5	144.0
G 88	148.0	146.7	148.0	146.7
B 1	166. 8	-	166. 8	-
G 70	153.5	164.2	160.7	165.8
10229×G86	164.7	152.9	163.2	159.2
G 90	174.3	165.8	174.3	167.3
G89×G86	176.1	179.5	182.9	181.2
G 86	160.8	168.1	176.4	174.5
B 2	203.0	-	208.6	-
C 3	208.6	-	208.6	-
90×Aus.	212.9	191.7	207.1	199.0
C 4	225.2	-	229.4	-
mean	161. 9	158.8	163.8	161.7

t :not significant

Fig5: the relationship between FMT fineness and HVI fineness readings



Conclusion

Comparison of micronaire and maturity data of the two calibrated Micromat and HVI instruments proven that the two instruments were providing statistically similar micronaire data. Consequently, they must have similar PL data. The different of the principle of measuring the maturity ratio did not affect the Ph value in a wide range because the formula of calculated the Ph depends on both of the PL and maturity ratio readings .The congruency of true fineness and calculated fineness using HVI Instrument in most the samples indicated the validity of our calibration.