Evaluation of Cottonscope precision for module averaging

Patrick Mileto and Stuart Gordon

March 18th 2014

CSIRO – MATERIALS SCIENCE AND ENGINEERING
www.csiro.au

Introduction

This work examines the sampling required to measure Cottonscope values with an acceptable degree of precision.

The application is aimed at 'high volume' instrument testing and particularly at the variation seen between successive bales from the same module.

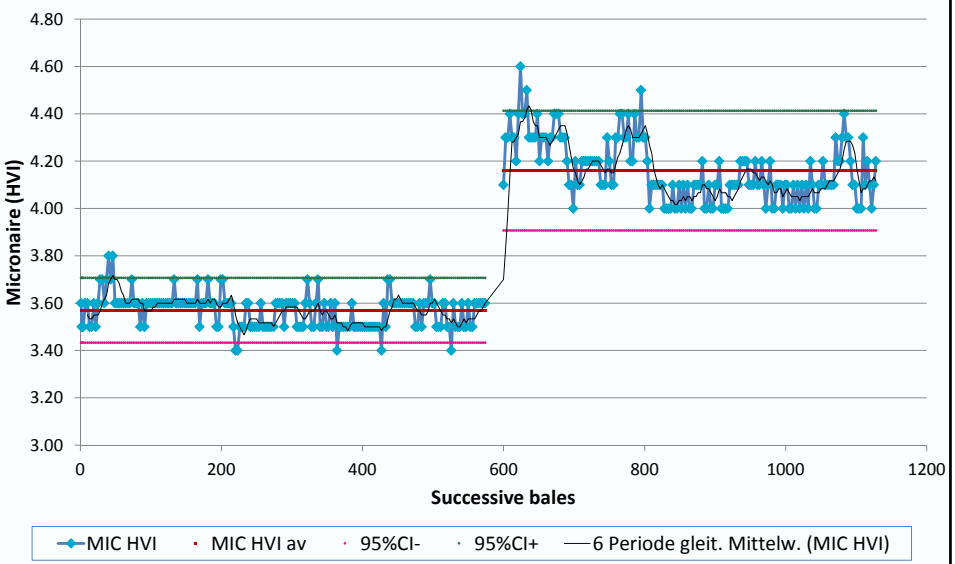
Precision defined in terms of relative error is reported for Cottonscope values based on a module averaging sampling regime; i.e. one bale in three tested for a standard module.

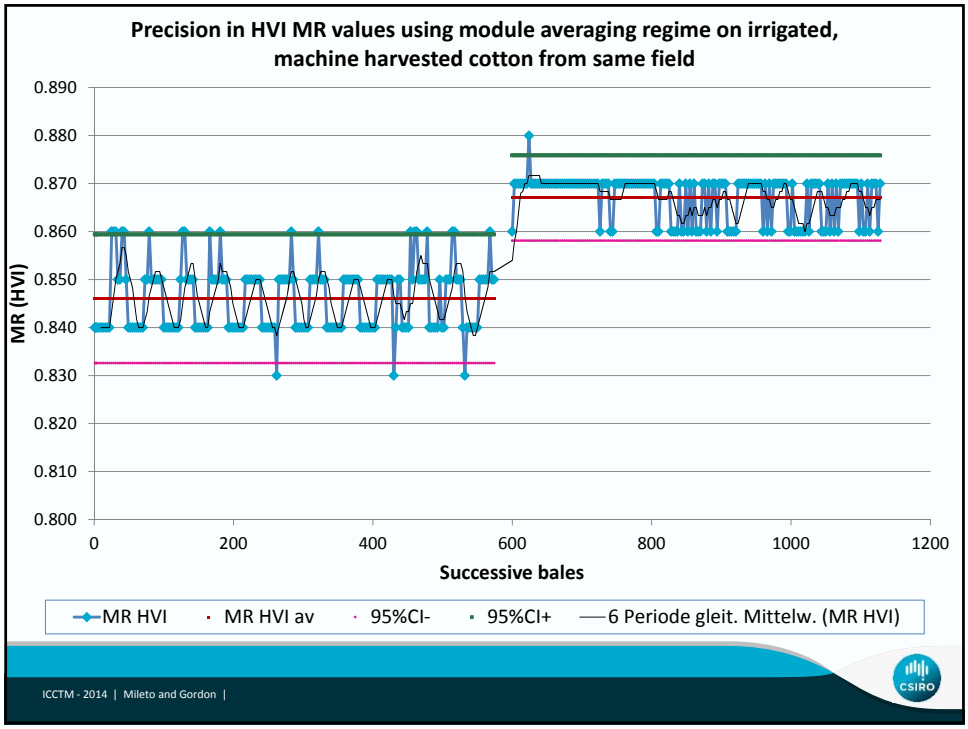
Materials

600+ bales (≈30 modules) each of low MIC (3.6) and standard MIC (4.2) cotton ginned, sampled and classed in succession.

Samples tested by HVI and Cottonscope followed standard procedures.

Precision in HVI Micronaire values using module averaging regime on irrigated, machine harvested cotton from same field





1 in 3 bales tested by HVI
1 bale = 1 HVI test specimen (100 – 200 g)

Cotton	'Run' mean	Range of 'module' means	Range of 'module' SEs	Mean relative error[1] in 'module' average
'Low' MIC	3.57	3.46 – 3.72	0.04 – 0.08	2.8%
'Standard' MIC	4.16	4.04 – 4.41	0.05 – 0.12	3.7%
'Low' MR	0.846	0.840 – 0.854	0.000 – 0.011	1.1%
'Standard' MR	0.867	0.861 – 0.871	0.000 – 0.006	0.8%

Mean value of each 'run' represents 600+ successive bales from same field
Mean value of each 'module' represents 15-21 bales

[1] *Relative error = (95% confidence value around module std. error/module mean) x 100*

ICCTM - 2014 | Mileto and Gordon |

Experimental – Cottonscope testing

Consecutive bale samples x 6 (1 module)

Standard MIC cotton

Low MIC cotton

Bale samples are sub-sampled (SS)

1SS, 2SS, 5SS and 10SS taken per sample

SS stored under std. conditions during sampling

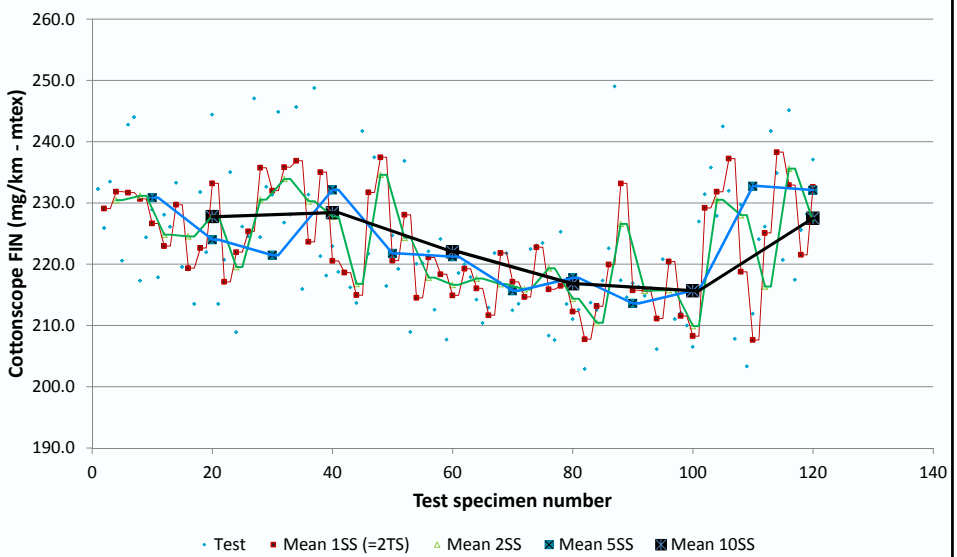
Two test specimens (TS) prepared from each SS

TS conditioned for 12hrs under std. conditions

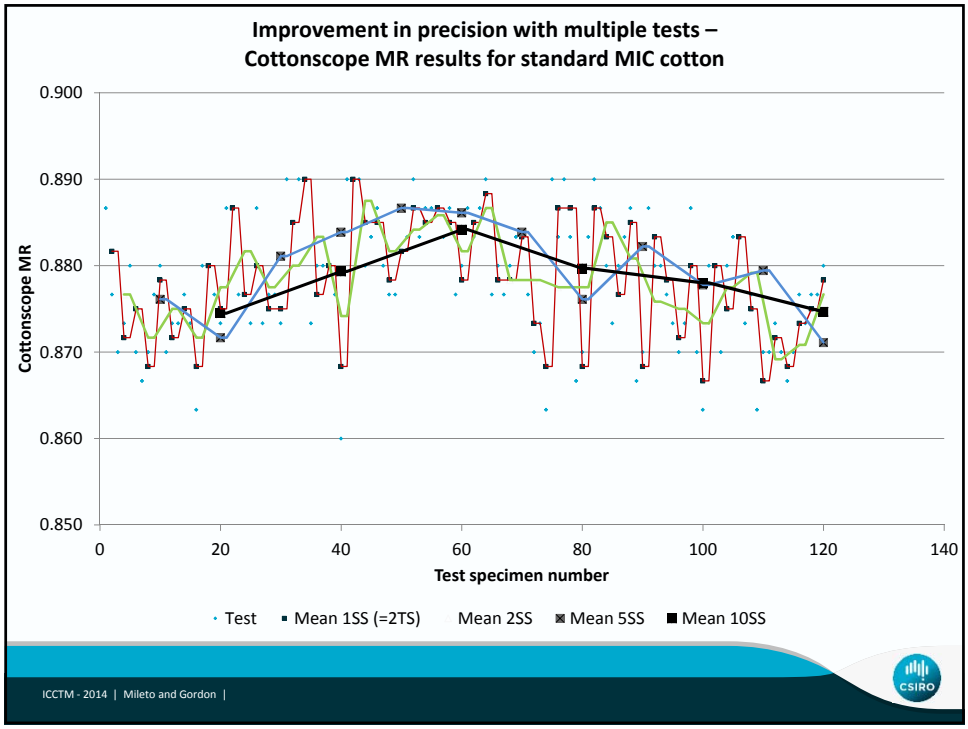
Cottonscope 2TS tested per SS

CSIRO

Improvement in precision with multiple tests – Cottonscope FIN results for standard MIC cotton



CSIRO



1 in 3 bales tested by Cottonscope
1 bale = 1 sub-sample (1SS), 2SS, 5SS or 10SS tested

Cotton	Relative error for 'module' average 1SS	Relative error for 'module' average 2SS	Relative error for 'module' average 5 SS	Relative error for 'module' average 10SS
'Low' FIN (189 mtex)	6.8%	5.8%	4.3%	3.9%
'Standard' FIN (223 mtex)	7.5%	6.6%	6.2%	5.1%
'Low' MR (0.844)	1.2%	1.1%	1.0%	0.7%
'Standard' MR (0.878)	1.5%	1.2%	1.1%	0.8%
'Low' MIC (3.65)	4.8%	4.4%	4.3%	3.4%
'Standard' MIC (4.41)	3.9%	2.7%	2.6%	1.3%
'Low' WID (14.30 um)	0.8%	0.7%	0.6%	0.5%
'Standard' WID (14.28 um)	1.0%	0.9%	0.9%	0.7%
1SS = 2 test specimens (TS) = 100 mg of sample tested				

ICCTM - 2014 | Mileto and Gordon |
CSIRO

Conclusions

Comparison HVI v. Cottonscope values

Cotton	HVI mean	Mean relative error[1] in 'module' average	Cottonscope mean[2]	Mean relative error[1, 2] in 'module' average
'Low' MIC	3.57	2.8%	3.65	4.8%
'Standard' MIC	4.16	3.7%	4.41	3.9%
'Low' MR	0.846	1.1%	0.844	1.2%
'Standard' MR	0.867	0.8%	0.878	1.5%

[1] Relative error = (95% confidence interval around module std. error/module mean) x 100
[2] For one module only; error values represent 1 SS (2 x TS) per bale

Cottonscope precision in measuring MIC and MR using 1 SS (2 x TS) per bale is similar to HVI MIC and MR using 1 test sample

Cottonscope precision in measuring FIN can be improved by increasing the number of SS tested per sample; ±15 mtex (1 SS) → ± 9 mtex (10 SS)

Acknowledgements

Sponsorship by Cotton Incorporated is gratefully acknowledged

Patrick Mileto

Lisa O'Brien

Thank you

CSIRO
Stuart Gordon
Research Group Leader
Fibre Physics and Engineering

t +61 3 5246 4809
E stuart.gordon@csiro.au
w www.csiro.au

CSIRO MATERIALS SCIENCE AND ENGINEERING
www.csiro.au