	<u> </u>
Author	Topic
Darryl Farnact LISDA AMS	Innovations in USDA Cotton Classification
Darryl Earnest, USDA-AMS	Innovations in OSDA Cotton Classification
Gretchen Deatherage, USDA-AMS	USDA Cotton Classification and Standards Update
Sandra Meier, Loepfe, Switzerland,	Introduction of Mesdan Contest and Loepfe Labmaster
and Daniela Messa, Mesdan, Italy	Fibermap
Dhandayuthapani Chidambaram, MAG, India	MAG, MAG instruments, new developments
A. Negm / S. Sanad, CRI, Egypt	A comparison of HVI, AFIS and CCS Cotton Testing Methods
David McAlister, Uster, USA	HVI Elongation
Stuart Gordon, CSIRO, Australia	"Calibration" of HVI Elongation
Shouren Yang, CSIRO, Australia	Specific Cotton Fibre Elongation
Daniela Messa, Mesdan, Italy, and	Stickiness measurement by Loepfe Fibermap and Mesdan
Sandra Meier, Loepfe, Switzerland	Contest
JP. Goulot, S. Lassus & G. Gawrysiak,	
CIRAD, France	new results and proposal for an harmonization step forward
Hy Hwang (Cottonscope P/L)	A Brief Update on Cottonscope
Anja Schleth, Uster, USA	AFIS/HIV Maturity Measurement Revised Algorithm
Eric Hequet (TTU) & Vikki Martin (CI)	Creation of a set of reference cotton for fiber maturity measurements
Stuart Gordon , CSIRO, Australia	Cottonscope Speciment Preparation
stuart cordon, como, nastrana	Socialisa Speciment Treparation
Stuart Gordon, CSIRO, Australia	Recognition of Cottonscope - an instrument for testing cotton fibre maturity, fineness, ribbon width & micronaire
Guntram Kugler, Textechno, Germany	1
James Knowlton, USDA-AMS, USA	USDA Imaging Developments
Mohamed Negm & Suzan Sanad, CRI,	Relationship between HVI & CCS & Tensile Yarn Strength
Chris Delhom, USDA-ARS, USA	Laboratory Cotton Fiber Moisture Measurements with the
	Aqualab Microwave Instrument

Innovations in USDA Cotton Classification

Bremen International Cotton Conference

Darryl W. Earnest
Deputy Administrator
USDA, AMS, Cotton and Tobacco Program
Memphis, TN

Main Topics to Cover

- High Volume Instrument Improvements
- Automation of Sample Movement Process
- Image Analysis for Color, Trash, and Extraneous Matter
- Business Intelligence Analytics
- Quality Management Program
- Future Considerations

Mission

Facilitate the efficient marketing of U.S. cotton and tobacco to both domestic and international markets through providing accurate, timely, efficient, and unbiased services that assist the industries in conducting fair and competitive trade practices and promoting the commodities worldwide for the benefit of all segments of the U.S. industries and end consumers.

Vision

To pursue innovation; embrace efficiency; reject complacency; deliver the highest level of customer service; personify professionalism, integrity, and respect; accept social responsibility; and strive for excellence.

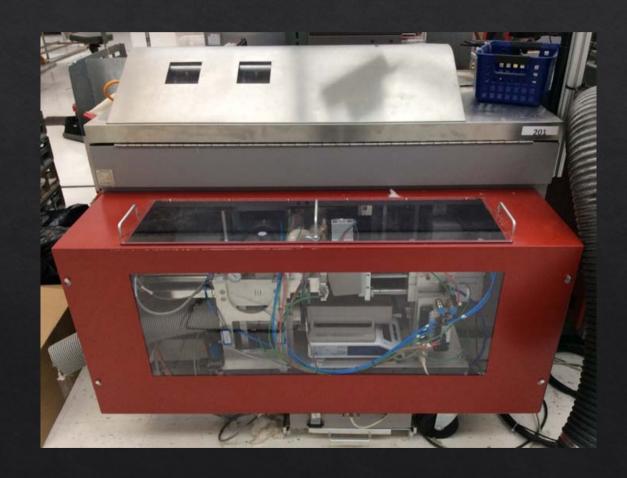
Vision

To pursue <u>innovation</u>; embrace <u>efficiency</u>; reject complacency; deliver the highest level of <u>customer service</u>; personify professionalism, integrity, and respect; accept social responsibility; and <u>strive for excellence</u>.

High Volume Instrument Improvements

High Volume Instrument Improvements

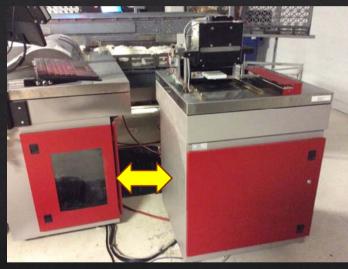
Automated Micronaire



High Volume Instrument Improvements De-Coupled Instrument Components



Traditional Coupled



De-Coupled



Individual Operation

=

Increased Flexibility & Optimization







Abilene, TX Classing Office







Abilene, TX Classing Office



Abilene, TX Classing Office

Results of Automation in Abilene

- Reduced the number of HVIs from 14 to 8
- ♦ Increased the number of samples classed per hour from 108.3 to 114.9 (net) and testing output close to 120 s/h
- ♦ More improvements expected for 2016 season
- Better optimized personnel and instruments which correlated into increased efficiency





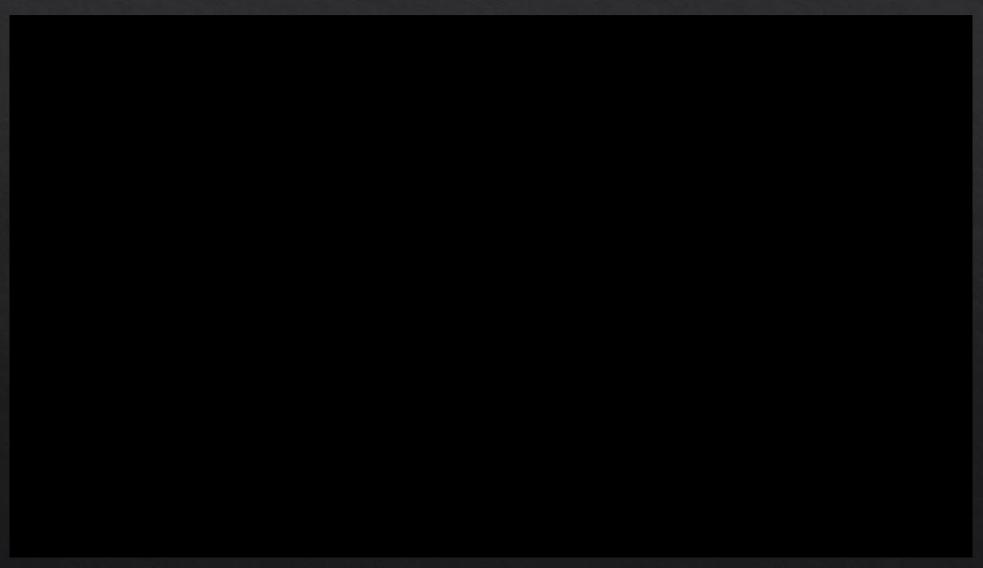
Memphis, TN Classing Office







Memphis, TN Classing Office



Results of Automation in Memphis

- Four instrument system
- Passed qualifications and contract criteria over past couple of weeks
- Qualifications resulted in 125+ samples per hour instrument-tested. This compared to average of 93.4 samples per hour in MCO in 2015-16 using traditional methods
- More testing and qualifications to follow in 2016 with full utilization planned for 2016 classing season

Image Analysis of Color, Trash, and Extraneous Matter

Image Analysis for Color, Trash, and Extraneous Matter

- USDA secured contracts with three companies for imaging prototype technology
- ♦ USDA desired to seek new potential lighting and imaging technology to enhance measurement ability for color and trash and also to pursue potential of electronic detection of extraneous matter
- ♦ Each of the three companies used different state-of-the-art approach

Image Analysis for Color, Trash, and Extraneous Matter







Image Analysis for Color, Trash, and Extraneous Matter

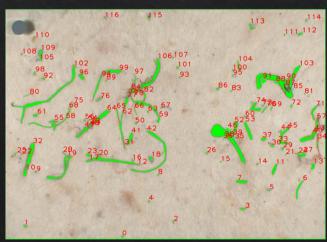












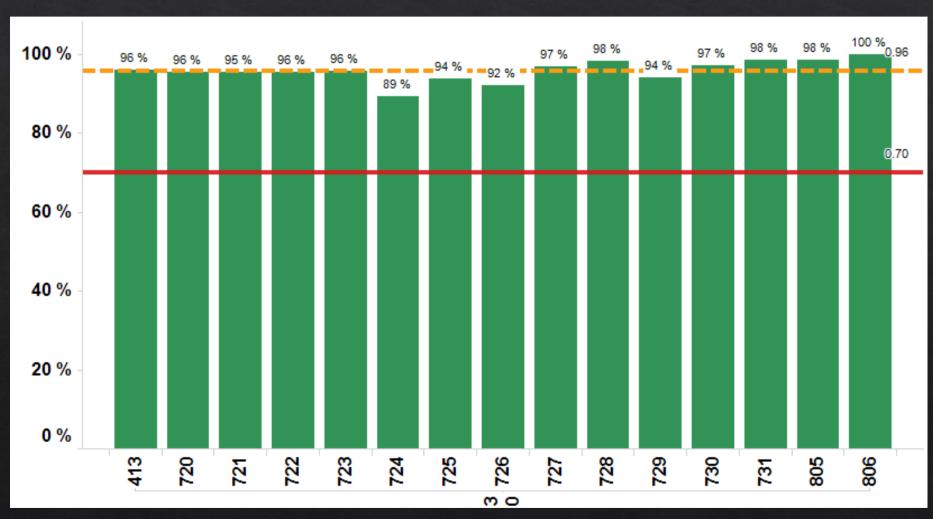
Business Intelligence Analytics

Business Intelligence Analytics

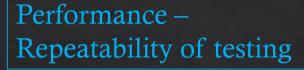
- Utilization of real-time analytics for immediate graphic and data feedback on a variety of operations to make critical decisions
- ♦ For cotton classification, use data from known-value inhouse cotton along with live measurements to provide immediate feedback for monitor of performance and to make any adjustments
- Business intelligence analytics can be used for all facets of operations that use or generates data (which is virtually everything)

Business Intelligence Analytics – In-House Known Value Check

In-house Tolerance - Micronaire

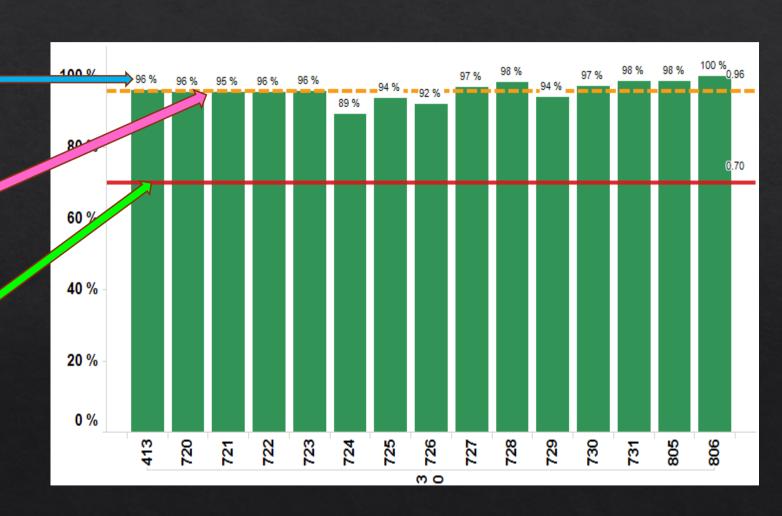


Business Intelligence Analytics – In-House Known Value Check



Calculated Trend Lines and Statistics

Adjustable Target Line for Minimum
Performance



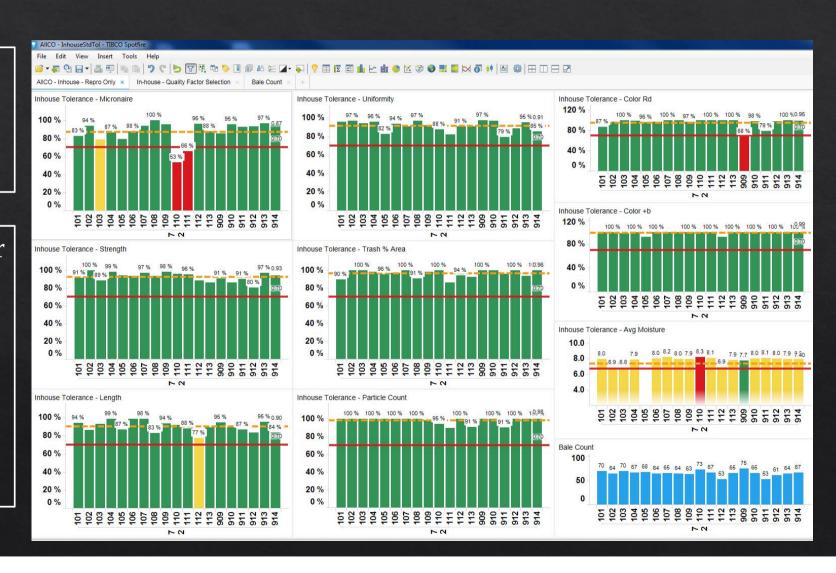
Business Intelligence Analytics – Large Amount of Data



Business Intelligence Analytics – Color Coded Graphics

Immediate graphical recognition of problems or potential problems

Regardless of number of instruments, can immediately hone in on RED lines to address issues and YELLOW lines that may be approaching RED



Business Intelligence Analytics Immediate Real-Time Performance Data





Business Intelligence Analytics

Big Screen Monitors in Plain View of all Lab Operations to assess performance throughout the entire shift





Business Intelligence Analytics

- ♦ Powerful tool to analyze large amounts of data in short amounts of time
- Immediate feedback for quick decisions
- We can also look at many different analyses with the entire crop in real time

Quality Management Process

Quality Management Program

- Use known-value cottons and materials and the current methods of in-house verification checks throughout each shift to manage accuracy and precision in each office
- Couple the known-value checks with business analytics software to give immediate real-time feedback
- Allows for frequent ongoing checks instead of sending cotton to Memphis overnight for retesting (current check-lot system)

Quality Management Program

Can use Analytics in QMP to measure performance of testing instruments, classers, supervisors, shifts, offices, divisions, etc.

Can analyze thousands of data points in seconds and millions in minutes



Quality Management Program

- ♦ C&T pilot-tested the QMP in 4 classing offices in 2015 crop (one pilot office in each region) with very promising results that proved the principles that were expected
- ♦ Full implementation of the QMP in all 10 classing locations will take place in 2016

Future Considerations

Future Considerations

- Continue to work with instrument manufacturer to improve HVI equipment
- Evaluate Beta models for three imaging prototypes
- Continue to evaluate automation (both types) and plan for future procurement and implementation in other locations
- ♦ Advance toward full automated cotton classification
- Plan future classing office modifications and new offices around automation and business analytics
- Leverage technology and analytics to identify areas for efficiency improvements in all facets of operations

Conclusion Keep the Mission and Vision in Mind

To pursue **innovation**; embrace **efficiency**; reject complacency; deliver the highest level of **customer service**; personify professionalism, integrity, and respect; accept social responsibility; and **strive for excellence**.

Innovations in USDA Cotton Classification

THANK YOU!!!



USDA COTTON CLASSIFICATION AND STANDARDS UPDATE

Presented by Gretchen Deatherage Deputy Director of Standardization Cotton & Tobacco Program



WHAT'S NEW AT USDA?

- Implementation of Quality Management Program
- Changes with ELS (Pima) Calibration Cotton
- Universal Cotton Standards Conference Update

Quality Management Program



Quality Management Program

USDA is implementing a new system for monitoring and maintaining consistent testing levels.



- USDA's next step in continuously improving the quality of cotton testing data provided to our customers
- Replaces USDA's "Checklot" system
- It utilizes more of a "round testing" concept.

Quality Management Program

WHAT IS IT?

Offers an improved method for checks and balances

- Incorporating new instrument calibration routine
- Testing levels verified utilizing known-value cotton
- Real-time data analytics
- Weekly round-testing





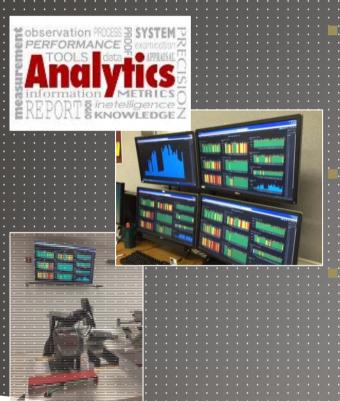
Verification Materials

- Known-value cottons (IHC) with established values for strength, length, UI, and micronaire
- Monitoring of color and trash performance
 - Tiles
 - IHC Cottons





Known-Value Cottons and Real-Time Data Analytics



- Known-value cotton (IHC) tested every two hours within each USDA laboratory
 - Known-value cotton (RLC) tested weekly in all USDA laboratories
- Data analyzed and charted using data visualization and analytics software

Extra-Long Staple (Pima) Calibration Cotton

CHALLENGES AHEAD



Extra-Long Staple (Pima) Calibration Cotton (Long/Strong)



- Current inventories of ELS Long/Strong cotton are saw-ginned
 - Unable to acquire new supplies
 - Current supplies should last approximately one more year

Extra-Long Staple (Pima) Calibration Cotton (Long/Strong)

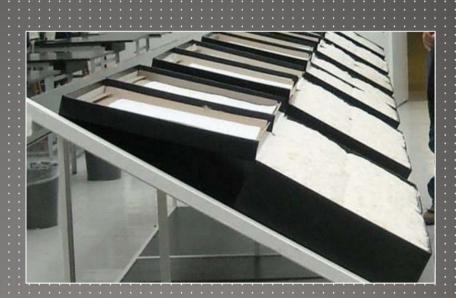


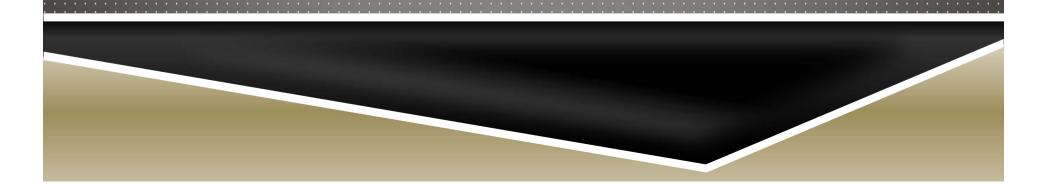
- More crop selection options
- Higher measurement levels
- Higher measurement standard deviations
- Possible need for additional repetitions in calibration routine



Universal Cotton Standards Conference

UPDATE





Universal Cotton Standards Conference

- Last conference was held in Raleigh, North CarolinaUSA in June 2013
- Request for proposals was made this past December, but none were received.
- Decision made to postpone the conference scheduled for June 2017
- Decision for a 2018 conference will be made at the
 end of 2016

2016 Universal Cotton Standards Dates to Remember

- Universal Cotton Standards Guide Box Review
 - April 26, 2016
- Universal Cotton Standards Matching
 - June 23, 2016



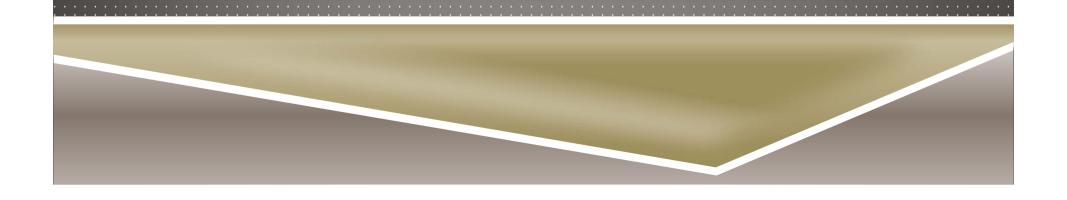


USDA COTTON CLASSIFICATION AND STANDARDS UPDATE

Presented by Gretchen Deatherage

Deputy Director of Standardization

Cotton & Tobacco Program







Introduction of Mesdan CONTEST and Loepfe LABMASTER FIBERMAP

ITMF – ICCTM meeting, March 15th 2016
Daniela Messa, CEO Mesdan & Sandra Meier, Product Manager, Loepfe AG



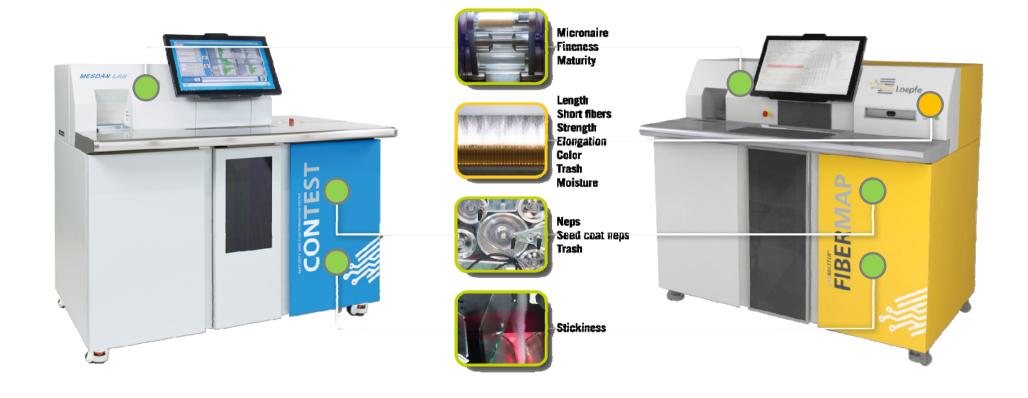




Savio group: qualified technologies in the textile industry







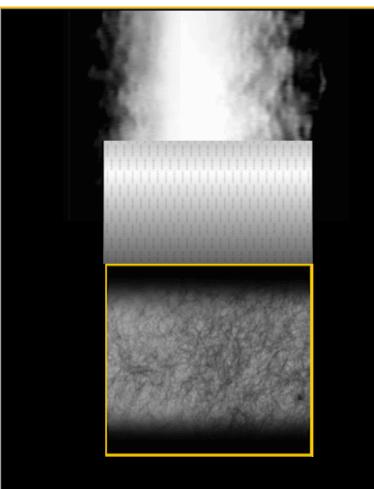
Loepfe LABMASTER FIBERMAP and Mesdan CONTEST





Measuring principle

- Large sample size (3.5g)
- Automatically transformed into a 10m web
- Image analysis of impurities (neps, seed coat neps, trash)
- Count and classification of impurities by type and size (5 classes; count/gr; average size)



Classification of neps, seed coat neps, trash







Over 100 images are processed by image analysis software:

- Neps
- Seed Coat Neps
- Trash

Impurities are counted, measured and classified.

Classification of neps, seed coat neps, trash



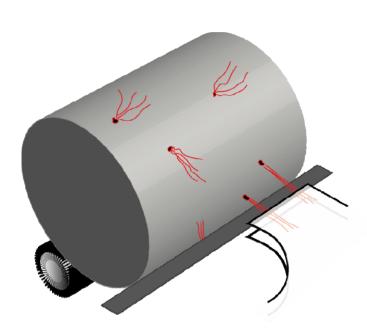


Measuring principle

- Thermodetection of sticky deposits in the web
- 3.5 gr/10mt sample pressed through 38° heated drums
- Stickiness analysis by optical system
- Automatic cleaning of the testing surface
- Stickiness count/g. & size
- Stickiness grade

Advantages

- Testing of large number of samples
- Prediction of processing problems due to sticky cotton
- Classing of cotton bales in stickiness grades



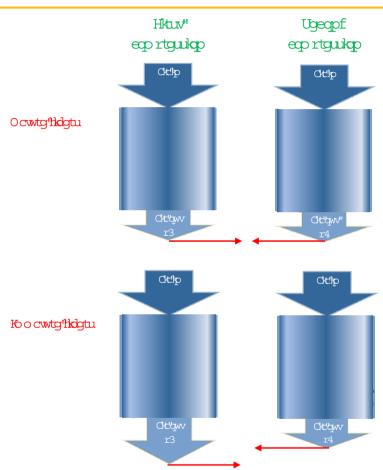
Stickiness measurement & advantages





Measuring principle

- Micronaire by air permeability of 3.5 g cotton sample
- Maturity by double compression simultaneous test
- Fineness in millitex calculation
- Auto-sampling of 3.5g blended cotton
- · Auto-checking of sample weight at the end
- High speed measuring system of fiber immaturity enables to check if cotton bales have potential for white specks



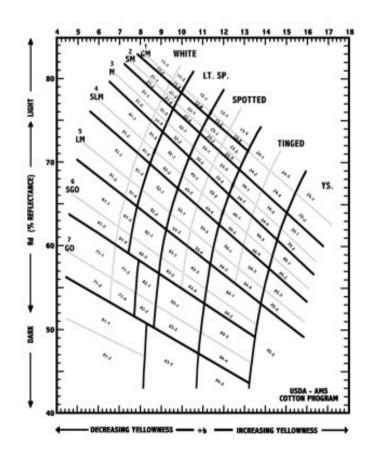
Micronaire and Maturity by double-compression





Color & Trash parameters

- 30 g Cotton sample are automatically fed to the instrument by a cassette
- The color of the cotton +Rd (reflectance) and +b (yellowness) is measured by spectrophotometer
- Color Grade is calculated based on Nickerson-Hunter cotton colorimeter diagram for Upland cotton
- The trash count and Trash Area % is measured by a digital camera and the Leaf Code is derived according to USDA classification
- The color & trash sensor is calibrated by means of USDA color & trash tiles



Nickerson-Hunter colorimeter diagram





Length, strength & elongation

- Optical measurement of all related length parameters like UHML, Uniformity and Short Fiber Index from the fibrogram
- Measurement of the strength and elongation of the cotton fibers
- Automatic sample preparation
- One sample to measure all parameters
- Calibration with standard cotton from USDA
- Sample throughput of FIBERMAP is 36 samples per hour / 290 samples per 8-hour shift to fulfill the requirements of a spinning mill





Length, strength and elongation to complete the fiber profile





Key benefits

- Complete fiber profile in one instrument in the shortest measuring time
- Detailed information about processing relevant parameters
- Integrated, fast and reliable stickiness measurement
- Additional parameters known from cotton classification
- Automated testing, easy sample preparation for reproducible results
- One instrument for highest efficiency
- Technological advantage by connecting fiber characteristics to yarn quality
- Data integration in the management cockpit

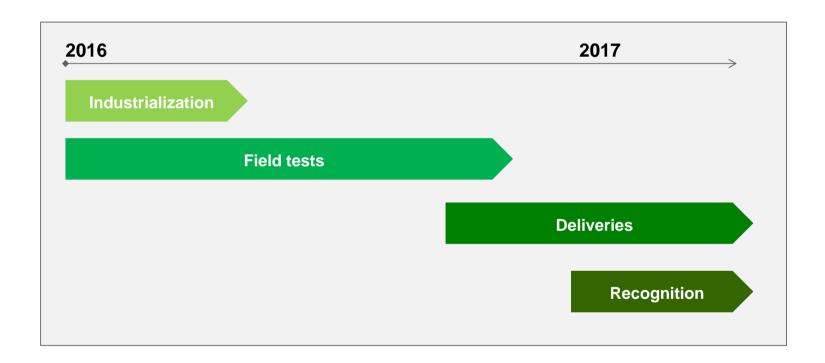


Key benefit: integration for a complete fiber profile





Time line



Timeline

MAG Solvics Private Limited



Welcome



Presentation to ITMF Cotton Testing Committee

15th March, 2016



MAG beyond quality

Agenda

- Introduction
- > Trash measurement in High Volume Fibre Tester

Introduction



- MAG Solvics Pvt. Ltd. is from Coimbatore, India
- ISO 9001 : 2008 certified company
- ➤ In the textile testing field since 1991 (25 years)
- Manufacturer of testing equipment for entire textile chain (Ginning Garments)
- > 136 Products
- CE compliance products

Few Products In Our Range



Fully Automatic High Volume Fibre Tester

Moisture Meter

Portable Micronaire Tester







Yarn Evenness Tester

Fully Automatic SYS Tester

Fabric Multi Property Tester









Trash Measurement



Importance of Trash

Trash in cotton has the impact right from Ginning till yarn and fabric production

- Decides the ginners' quantum of output and value
- Commercial decision in cotton procurement
- Yarn realization



Importance of Trash

- Optimization of machine / process parameters in spinning preparatory
- Quality of products and its working performance



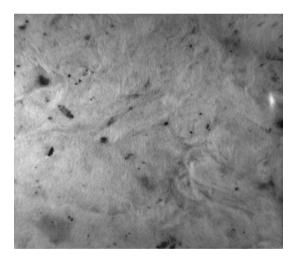
Available Methods

- Optical Method Surface Trash
- Gravimetric Method Real Trash by actual extraction



How Good Is The Surface Trash Measurement?

Scans only the surface of cotton for the presence of trash



Quick and easy way to get an overall idea



How Good Is The Surface Trash Measurement?

- Output: Trash count, Trash area and Trash Grade
- Indicative parameters
- Hidden trash not accounted
- Decision making in terms of commercial and machine or process settings not possible

Due to its limitations, industries do not prefer the surface trash measurement

The Right Way



- Real Trash content by actual extraction
- Output: Trash % by weight







- Useful for
 - Fixing price during cotton procurement

The Right Way



- Setting up machine / process parameters in spinning preparatory
- Assessment of yarn realization
- Quality of products (Yarn & Grey fabrics)
- Working performance in spinning & fabric forming

Due to its significant impact, industries prefer the gravimetric trash measurement



Constraints In Present Gravimetric Trash Measurement

430 conventional instruments working worldwide; has experience in Gravimetric Trash measurement

- Manual dependency right from sample measurement till calculation
- Needs multiple passes always to get accurate results
- Time taken per test is high

The Need



- Automatic trash separator with minimum manual intervention
- Optimum sample size and testing speed
- Long term data storage
- Data analysis
- Integrated with High Volume Fibre Tester

Solutions From MAG



- Automatic & accurate trash measurement through Gravimetric method
- Trash is separated through buoyancy separation technique by use of air current
- Wider sample feed area for single feed with optimum sample size of 50 grams
- > Faster testing; single pass most of the time

Solutions From MAG



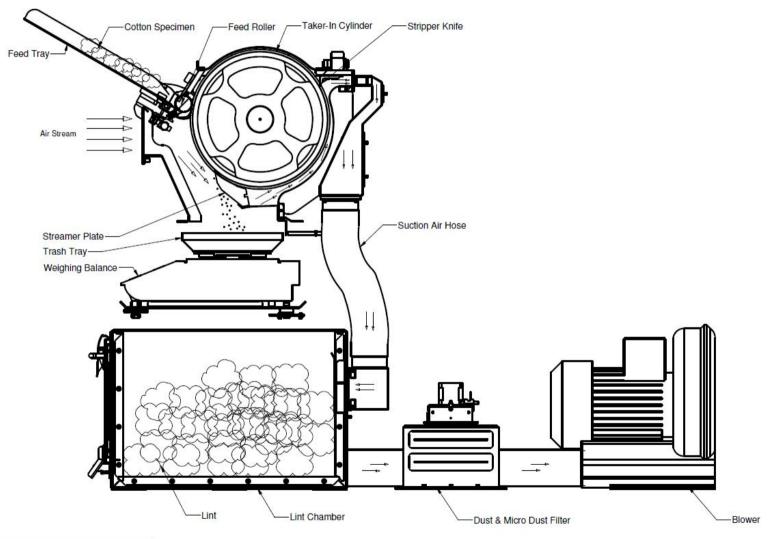
- Measures trash content of raw cotton, in-process and wastes
- Made available as part of High Volume Fibre Tester



Automatic Trash Analyzer from MAG

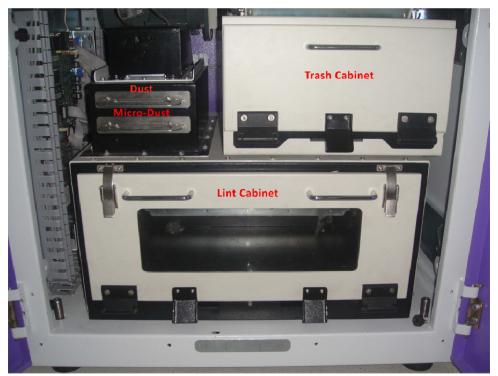








4 point collection zone(Lint, Trash, Dust and Micro-Dust)





Dust & Micro-dust cartridge



- Variable speed system for better opening and testing of different type of cotton materials
- Air current is automatically adjusted for better trash separation on continuous basis
- AccuTrash has got wide acceptance in the market and our 70% of HVT supplied with AccuTrash only
- Also available as stand alone product

AccuTrash Report



Customer Address,				AccuT i Version		\ G [™] quality
ID Cotton Type	rash (%)	Report	Operator	: Administrator	sture :27°C	:
Deparash Du	st Micro	dust 1	• Machine No.	:-		
2.44 0.	08	0.05	2.57	Trash (%)		IV
2.46 0.	09	0.07	2.62 ash	Dust Micro dus	t Total	Loss (%)
2.77 0.	09	0.07	2.93	0.08 0.05 0.09 0.07		0.90
2.58 0.	10	0.07	2.75 8	0.09 0.07 0.10 0.07		0.79
2.56 0.	09	0.07	2.72 86 86 44	0.09 0.07 11.11 14.29 0.08 0.05	5.68 2.57	0.73 14.29 0.64
5.86 11.	11 1	4.29	5.88 0.15	0.10 0.07 0.01 0.01		0.90 0.13
2.44 0.	08	0.05	2.57			
2.77 0.	10	0.07	2			
5 0.	01	0.01				



MAG High Volume Fiber Tester with

AccuTrash





HVT Genius 2030

HVT Expert 1401

Next



- Though MAG already started supplying in the market, there are various trials being conducted to optimize the need...
- Look forward to work with international bodies like ITMF to get recognition for this product

Also from MAG





Innovative Portable Micronaire Tester

DigiMic XT



Measures Micronaire of cotton



- The value is in line with High Volume Fibre Tester
- 5 6 hours of continuous testing with one charge through built-in rechargeable battery
- No need of external air source due to built-in compressor mechanism

DigiMic XT





- Weight is 12 kg; easily portable
- Handy digital weighing scale
- Last 1000 readings storage capacity
- Analysis by transferring data through software

Thank you...

MAG Solvics Private Limited

Textile Testing Solutions

www.magsolvics.com

A COMPARISON OF HVI, AFIS AND CCS COTTON TESTING METHODS

Mohamed A. Negm1, Suzan H. Sanad1, and G. Kugler2

¹Cotton Research Institute. Agric. Res. Center, Giza, Egypt.

²Textechno Herbert Stein- Monchengladbach-Germany

INTRODUCTION

 Improvements in fiber quality have long been a primary objective of cotton breeders. One major obstacle for early breeders was the lack of reliable methods to measure fiber characteristics. Those methods have become available with the advent of HVI in the late 1960s and AFIS in the 1980s.

- HVI uses automated sampling techniques and measures fiber properties from a bundle of fibers. This system remains popular today for both marketing and breeding, because it is efficient in terms of time and cost.
- One of the primary objectives in the early design of AFIS instrument is useful for quality control and production efficiency in mills, as well as for providing information needed to improve product quality.

- The Textechno CCS Cotton Classifying System is an alternative system overcoming the abovementioned drawbacks. It considers cotton testing from a different point of view, taking the spinning method into account in order to assess the spinnability of fibers within the spinning process.
- The CCS a new generation of cotton testing instruments - is designed as a so-called MVI (Medium Volume Instrument), realizing a capacity of 20 tests per hour.

OBJECTIVE

• In this paper, HVI, AFIS and Cotton Classification System (CCS-Textechno) cotton testing methods were evaluated and compared, with the emphasis on the measurement of fiber length, fiber strength.

MATERIALS AND METHODS

- Eight cotton varieties, based on a wide range of fiber length, strength and micronaire (finance) were used for this study.
- To test the repeatability of fiber properties a representative sample of approximately 50 kg (one Cantar) was taken from commercial Egyptian cotton varieties and two Upland cottons. Each sample was homogenized and tests were carried out under standard atmospheric condition of 65% ±2% and 22°C ±1°C temperature.

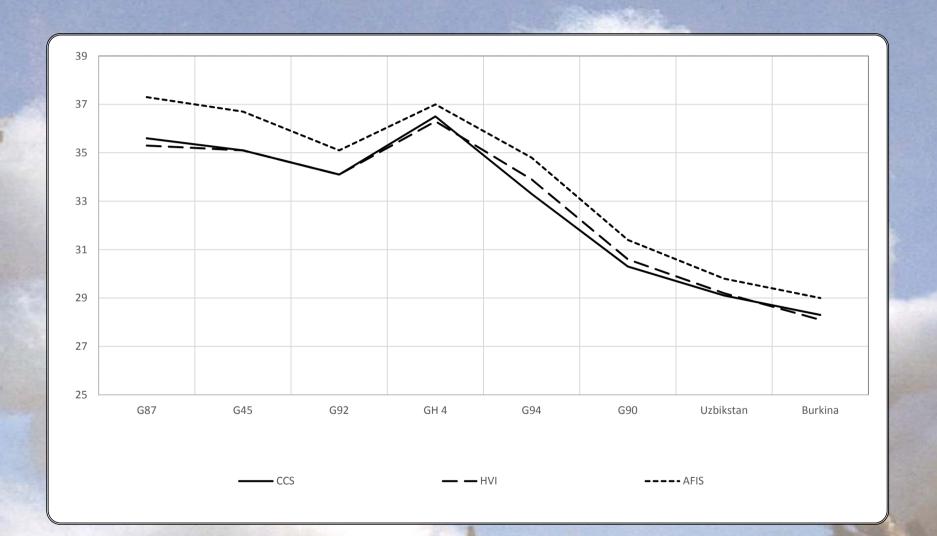
 The cotton samples were tested on High Volume Instruments (HVI and Advanced fiber information System AFIS in El-Baraka Co. for spinning), with 10 replications for length, uniformity, tenacity, and elongation measurements and 4 replications for micronaire measurements. While, the tested samples on Cotton Classification System (CCS-Textechno) were carried out on Turkey.....

RESULTS AND DISCUSSION

UHM Length

• The readings derived from the AFIS testing method are slightly larger than those derived from HVI and CCS. As shown in Figure 1, the shape of the three curves is approximately the same. It could be observed that the values of the cotton fiber length derived from the CCS testing method are strongly correlated with those derived from both HVI and AFIS measurements with the correlation coefficients of 0.99 and 0.98 respectively.

UHM Length



Fiber strength

 The value of strength and its correlation were presented in table 2 and Fig. (2). Fiber strength parameters obtained from HVI and CCS show positive and highly correlation R=0.996102

Fiber strength

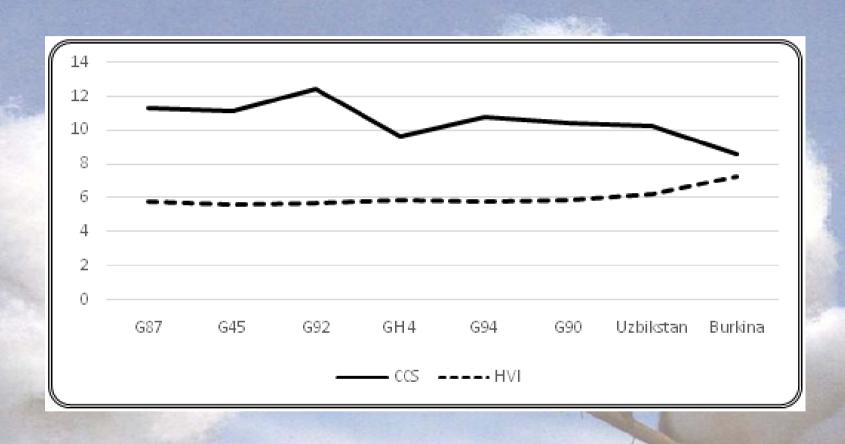
Cotton Variety	CCS	HVI
Giza 87	42.08	42.8
Giza 45	43.81	43.4
Giza 92	45.61	46
Giza H 4	44.45	44.7
Giza 94	39.91	40.8
Giza 90	35.06	35.3
Uzbekistan "Upland"	30.87	30.4
Burkina Faso "Upland"	28.45	28.65

Fiber Elongation

Cotton Variety	CCS	HVI
Giza 87	11.27	5.8
Giza 45	11.16	5.6
Giza 92	12.45	5.7
Giza H 4	9.63	5.9
Giza 94	10.77	5.8
Giza 90	10.42	5.9
Uzbekistan "Upland"	10.28	6.2
Burkina Faso "Upland"	8.59	7.3

Fiber Elongation

- Comparisons of the HVI fiber elongation measurements with CCS showed high variation levels of elongation in comparison of HVI. May and Taylor (1998), reported negative correlations between fiber elongation and fiber tenacity.
- This results was harmony between fiber strength and fiber elongation measured by HVI "R= -0.79838" ". While there is positive correlation between fiber elongation and fiber strength measured by CCS "R= 0.685861"



Color attribute

- The range of Reflectance (RD) values from the CCS shifted in the direction of higher values in comparison to the range of the HVI. The results indicated a weak correlation "
- R= 0.64251" between the two Reflectance (RD) testing method.

 whereas the range of yellowness (+b) from the CCS shifted in the direction of similar values in comparison to the range of yellowness (+b) from the HVI. A correlation analysis showed strong correlation "R= 0.94229" between the values of the degree of reflectance (Rd) between the two yellowness (+b) testing method.



An update on improvements to the elongation measurement

Dr. Roger Riley (presented by David McAlister), March 7, 2016

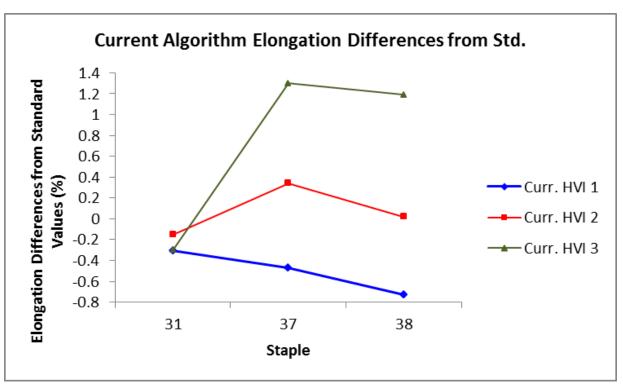


HVI Elongation Improved HVI 1000 elongation

- Uster has developed a new elongation algorithm which results in improved results within instruments and between instruments.
- The new elongation algorithm has been tested on three HVI's in Uster in Knoxville and as well between Uster Technology Center HVI's in Knoxville, USA; Uster, Switzerland, and Suzhou, China.



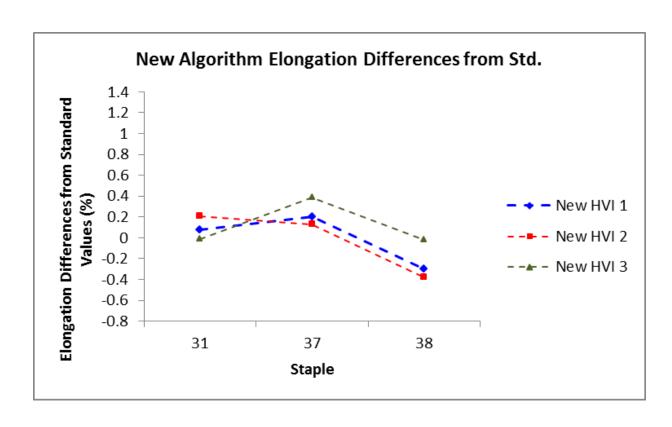
Comparison of elongation difference from standard values for three different cottons on three HVI 1000 – Current Algorithm



- Differences
 between
 instruments for the
 three cottons are
 highly variable
- Differences are calculated from the standard elongation value for each cotton



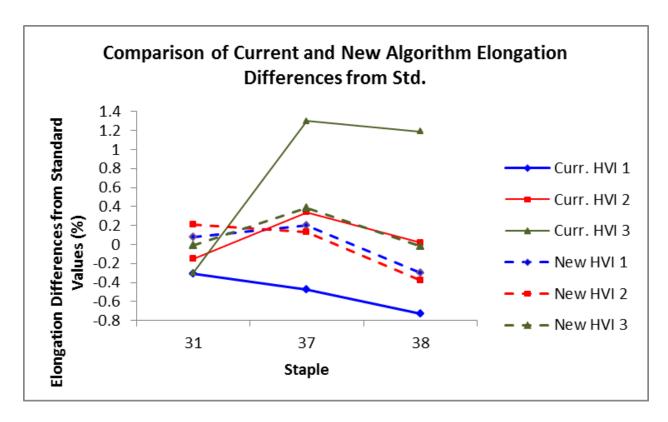
Comparison of elongation difference from standard values for three different cottons on three HVI 1000 – New Algorithm



- Differences
 between
 instruments for the
 three cottons are
 more consistent
 and show better
 agreement
- Differences are calculated from the standard elongation value for each cotton



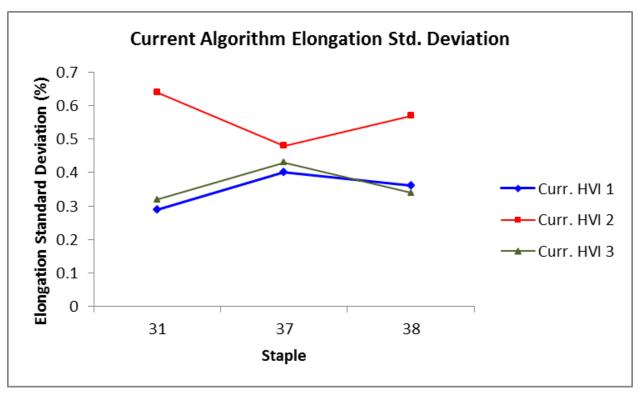
Comparison of elongation difference from standard values for three different cottons on three HVI 1000 - Current vs. New Algorithm



 Clearly the new algorithm produces better agreement between machine and as well with the standard values of each cotton.



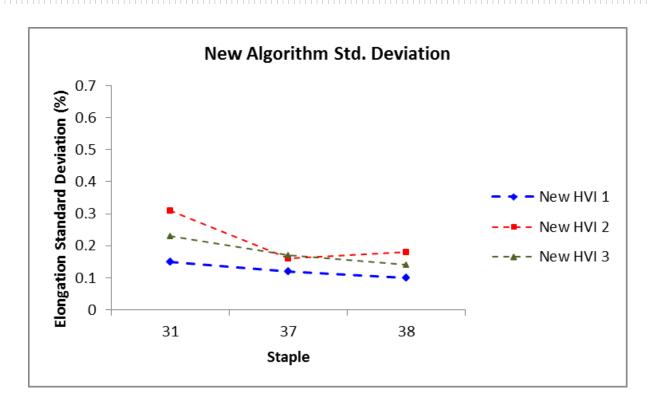
Comparison of elongation standard deviations for different staples on three different HVI 1000 – Current Algorithm



 Standard deviations are high between machines and within machines



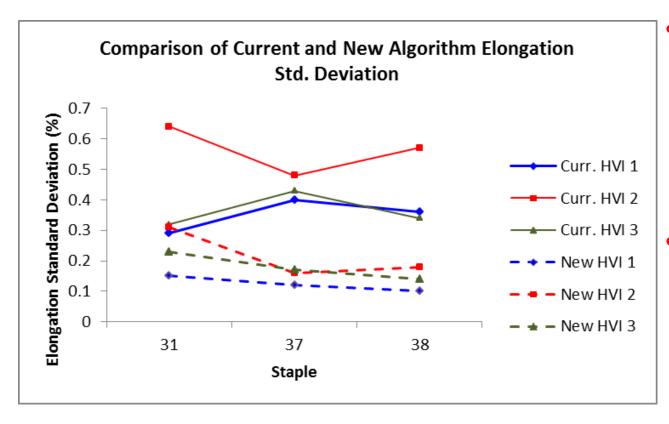
Comparison of elongation standard deviations for different staples on three different HVI 1000 - New Algorithm



 Standard deviations are lower between machines and within machines



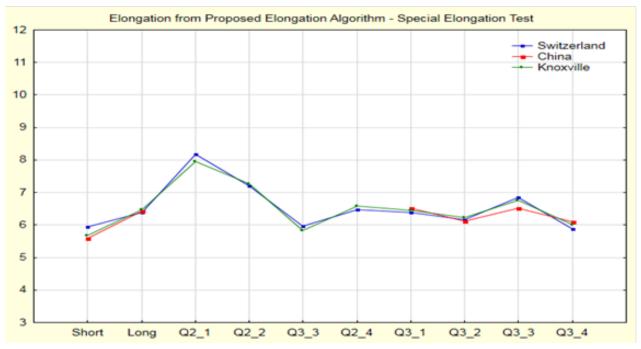
Comparison of elongation standard deviations for different staples on three different HVI 1000 – Current vs. New Algorithm



- Standard deviations are reduce by approximately half with the new elongation algorithm
- Lower standard deviations allows for better reproducibility and repeatability of elongation values



Comparison of elongation values for CSITC cotton on three different HVI's in 3 different Uster laboratories in US, CH, and CN - New Algo.



- Standard Short/Weak, Long/Strong calibration cottons and CSITC cottons used to compare different HVI's in three different laboratories.
- New algorithm, shows excellent agreement between instruments/labs for all cottons.



Conclusions/Next Steps

Conclusions

- The proposed elongation algorithm produces a much better agreement between the HVI's.
 - Better Reproducibility and Repeatability
- Standard deviations for the proposed elongation algorithm are ~ ½ of those for the current algorithm.

Next Steps

- Inclusion of the new elongation into the HVI 1000 software
- New elongation will be designated as suggested:
 - Elg 1 = Current elongation
 - Elg 2 = New elongation



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'Calibration' of HVI elongation

Shouren Yang and Stuart Gordon ICCTM, Bremen, March 2016

CSIRO MANUFACTURING

www.csiro.au





Outline

- Calibrating HVI; why?
- Test HVI elongation
- Results
- Conclusions



Calibrating HVI; why?

- Properties; MIC, LEN and STR, relatively well controlled
- Breeding (cultivar selection)
- Fine count yarn production (improved work-to-break)
- Understand factors affecting HVI elongation measurement
- Need calibrated tools



Test HVI

CSITC-type trial

- 3 days x 2 HVI x 20 samples x 6 replicates = 720 test
 - Using HVI1000 lines in reputable classing lab; i.e. regularly has good scores in CSITC round trials
- Trial 1 Dec 2015; calibrated with USDA SW and LS; instrument ELO offset not accorded with fibre value.
- Trial 2 Jan 2016

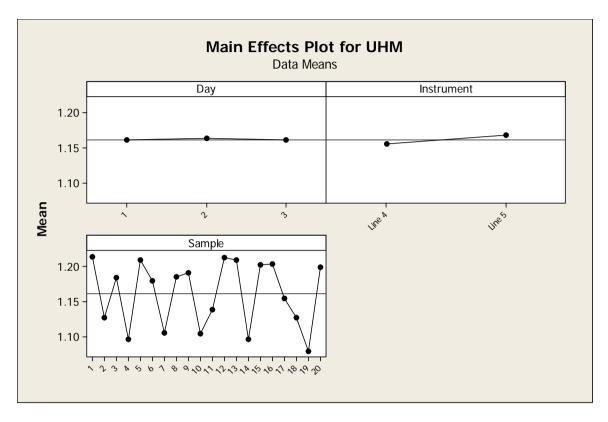


Analysis

- Data tested using nested ANOVA
 - Day, instrument, sample, test replicates
 - $3 \times 2 \times 20 \times 6 = 720$ tests, main effects tested at $\alpha = 0.0$
- Expected hypothesis:
 - No interactions between day, line and sample
 - Variation to be based on sample only



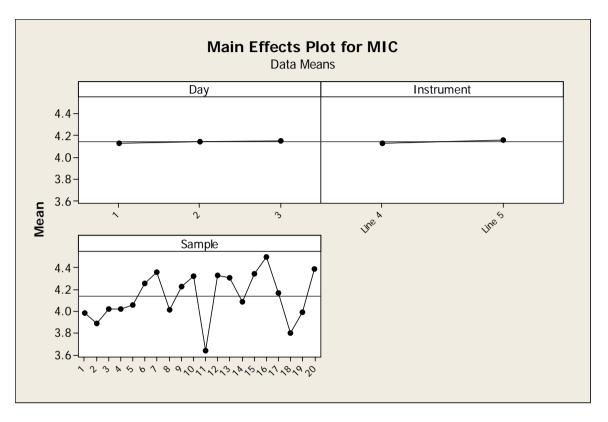
Results – Trial 1 LEN



Source	Var Comp.	Total	StDev	
Day	-0.000*	0.00	0.000	EXCELLENT
Instrument	-0.000*	0.00	0.000	EXCELLENT
Sample	0.002	90.53	0.047	EXCELLENT
Test	0.000	9.47	0.015	GOOD
Total	0.002		0.049	



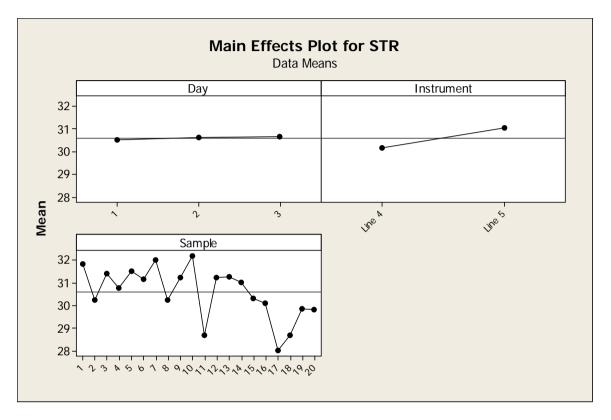
Results – Trial 1 MIC



Source	Var Comp.	Total	StDev	
Day	-0.000*	0.00	0.000	EXCELLENT
Instrument	-0.002*	0.00	0.000	EXCELLENT
Sample	0.049	90.38	0.222	EXCELLENT
Test	0.005	9.62	0.072	GOOD
Total	0.054		0.233	



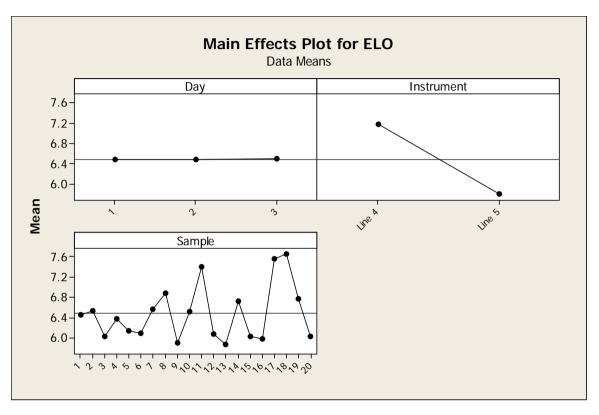
Results – Trial 1 STR



Source	Var Comp.	Total	StDev	
Day	-0.195*	0.00	0.000	EXCELLENT
Instrument	0.324	13.13	0.570	OK
Sample	1.480	59.87	1.216	OK
Test	0.667	27.00	0.817	POOR
Total	2.471		1.572	



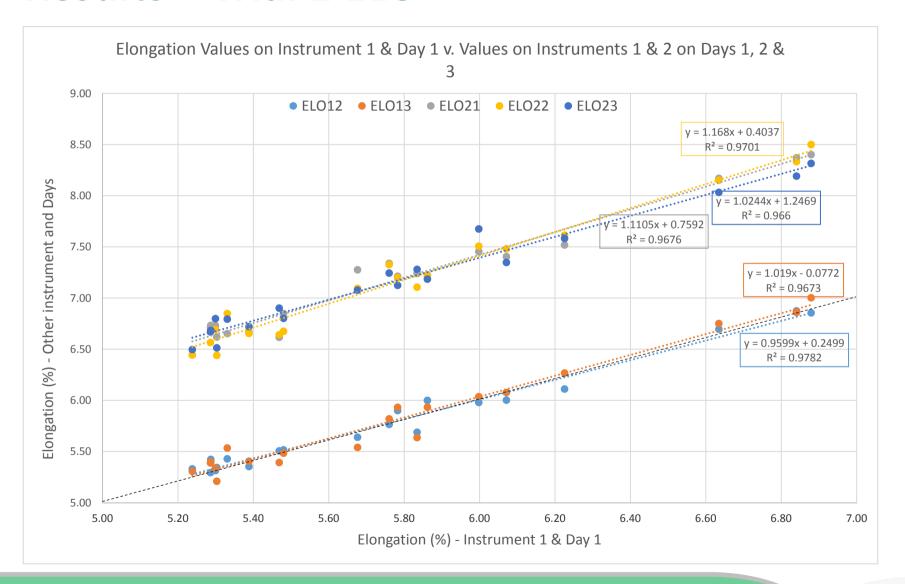
Results – Trial 1 ELO



Source	Var Comp.	Total	StDev	
Day	-0.470*	0.00	0.000	EXCELLENT
Instrument	0.924	73.33	0.961	POOR
Sample	0.304	24.11	0.551	POOR
Test	0.032	2.56	0.179	EXCELLENT
Total	1.260		1.122	

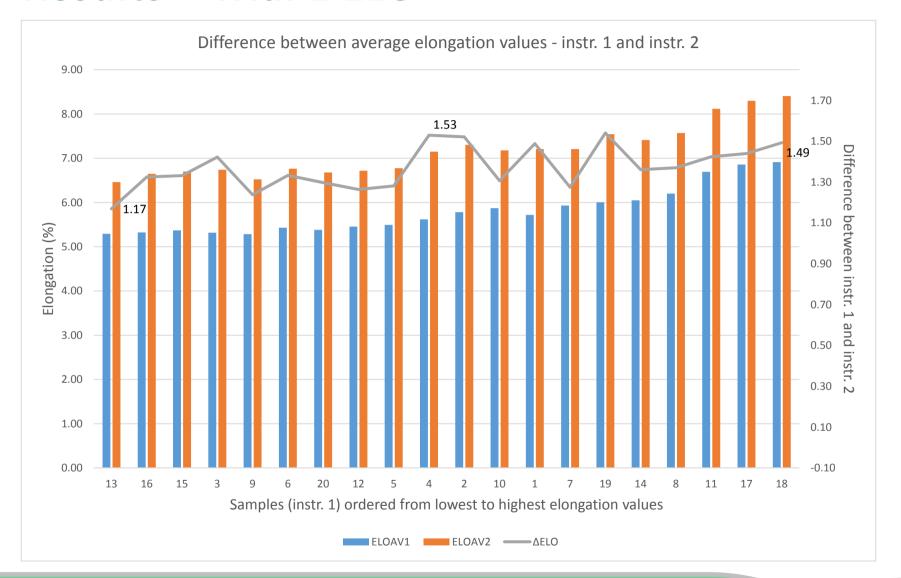


Results – Trial 1 ELO





Results – Trial 1 ELO





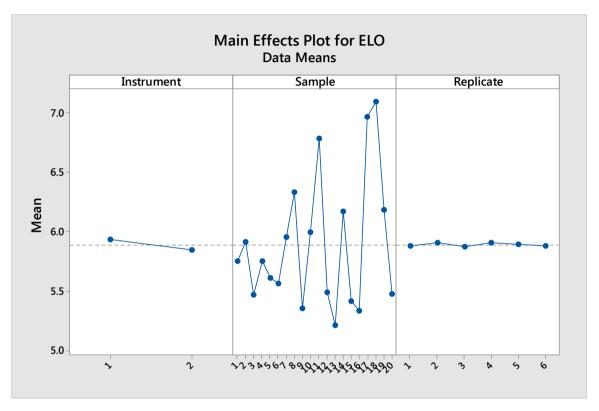
Test

CSITC-type trial

- 3 days x 2 HVI x 20 samples x 6 replicates = 720 test
 Using two HVI1000 lines in reputable classing lab; i.e. good scores in CSITC round trials
- Trial 1 Dec 2015; calibrated with USDA SW and LS; instrument ELO offset not accorded with fibre value.
- Trial 2 Jan 2016 repeat of Dec 2015; calibrated with USDA SW and LS + ELO offset set according to USDA SW 32 (ELO = 5.3 ± 0.1) and LS 38 (ELO = 6.0 ± 0.2) values (n = 12).



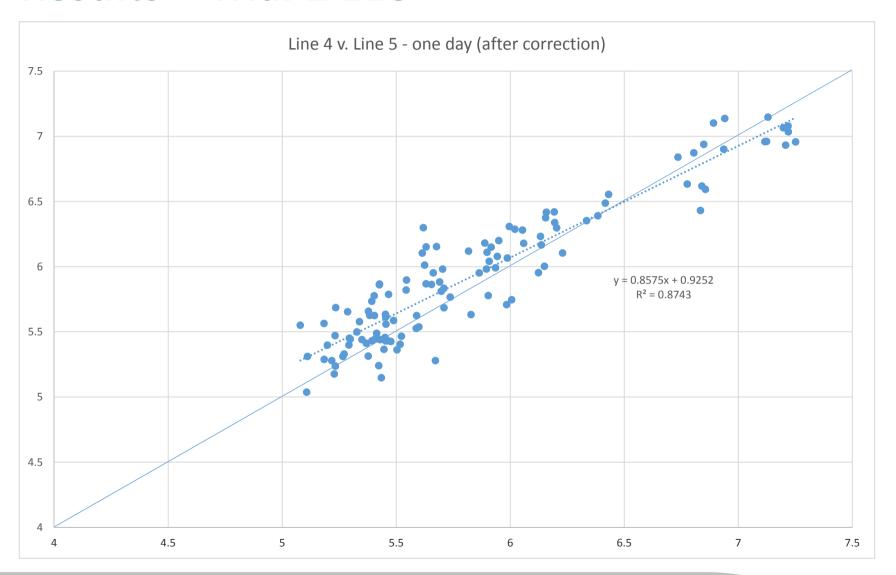
Results – Trial 2 ELO



Source	Var Comp.	Total	StDev	
Instrument	-0.011*	0.00	0.000	Excellent
Sample	0.308	87.67	0.555	Excellent
Test	-0.027*	0.00	0.000	Excellent
Error	0.043	12.33	0.208	Days?
Total	0.351		0.593	



Results – Trial 2 ELO





Conclusions

- HVI elongation can be adjusted (calibrated) to accord inter-instrument (and laboratory) values
- Relatively stable value; some sample/day variation

Further work:

- Elongation measurements be included in CSITC rounds
- Further evaluation of calibrated values and interactions with other properties, test bundle formation and laboratory conditions required.
- Elongation is specific to material; therefore fineness and maturity come into play.



Thank you

CSIRO Manufacturing

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Nicole Phair (CSIRO)





Specific cotton fibre elongation

Drs Shouren Yang & Stuart Gordon, CSIRO

15 March 2016 Bremen

Objectives

- To confirm findings from a previous study:
 - Good correlations between Favimat SFE and Tensor BE.
 - Specific elongation cotton fibre elongation is fibre linear density.
- To investigate the relationship between cotton fibre elongation and fibre tenacity.

Materilas and methods

- Twenty five international control s:
 - 22 upland cottons
 - 3 Pima cottons
- Favimat single fibre tester
 - 300 fibres per sample
 - Gauge length: 13 mm
 - Test speed: 13 mm/min
- Tensor bundle tester
 - 10 tests per sample
 - Gauge length: 5 mm
 - Test speed: 20 mm/min

Need to know whethertensile values normalised on individual or average basis Gordon, Stuart (CMSE, Geelong WP); 21.02.2014 gor154 1

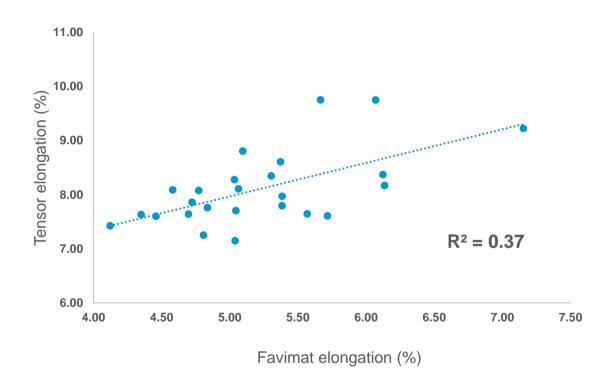
SIROLAN-TENSOR



Results and discussions (1)

- Reasonably good correlation between Tensor BE and Favimat SFE.
- Specific fibre elongation:
 - The ratio of the fibre or bundle elongation-tobreak value to its linear density.
 - Assumption: elongation values are linear density dependent.

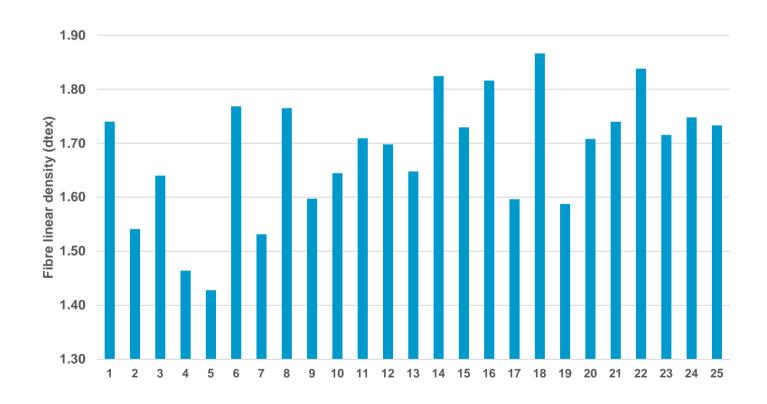
Tensor BE vs. Favimat SFE



gor154 2

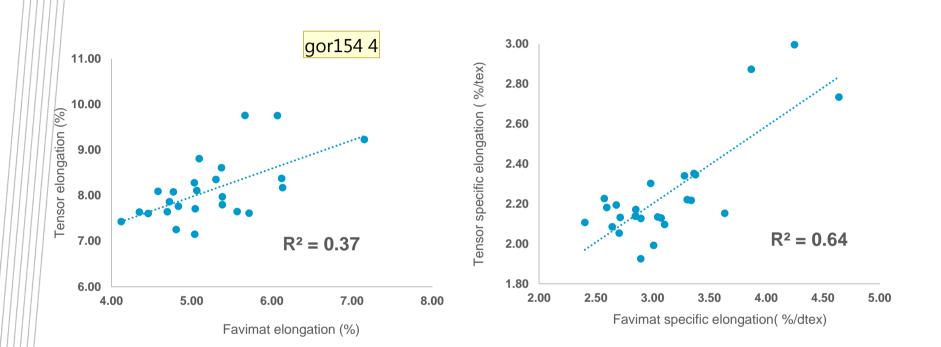
 Reasonably good correlation between Favimat SFE and Tensor BE. While it is not necessary to have a statement written on this slide you will need an explanation as to why Tensor elongation values are larger Gordon, Stuart (CMSE, Geelong WP); 21.02.2014

Variations in fibre linear density



gor154 3 Can you also normalise for maturity; we know that as crystallite dimensions increase with maturity. There is a thought that as maturity increases elongation decreases. Normalising with a ratio is better mathematically too. Gordon, Stuart (CMSE, Geelong WP); 21.02.2014

Tensor BE vs. Favimat SFE



 Correlations between Tensor BE and Favimat SFE significantly improved with Specific Elongation.

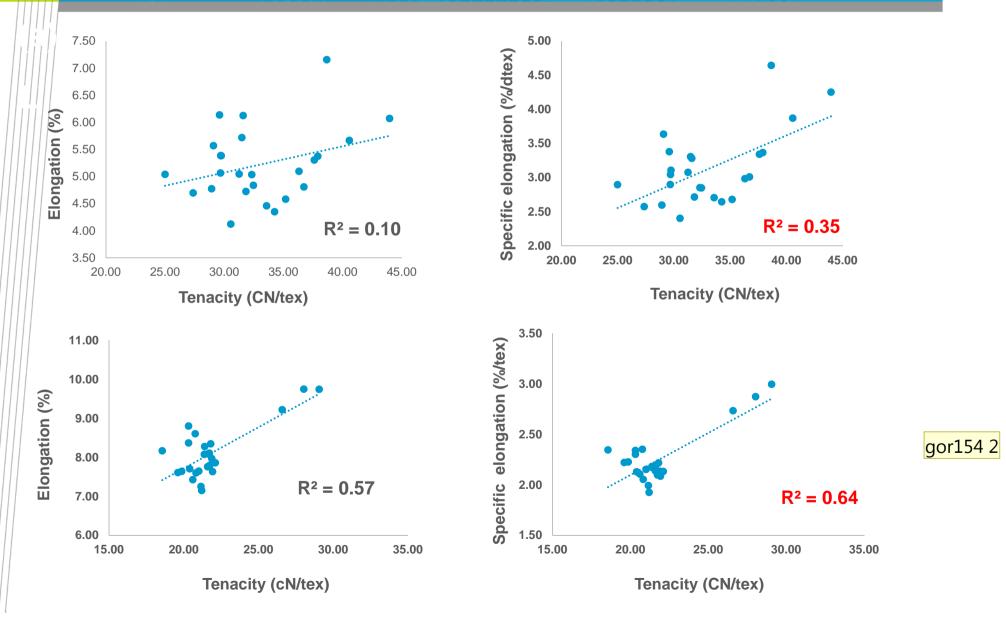
gor154 4

Normalise with maturity? Gordon, Stuart (CMSE, Geelong WP); 21.02.2014

Results and discussions (2)

 Relationships between fibre elongation and tenacity (single fibre or bundle)

Correlations between elongation and tenacity Favimat (top), Tensor (bottom)



While it is not necessary to have a statement written on this slide you will need an explanation as to why Tensor elongation values are larger Gordon, Stuart (CMSE, Geelong WP); 21.02.2014

Conclusions

- Good correlation between Tensor BE and Favimat SFE, which is greatly improved with specific elongation.
- Specific elongation is a logical and useful concept.
- Positive correlations between fibre elongation and tenacity from Favimat and Tensor.

Acknowledgement

- This work is financially supported by CRDC and CSIRO.
- The excellent technical work of Ms. Nicole Phair-Sorensen is gratefully acknowledged.

CSIRO Materials Science Engineering

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THANKYOU!

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Stickiness measurement by Loepfe FIBERMAP and Mesdan CONTEST

ITMF – ICCTM meeting , March 15th 2016 Daniela Messa, CEO Mesdan S.p.A Sandra Meier, Product Manager, Loepfe AG





ICCTM meeting held on 18th of March 2014

Plan of future actions on Stickiness topic:

- ✓ Continue research for a reliable measuring device
- ✓ Reconsider recognition of old instrument (following to presentation of the results of RT conducted by J.P.Gourlot)

ICCTM meeting 2014: guidelines for future actions







Stickiness measurement

Some measuring devices for stickiness evaluation



Introduction of ICCTM 2014 stickiness session





Measurement of stickiness

- Following the request of ITMF for a reliable instrument for stickiness
- Based on the 20 years information accumulated by FCT/FIBERLAB end users
 - Savio Group decided to purchase Lintronics' technology and with the support of Dr.Uzi Mor to integrate the measurement of stickiness in their new instruments

FIBERMAP & CONTEST

Savio Group reply to ICCTM invitation to work on stickiness







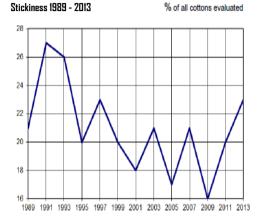
Loepfe FIBERMAP and Mesdan CONTEST





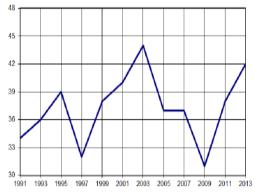
Stickiness is anything in the lint that can adhere to cotton processing equipments and it can be caused by:

- excess/mixture of sugars in the cotton lint:
 - from the plant (physiological sugars)
 - ↑ immature fibres
 - from insect's secretion (entomological sugars)
 - from oil released from crushed seed coat fragment
 - from any other source
 - ✓ Stickiness, SCN, maturity are measured in the same sample





% of all cottons evaluated



ITMF Cotton Contamination Survey, 2013

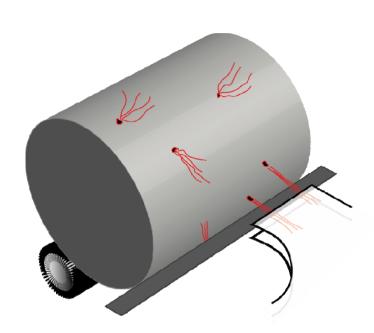
Stickiness SCN maturity combined testing





Measuring principle

- · Thermodetection of sticky deposits in the web
- 3.5 gr/10mt sample pressed through heated drums (38°)
- All the sticky particles adhere to the drums
- Sticky deposit on the drum surface are optically examined by means of a laser source
- Sticky points are measured and classified by amount and size.
- Two brushes rotating tangent to the drums and a knife automatically clean the drums surface after measurement in order to ensure one detection for each deposit



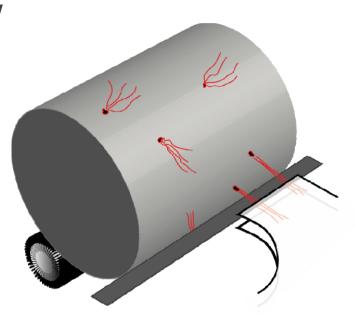
Stickiness measuring principle





The new automatic and electronic control improves reliability and accuracy of the measurement

- Accurate setting and control of surface temperature of drums during the test
- Moveable & settable brushes* enabling the adjustment of friction force
 - \rightarrow rapidity in achieving testing temperature
 - \rightarrow accurate maintenance of temperature
- Improved laser pointing system



Upgrading of the stickiness tester

^{*} Patent pending

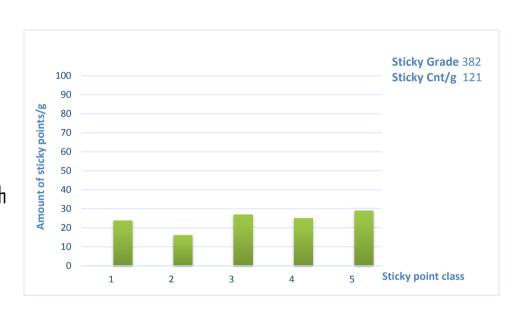




Sticky class: sticky deposits are divided in 5 size classes from 1 to 5 based on the voltage peak.

Sticky Cnt/g: the total count of sticky points for each class and the grand total referred to 1 gram.

Sticky grade: the weighted sum of the sticky deposits counted for each class: more importance is given to larger than small deposits.



Stickiness Results





One of the biggest advantages is the **ability to detect all kind of stickiness** that damages the spinning process by simulating the carding process as a part of a small spinning cycle, **returning actual values of stickiness** that enable the spinner **to decide how to process sticky cotton bales**.

This fact is supported by 20 years of experience of end users ...



FIBERMAP & CONTEST:main advantage for stickiness testing







- Filartex cotton spinning mills since 1958 with a production capacity of 10,000 tons c.a. per year in 2000.
- Quality minded company with a centralized lab to test cotton fibers quality and to optimize process.
- Nevertheless, in the mid-80s a high quality cotton clogged spinning machinery for a problem of stickiness!
- Filartex tried all possible tests for cotton stickiness available at that time.
- In 1995 FILARTEX purchased FCT to measure any contamination that could somehow create a stickiness problem in the spinning process.

Filartex experience



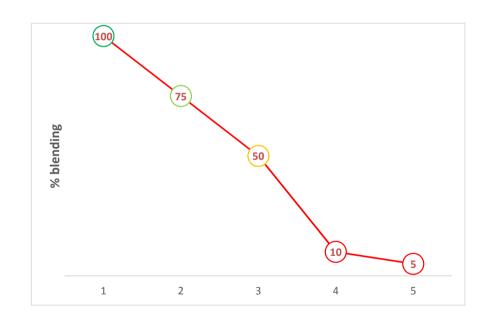




Since then, stickiness test is the main test among the many that can be produced: because a Sticky cotton absolutely cannot be processed if not in a well-defined variable quantity according to the degree of stickiness.

Filartex defined 5 STICKY GRADE CATEGORIES:

- C1 < 30 (not sticky cotton : free blending)
- C2 = 31 to 60 (low sticky cotton: about 75% blending)
- C3 = 61 to 90 (moderate sticky: about 50% blending)
- C4 = 91 to 120 (sticky cotton: about 10% blending)
- C5 > 120 (very sticky cotton : 5% or less blending)



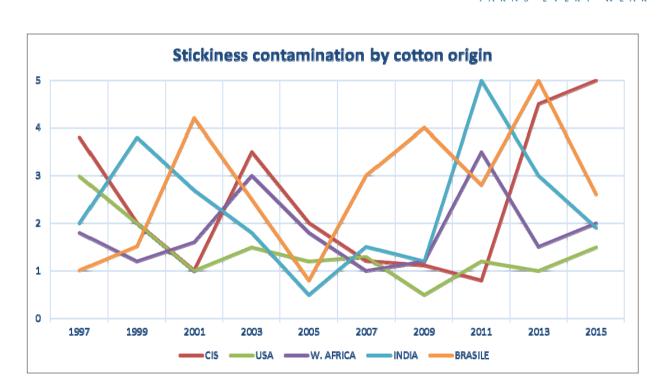
Filartex experience







Based on the classification of 67000 tested sample, Filartex can build the stickiness contamination profile for all the different cotton origins processed in almost 20 years of production



Filartex Experience



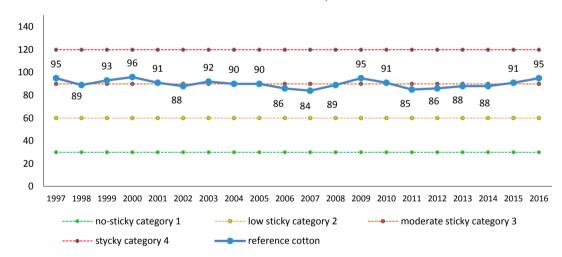




Plotting the average annual value of FILARTEX reference cotton it is possible to appreciate how the stickiness measurement has been repeatable throughout the 20 years period

Average sticky grade for reference cotton

Gt ave=89.8 SD=3.76 CV=4,2%



Experience Filartex









- The Israel Cotton Production & Marketing Board Ltd (ICB) established in 1956 is a private company owned by the cotton producers to help growers in marketing and production leadership
- Israel cotton is 100% machine picked, 100% roller ginned
- ICB class the quality of each bale: 100% HVI testing
 100% stickiness testing
- ICB purchased FCT stickiness testers in 1998
- ICB market cotton lint



CBI experience

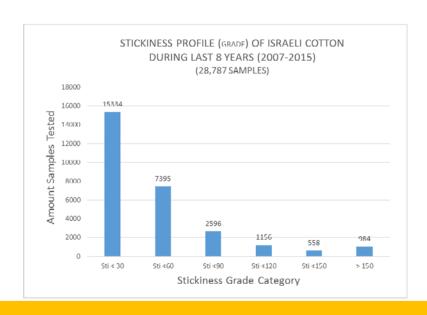


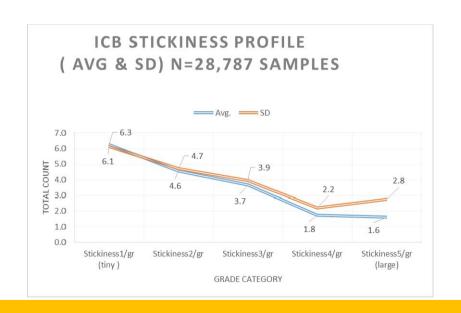






The 28787 samples tested in the period 2007-2015 show that only 9% of the cotton tested was found to be Sticky (grade 90 or higher) and that the size of sticky deposits was mostly tiny (sticky class 1).





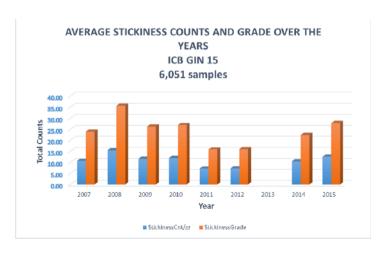
CBI experience

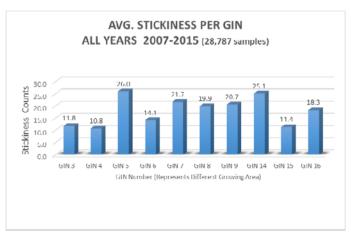


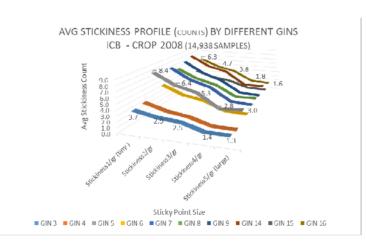




ICB could easily locate sticky bales for each gin and evaluate the average stickiness profile of each gin within the same crop by routine testing.



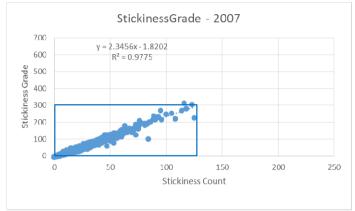


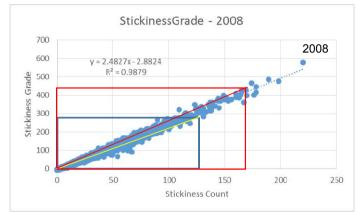


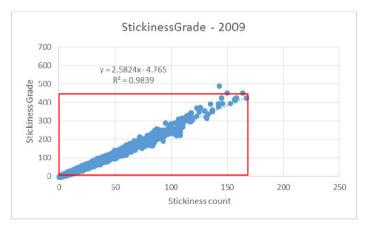
CBI experience











Stickiness Grade Vs. Stickiness Count differing every year from season to season







Conclusion

- FIBERMAP and CONTEST are instruments for mass testing of stickiness
- All sticky points are detected and measured whatever is the source of stickiness
- The measurement made on large samples is rapid, accurate and reliable
- Simultaneous testing of STICKINESS-MATURITY-SCN gives comprehensive information on cotton contamination
- Results enable to set bale management and the spinning process

Conclusion





Acknowledgements

to Cottlab Ltd special thanks to Dr. Uzi Mor (Technology Advisor)

to Filartex S.p.A.
special thanks to Gualtiero Sepati Quality and Production manager
for sharing with us the Filartex knowledge on stickiness measurement

to The Israel Cotton Board Ltd.
special thanks to Menahem Yogev and Matanya Zuntz on providing the ICB results on stickiness measurement





International Textile Manufacturers Federation (ITMF)

International Cotton Committee on Testing Methods (ICCTM)
Stickiness session

International round-test on stickiness measuring methods: new results and proposal for an harmonization step forward

GOURLOT J.-P., LASSUS S. and GAWRYSIAK G. Bremen, March 2016



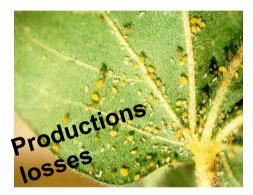
CIRAD UPR115 / Gesc Laboratoire de Technologie et de Caractérisation des fibres naturelles



Stickiness in spinning mill due to entomological sugars

These sugars or honeydew are mainly produced by *Aphis* and *Bemisia, ...* but new insects are coming (mealybug, ..., due to resistance, GMO...)

Aphis gossipii



Honeydew on open boll



Bemisia tabaci



Honeydew in fibers



Problems



=> Need for reliable characterization (method, <u>reference material</u>, predictive of problems in spinning...)

Mandates



Two of the mandates of the ICCTM are:

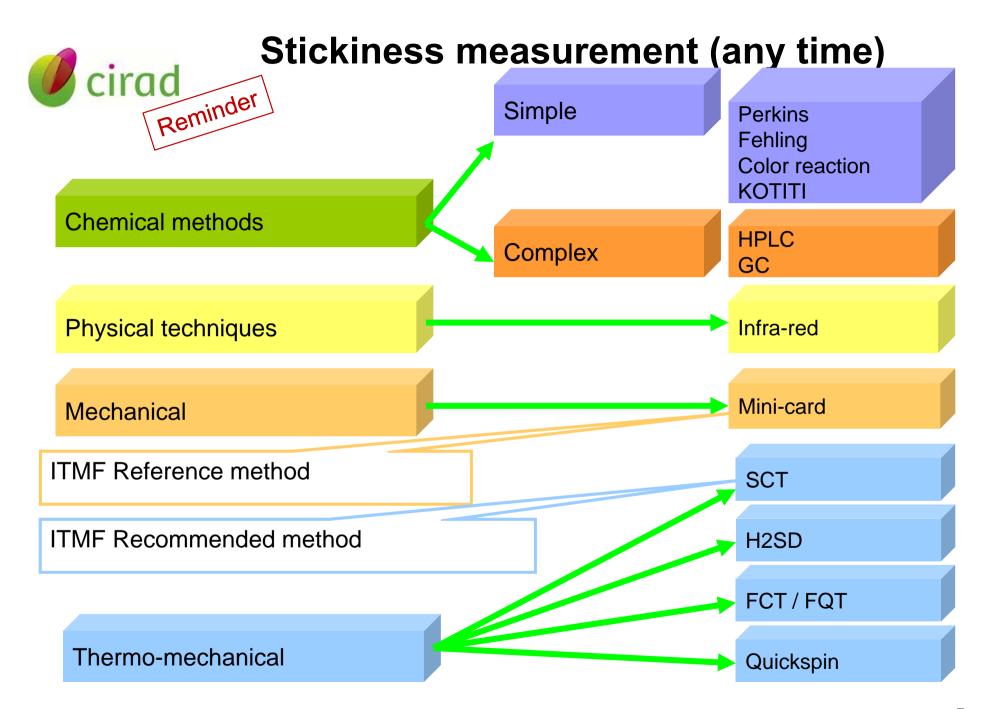
[.../...] "to harmonize cotton testing results by means of:

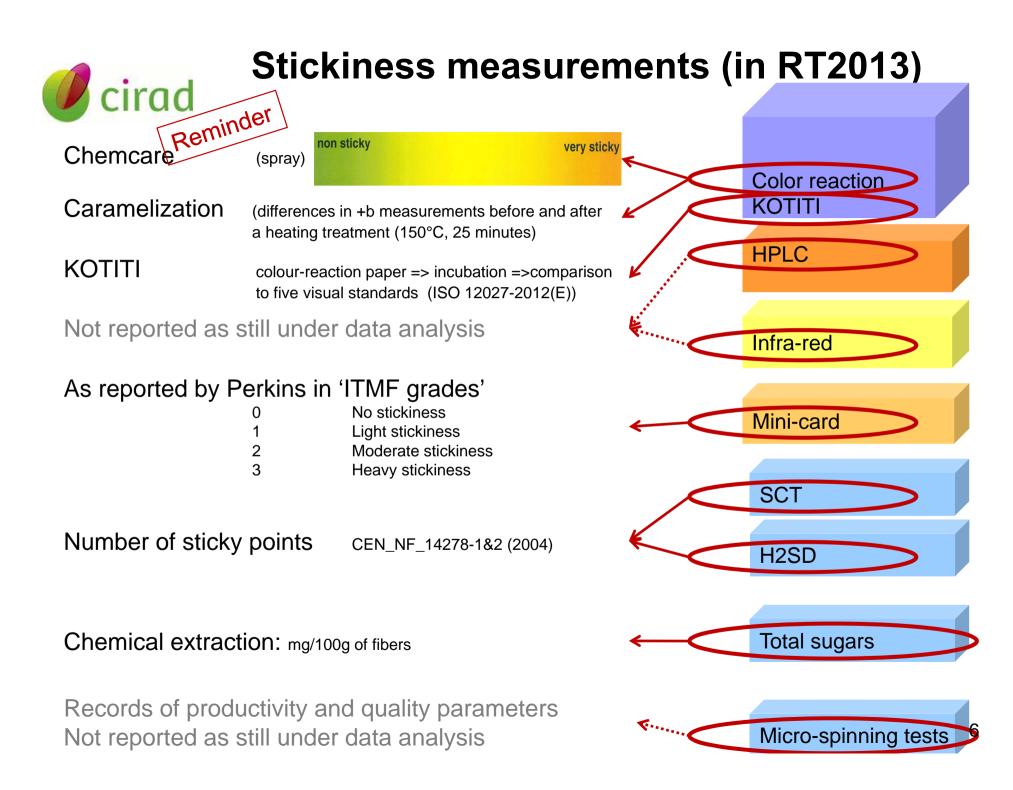
- a. proposition and support for the international standardization of test methods
- b. development of guidelines for testing
- <u>c. technical evaluations using world-wide round tests.</u> and to discuss the problems related to testing of cotton fiber properties and their relations to cotton processing." [.../...]



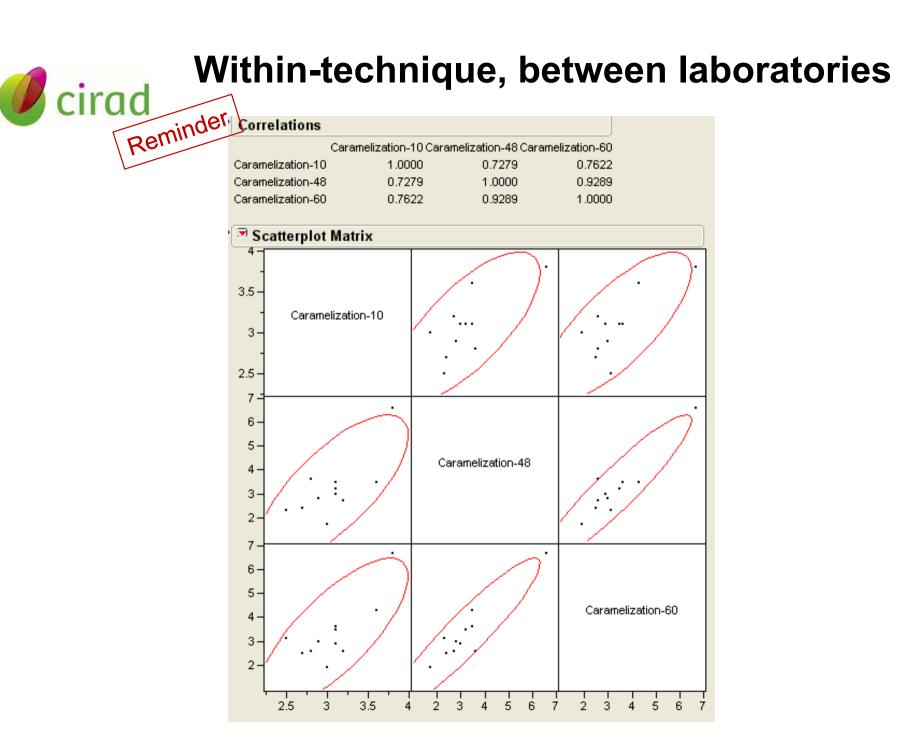
Objectives of the international inter-laboratory round-test

- To check the ability of each measuring technique to reproduce itself within a same single laboratory
- To check the ability of each measuring technique to reproduce itself between several laboratories
- To give some indications about the ability of various measuring techniques to correlate to each others

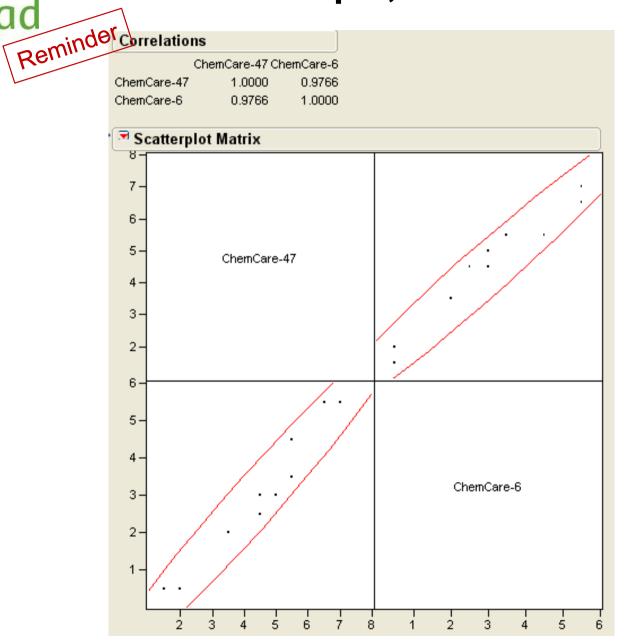




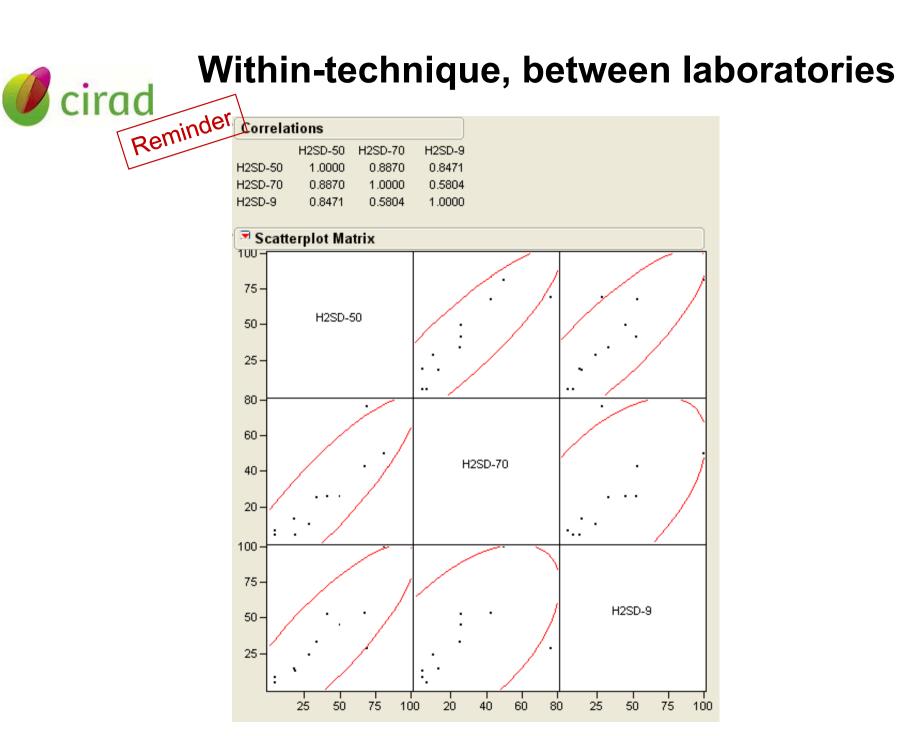




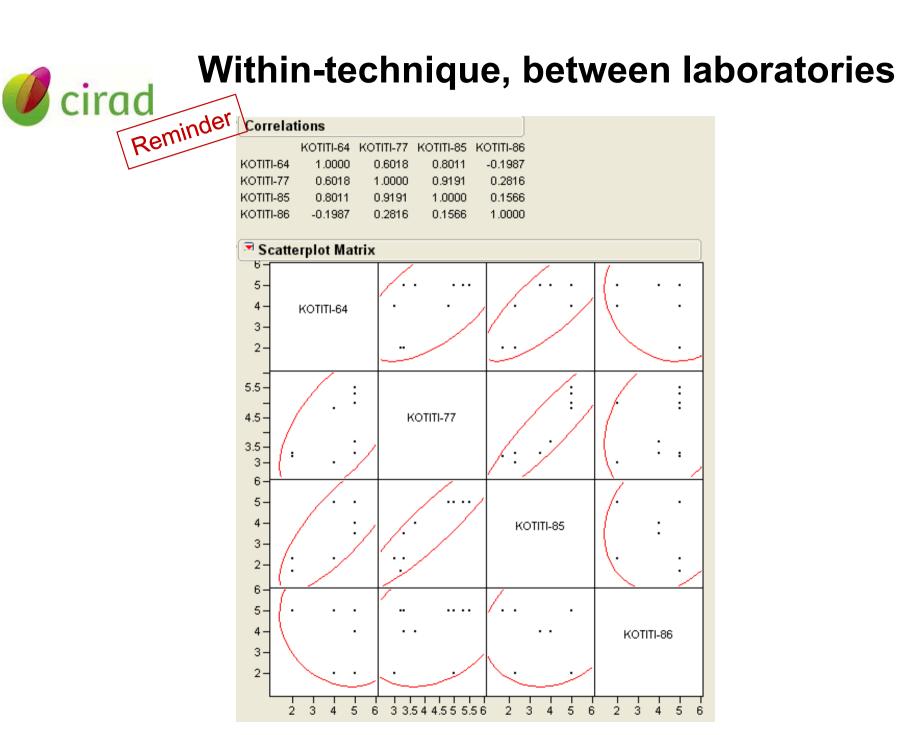
Within-technique, between laboratories



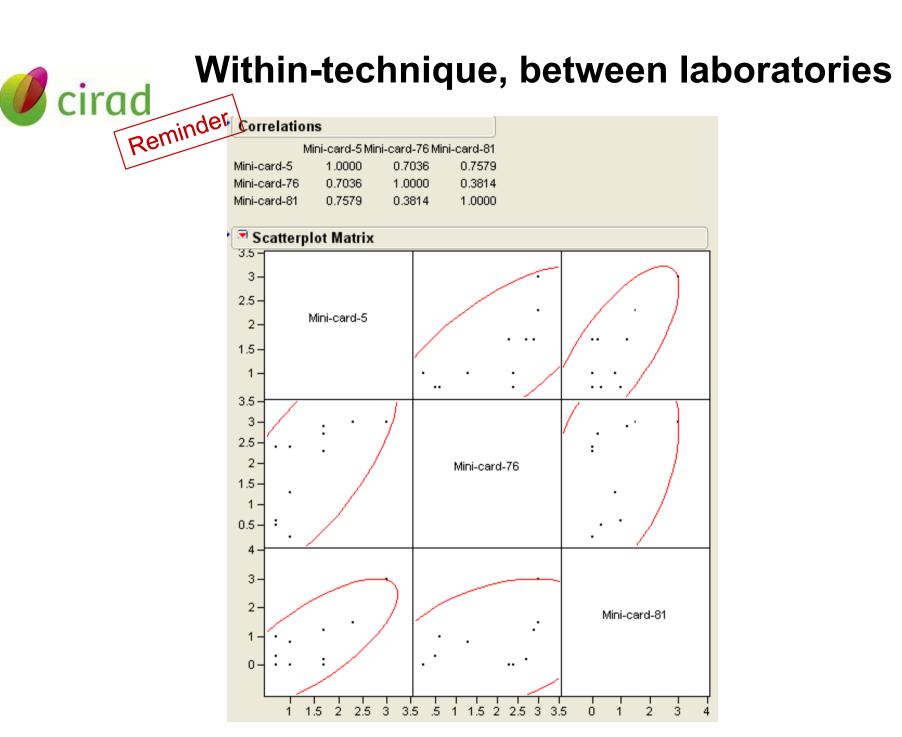


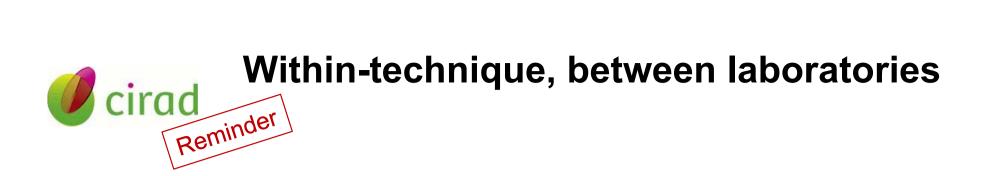




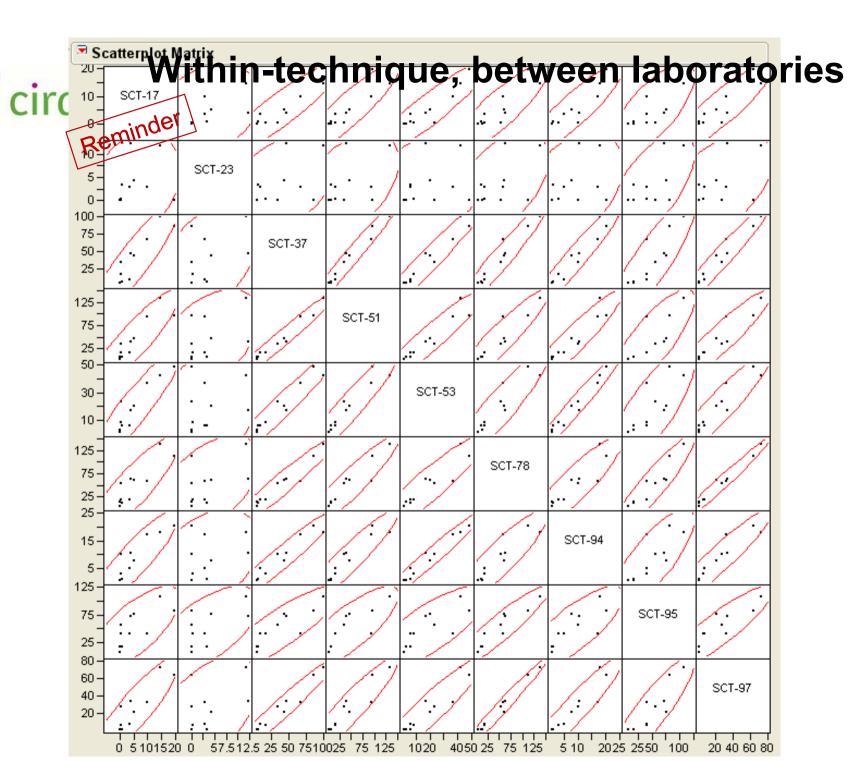








Correlations										
	SCT-17	SCT-23	SCT-37	SCT-51	SCT-53	SCT-78	SCT-94	SCT-95	SCT-97	
SCT-17	1.0000	0.2812	0.9039	0.8978	0.9137	0.8713	0.8974	0.7195	0.8967	
SCT-23	0.2812	1.0000	0.4816	0.4582	0.2735	0.5146	0.3663	0.6076	0.4890	
SCT-37	0.9039	0.4816	1.0000	0.9804	0.9665	0.9664	0.9626	0.8571	0.9723	
SCT-51	0.8978	0.4582	0.9804	1.0000	0.9479	0.9335	0.9397	0.8001	0.9369	
SCT-53	0.9137	0.2735	0.9665	0.9479	1.0000	0.9207	0.9781	0.7761	0.9390	
SCT-78	0.8713	0.5146	0.9664	0.9335	0.9207	1.0000	0.9064	0.9253	0.9871	
SCT-94	0.8974	0.3663	0.9626	0.9397	0.9781	0.9064	1.0000	0.7904	0.9414	
SCT-95	0.7195	0.6076	0.8571	0.8001	0.7761	0.9253	0.7904	1.0000	0.8879	
SCT-97	0.8967	0.4890	0.9723	0.9369	0.9390	0.9871	0.9414	0.8879	1.0000	





Participating techniques and laboratories

	Number of laboratories per stickiness technique
Caramelization	3
Chemcare	2
H2SD	3
KOTITI	4
Mini-card	3
SCT	9
Total sugar	1
Total Nb	25





- The meanings of the results provided by the various measuring techniques are not equivalent, even though they intend to measure/predict the same phenomenon: stickiness
- Units are fully different (grades, numbers, masses...)
- Observed differences in readings, both within laboratories using the same technique, and between techniques



Conclusions ... before discussions

- Need for a harmonization
- Which are the ways to achieve this harmonization?
- What to recommend?
- Requires policies and support tools to continue



Objectives of the international inter-laboratory round-test

- To check the ability of each measuring technique to reproduce itself within a same single laboratory
- To check the ability of each measuring technique to reproduce itself between several laboratories
- To give some indications about the ability of various measuring techniques to correlate to each others
- To check the level of ability of each measuring technique to predict stickiness as measured by the reference method and the recommended method
- To check the level of ability of each measuring technique to predict stickiness as measured by a micro-spinning test

o cirad

Spinning protocole

Operating method used for producing yarn in a micro ring-spinning facility ITMF-ICCTM inter-laboratory round test on stickiness, 2014

Laboratory opening machine

2 fleeces

(L=1.75m each; tex=31000)

Mini-card

1 fleece

(L=1.75m; tex=57200)

Drawing frame, pass 1

5 slivers

(L=3.35m each; tex=5800)

Drawing frame, pass 2

10 slivers

(L=3.35m each; tex=2900)

Drawing frame, pass 3

2 slivers

(L=37.40m each; tex=2300)

Spinning frame

10 bobins

(L=500 m each; tex=20)

Position 1 Position 2

55 g

55 g

Doubling

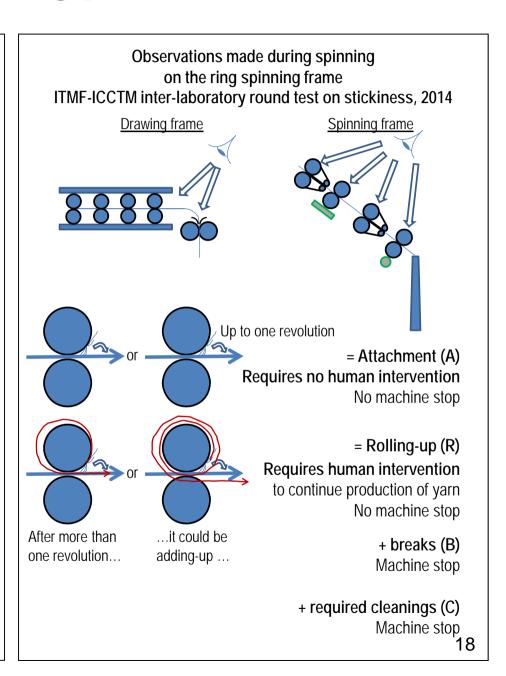
Doubling

Doubling

Eveness Tester: 100 m * 2.5 min / bobin

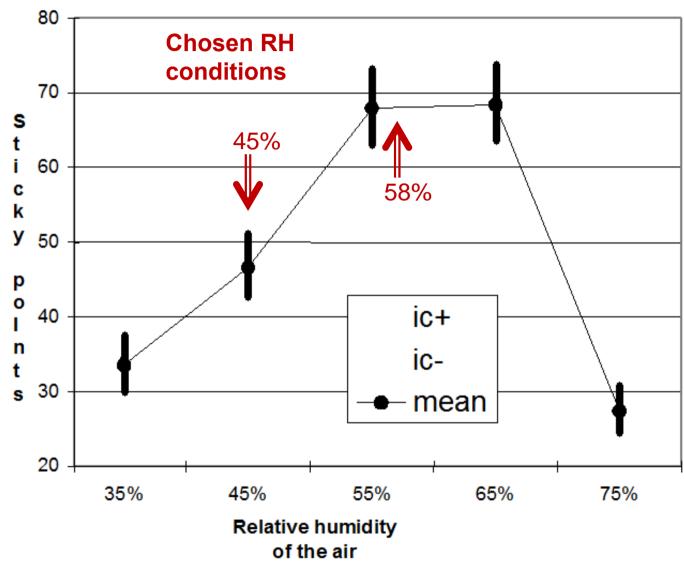
Strength Tester: 100 breaks / bobin @ 0.3 second per break

11 cottons * 2 RH * 2 blocks





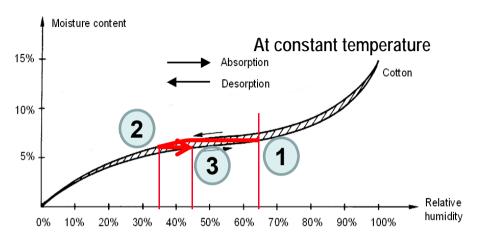
Spinning conditions



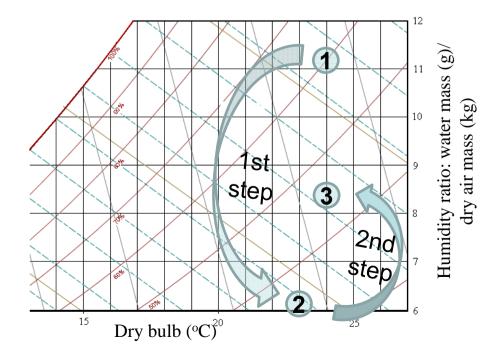
Source: Frydrych R., 2003, Habilitation à Diriger des Recherches « Les polluants du coton : cas du collage et des débris de coque », Université de Haute Alsace, 202 p.

19





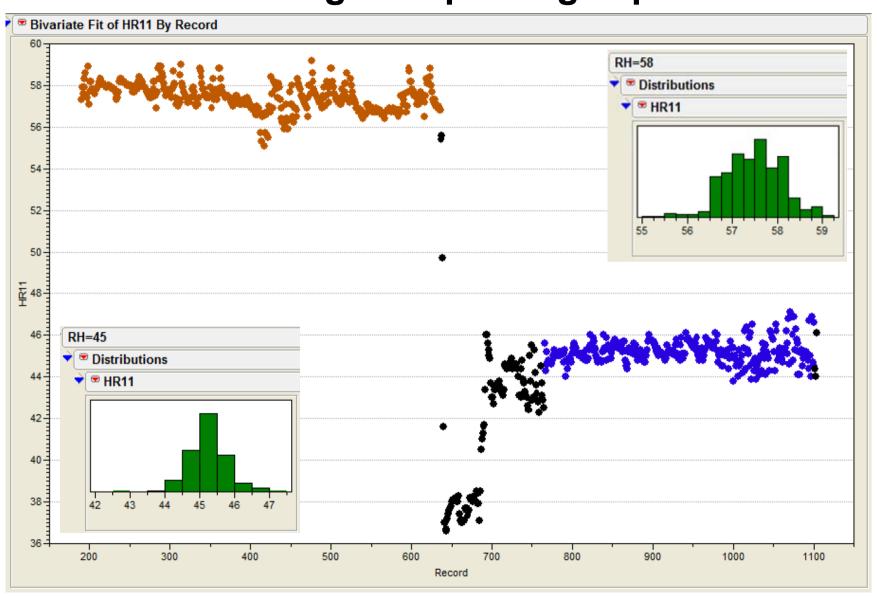
- 1 Spinning tests: first RH conditions
- 2 Drying period for cottons (72 hours)
- 3 Spinning tests: second RH conditions



	Nominal values								
	T°C	RH% g H ₂ O/g Gaz							
1	24	60	11.18						
2	23	35	6.09						
3	24	45	8.35						



T°C and RH% records during the spinning experiment



•: Setting at 58%RH

• : Drying + pre-conditioning

• : Setting at 45%RH



Recorded parameters for Yarn (Ys)

Quality (28)

- Um, CVm, CVm1
- Indice
- Tex
- Pil, Sh, Sh1
- Thin30, 40, 50, 60
- Thick35, 50, 70, 100
- Neps140, 200, 280, 400
- Fmax, CVFmax, Ten, WorkMax, N/texM1, N/texM2, All, CVAll

Productivity (8)

- Soulèv. / attachments
- Enroul. / rolling-up
- Nettoy. / cleaning
- Casses / break
- Events
- Events/km
- L_fil_produite m
- Prod m/mn



Recorded parameters For fiber (Xs)

	Number of Tech LabID	Mean	CF	Ranks*	so	PCA	Total
Caramelization	3	1	3	3	3	1	14
Chemcare	2	1	2	2	2	1	10
H2SD	3	1	3	3	3	1	14
KOTITI	4	1	4	4	4	1	18
Mini-card	3	1	3	3	3	1	14
SCT	9	1	9	9	9	1	38
Total sugar	1						1
Total Nb	25	6 +6 HPLC	24	24 +6 HPLC	24	6	121

^{*:} Partly studied and shown in 2014



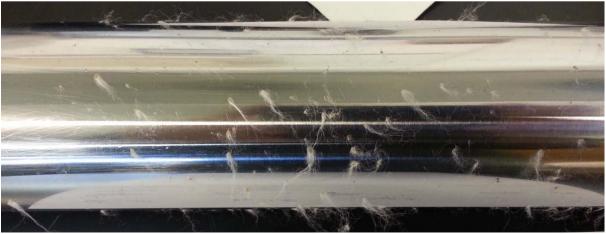
Strange #10 cotton...

(Not taken into account from now on)

RH: 58%



RH: 45%





Percent of significant relationships (α=5%) Yarn = f (Fiber)

Without cotton #10	Caram - 45%	Card - 45%	Chem - 45%	H2SD - 45%	Kotiti - 45%	SCT - 45%	Caram - 58%	Card - 58%	Chem - 58%	H2SD - 58%	Kotiti - 58%	SCT - 58%
Productivity (max=8)	0	1	4	1	1	1	6	7	5	6	2	6
Quality (max=28)	10	20	21	19	17	16	18	22	17	22	19	22
Nb significant	10	21	25	20	18	17	24	29	22	28	21	28
Nb total	36	36	36	36	36	36	36	36	36	36	36	36
Percent of significant relationships between fiber and yarn parameters	28	58	69	56	50	47	67	81	61	78	58	78

Green: > 70% of significant cases

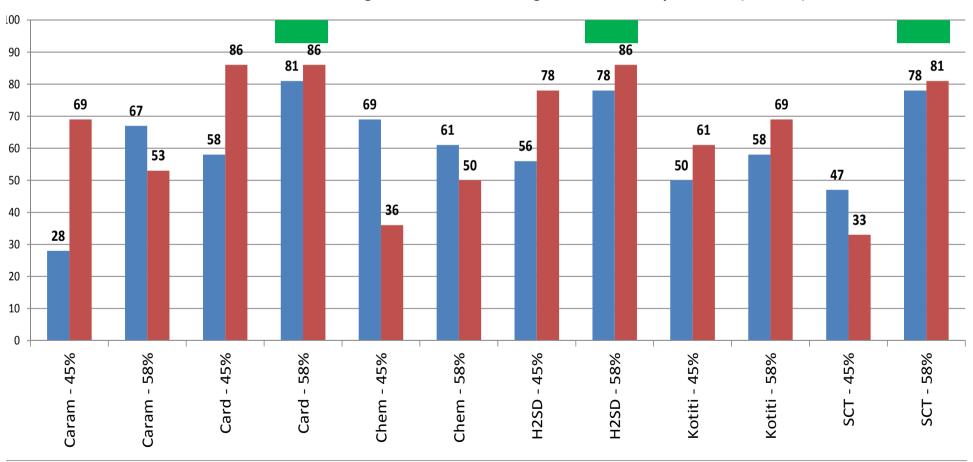
Orange: between 60 and 70% of significant cases Violet: between 50 and 60% of significant cases

No color below 50%



With/without #10 cotton: method sensitivity to outlier

- Pourcent de relations significatives entre collage et caractéristiques de fil (sans 10)
- Pourcent de relations significatives entre collage et caractéristiques de fil (avec 10)





Acknowledgements for contributions in the RT

- Contributors: Dr. A. Prades, N. Talha, Dr. J. Rodgers, Dr. C. Delhom, Dr. C. Fortier, Dr. E. Gozé, Prof. N. Ali, Dr. A. H. Abdelatif, M. Giner, Dr. E. Gérardeaux
- Participating laboratories
- Sponsors and technical partners: A. Macdonald (CSITC),
 Dr.T. Townsend (ICAC), Dr. J.-L. Chanselme (Cotimes)
- Funding:
 - Cirad
 - Participating laboratories for their own characterizations

What's next concerning any harmonization process?

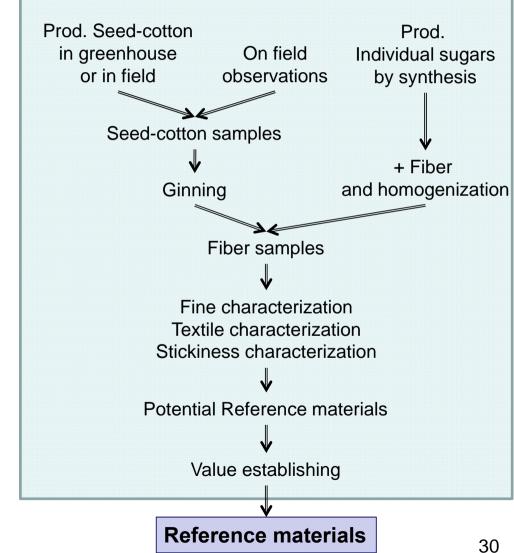
a path toward a joint project...



CIRAD UPR115 / Gesc Laboratoire de Technologie et de Caractérisation des fibres naturelles







→ Materials

→ Interpretation / management



On methods

Study how to produce
Study homogenization/variability
Study impact of ageing
Study packaging vs ageing
Study storage / distribution
Study sugar synthesis

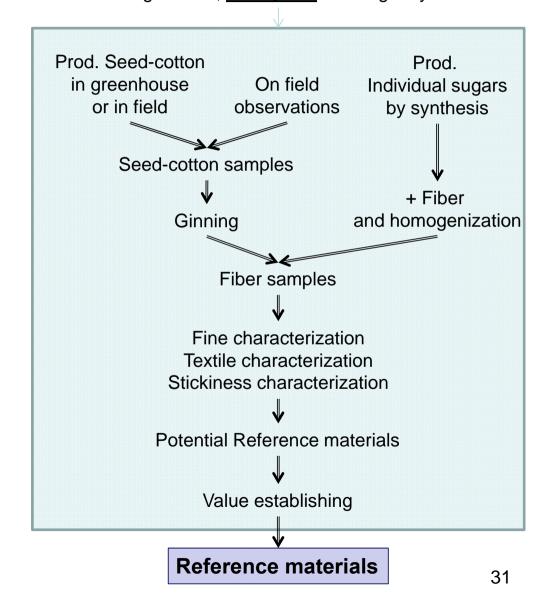
Study fine characterization Study textile characterization Study stickiness characterization

---> Results / information

→ Materials

→ Interpretation / management

On sucking insects, honeydew and sugar synthesis



Database

Procedure



On methods

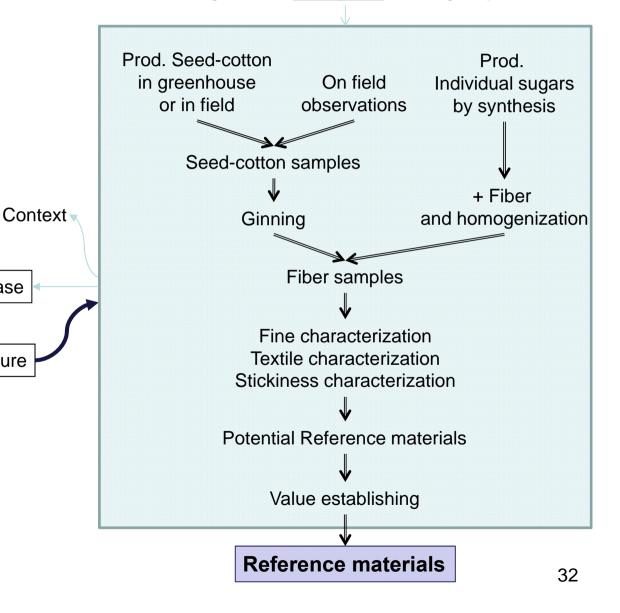
Study how to produce
Study homogenization/variability
Study impact of ageing
Study packaging vs ageing
Study storage / distribution
Study sugar synthesis

Study fine characterization Study textile characterization Study stickiness characterization

Study value establishing

- Results / information
- → Materials
- → Interpretation / management

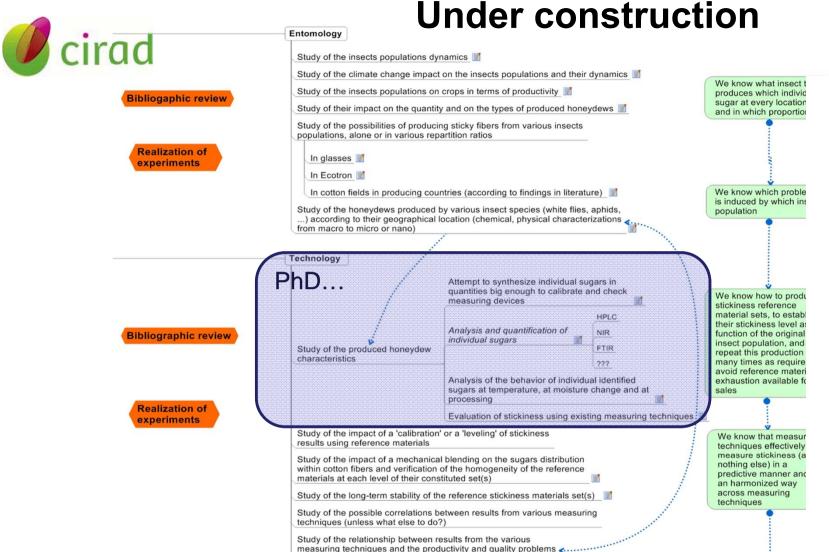
On sucking insects, **honeydew** and sugar synthesis





Potential partners...

On methods On sucking insects, honeydew and sugar synthesis LTC, LPMT, Prod. Seed-cotton Prod. Study how to produce in greenhouse On field Individual sugars Study homogenization/variability or in field observations by synthesis Study impact of ageing Study packaging vs ageing LPMT, LTC, UMR95 Study storage / distribution Seed-cotton samples Study sugar synthesis Context Ginning and homogenization LTC, IT (G10?) Fine characterizatic LTC, LPMT, USDA, ITMF
extile characterizatic ICAC, CSITC, Bremen
kiness chara Study fine characterization Database Study textile characterization Study stickiness characterization All, under ITMF, CSITC control, managed by LTC(?) LTC, USDA, ITMF Stickiness characterization Potential Reference materials All, under control of ITMF, Value establishing CSITC, managed by LTC(?) Study value establishing Results / information → Materials Reference materials Interpretation / management 33



observed in processing sticky materials

at the classing, commercial and processing scales III Establishment of a first set of reference materials for stickiness

at the laboratory scale III

measuring techniques

Accumulation of findings

to make it available

We know how to accumulate all this acquired knowledge



Proposed activities

1 Project management	
■ 1.1 Create and apply data management plan	
⊕ 1.2 Organize initial workshop	
1.3 Organize intermediate workshops	
■ 1.4 Prepare and distribute periodic scientific, technical, accounting and progress reports	
1.5 Organize diffusion of information between Project Members	
1.6 Organize diffusion of information outside the Project Members	
1.7 Participate to international seminars for diffusion of results	
⊕ 1.8 Organize final workshop	
1.9 Manage data and information after the end of the Project (provision)	
[∃] 2 Work in entomology to know how and where to produce sticky cotton from known origi	ins
[±] 2.1 Study the insects populations and their dynamics under climate change pressure	
[∃] 3 Produce/collect sticky fibers from various insects populations, alone or in various repa	rtition ratios
3.1 Organize the packaging, marking/labelling (in relation with database) and plan conservation of collect	ted samples
[⊞] 3.2 Study the possibilities of producing/collecting sticky seed-cotton from various insects populations, a	lone or in various repartition ratios
[⊞] 3.3 Produce seed-cotton contaminated by honeydew from known insects in greenhouse	
3.4 Produce seed-cotton contaminated by honeydew from known insects in Ecotron (not in this project)	
[⊞] 3.5 Produce seed-cotton contaminated by honeydew from known insects in cotton fields in producing co	untries (according to findings in literature)
[⊞] 3.6 Attempt to synthesize individual sugars in quantities big enough to calibrate and check measuring de	evices
3.7 Collect, homogenize, and gin seed-cotton into fibers per level in the range in standardized conditions	
$^{ extsf{I}}$ $^{ extsf{I}}$ 4 Study the characteristics of produced honeydew and individual sugars (as such and/or	r in fiber samples)
■ 4.1 Study available techniques for fine characterizations of insect honeydew	
[⊞] 4.2 Study the impact of a 'calibration' or a 'leveling' of stickiness results from commercial instruments us	sing reference materials
■ 4.3 Study homogenizing methods/techniques to insure a high uniformity of honewdew distribution and n	ot disturbing honeydew deposits
■ 4.4 Analyze and quantify individual sugars in honeydew	
■ 4.5 Study the behavior of individual identified sugars at temperature, at moisture change and at processing	ng
■ 4.6 Study the impact of ageing on honeydew characteristics and design storage methods accordingly	
⊕ 4.7 Plan budget for PhD, MS, students	
[⊕] 4.8 Study, plan and use preservation medias for long storage of reference materials	
■ 4.9 Study the long-term stability of the reference stickiness materials set(s)	■ 5.5 Organize international inter-laboratory round-tests using major fine and 'commercial' measuring techniques
5 Establish a first reference materials set of sticky fibers	5.6 Prepare report on the results and conclusions based on characterizion results
5.1 Apply an homogenization if required	5.7 Update an operating method on the way to produce, prepare, caracterize, establish reference materials to be release
■ 5.2 Realize fine characterizations on investigated potential future reference materials used for the round-to-	
■ 5.3 Organize discussion within CSITC-TF participants	5.9 Inform users about the availability of the operating method and of the reference material set
■ 5.4 Organize discussion within ITMF-ICCTM working groups participants	5.10 Feed data management plan
9 9	5.11 Distribute report 35



Proposed activities

□ 1 Project management		
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■ 2.1 Study the insects populations and their dynamics under climate change pressure		
■ 2.2 Study the insect's impact on the quantity and on the types of produced honeydews		
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	5.9 Inform users about the availability of the operating method a	nd of the reference material set
	5.10 Feed data management plan	
	5.11 Distribute report	36

Thank you

for

your attention



CIRAD UPR115 / Gesc Laboratoire de Technologie et de Caractérisation des fibres naturelles

A brief update on Cottonscope

Bremen 2016





Cottonscope features

- Measures fibre maturity and ribbon width directly off the fibre. Fineness and micronair from the sample
- Rapid 20,000 fibres in 30 seconds
- Accurate and repeatable
- Auto cleanup
- Small foot print



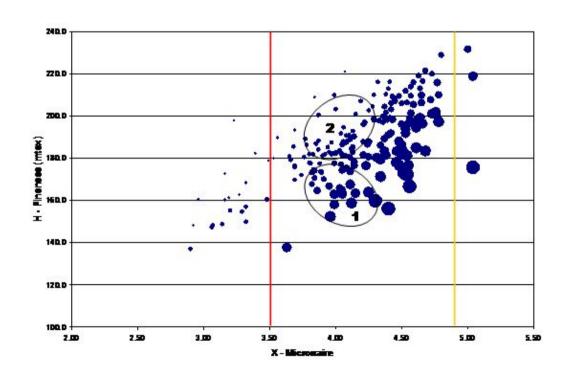


Calibration

- ARS calibration samples
- Calibration every 6 months
- Simplified calibration procedure

Applications

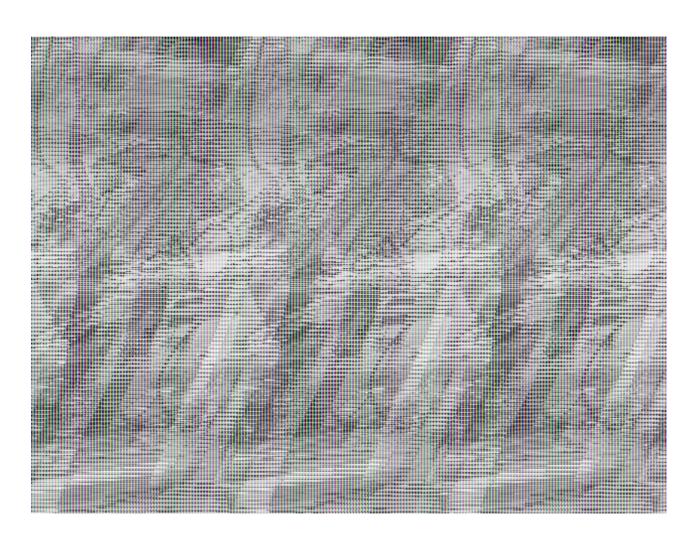
- Researchers
- Farmers
- Mills



Updates

- Distilled water and surfactant only
- Bubble detection improves fineness measurement
- New hardware layout improves instrument size and fineness
- 0.45 micron filter extends the period between water change for dirty cotton samples
- Portable case

Sample Corer



Thank you for your time



Questions and discussion

AFIS/HVI Maturity Measurement Revised Algorithm, cont.

ITMF 2016

Anja Schleth/ David McAlister



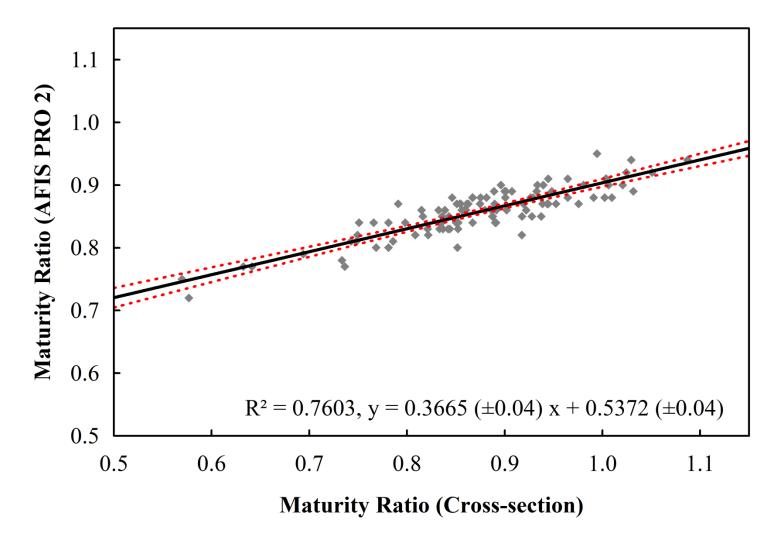
AFIS and HVI Maturity Measurement Background

- Maturity as a measured parameter was introduced in AFIS in 1996, and in HVI in 1998. The reference for the AFIS maturity measurement is image analysis (IA). The reference for the HVI maturity measurement is AFIS.
- On AFIS, the maturity measurements Maturity Ratio, Immature Fiber Content (IFC), and Fineness replaced the previously used parameter Diameter.
- IA data from 36 cottons provided by Texas Tech and measured by USDA-ARS (SRRC) was used to establish AFIS maturity and its initial calibration.
- As an effort to improve the accuracy and the range of reference data, a sample set of 104 cottons was collected and tested thoroughly via image analysis establishing maturity values.
- Comparison tests on AFIS and HVI, while showing good correlation, indicated a narrower range for this measurement reflecting the characteristics of the original reference samples, as also confirmed by Dr. Jim Rogers of USDA SRRC in a previous CSITC Task Force meeting.



AFIS and HVI Maturity Measurement

Dr. Rogers Study Results





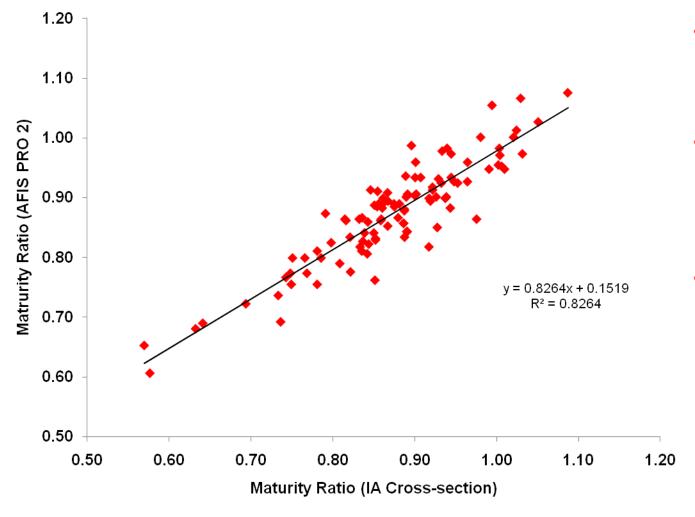
AFIS/HVI Maturity

2014 Study Methodology

- The purpose of the study was to take the IA data for the 104 cottons and create a new calibration for AFIS and HVI to improve the maturity measurement range
- New calibrations were created for the AFIS PRO2 and HVI 1000. and applied in order to compare the their respective maturity measurements to IA.



AFIS and HVI Maturity Measurement 2014 AFIS PRO 2 results – correlation to IA results

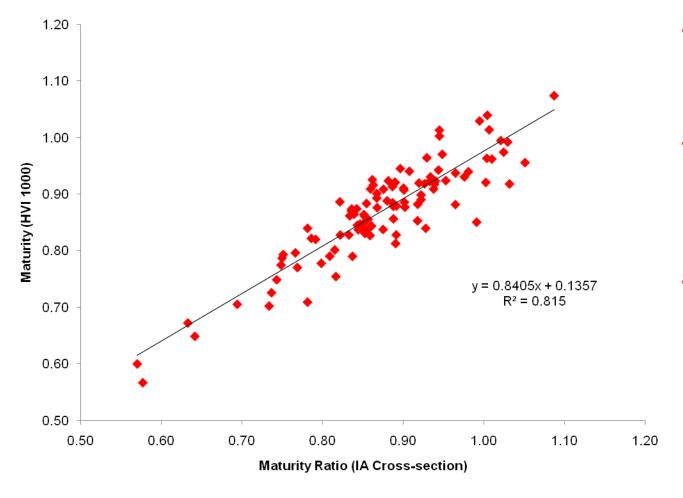


- Correlation improved from $R^2 = 0.76$ to R^2 = 0.83
- Likewise, the measurement range improved from 0.23 to 0.47
- The range for IA is 0.51



AFIS and HVI Maturity Measurement

2014 HVI 1000 results - correlation to IA results



- Correlation improved from $R^2 = 0.73$ to R^2 = 0.82
- Likewise, the measurement range improved from 0.09 to 0.50
- The range for IA is 0.51



AFIS and HVI Maturity Measurement 2014 Conclusions

- Using the IA maturity data from the 104 cottons, new maturity calibrations were devised & implemented for AFIS PRO 2 and HVI 1000.
- With the new calibrations, the correlations of AFIS PRO 2 and HVI 1000 to IA maturity data is further improved.
- Additionally, the measurement range for this measurement increased significantly to a similar range of the IA maturity data.

ITMF Progress Report 2014:

 Axel Drieling indicated that with a change of the maturity parameter in the given instruments it should be assured that the results based on the old definition should not be mixed up with the results based on a new definition. This should preferably be assured by giving a different parameter name.



AFIS and HVI Maturity Measurement 2016 Implementation

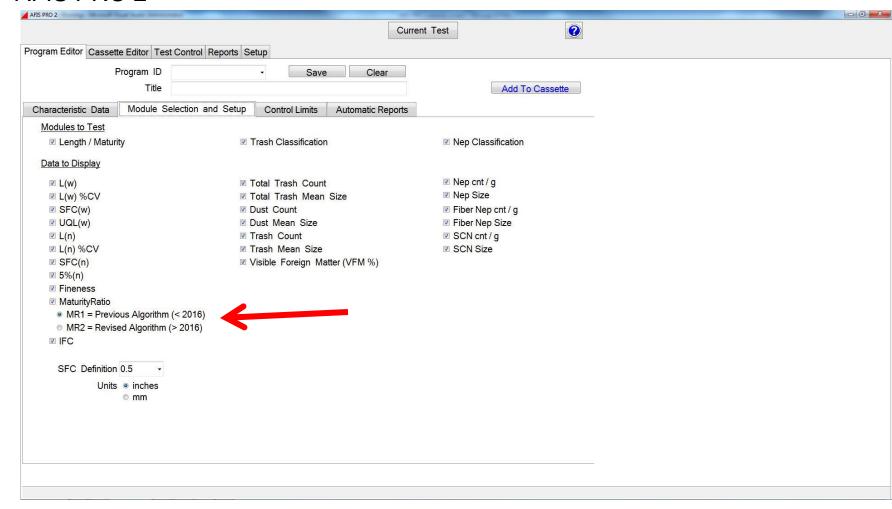
- An entirely different name is not easily implemented when the same parameter is being measured but with a revised algorithm/ calibration range only.
- Example: Change from Diameter to Maturity measurements on AFIS took years to be accepted by the end-user, especially those with AFIS units already installed and data being actively used. Many wanted to keep the Diameter measurement, despite Maturity being an improvement at that time.
- Proposal: Keep the definitions similar but easy to distinguish, and make them user-selectable!



AFIS and HVI Maturity Measurement

2016 Implementation

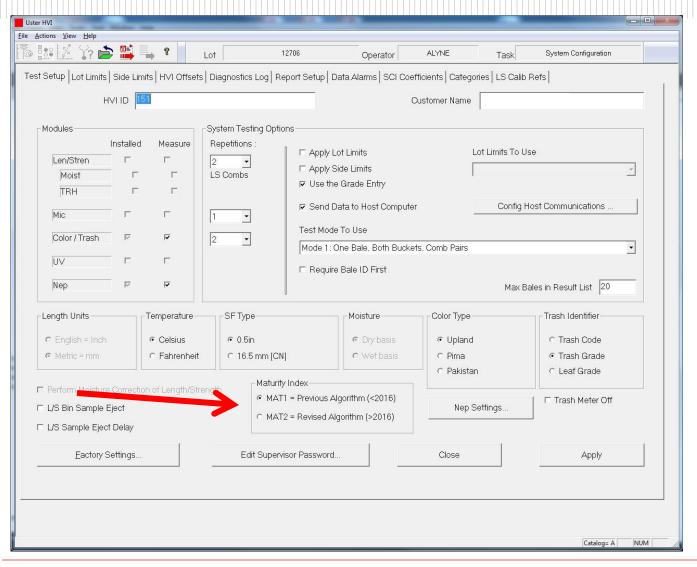
AFIS PRO 2





AFIS and HVI Maturity Measurement

2016 Implementation



HVI1000



AFIS and HVI Maturity Measurement 2016 Implementation

 Roll-out with next regularly scheduled software release in 2016 (exact dates TBD).



Think quality



Creation of a set of reference cotton for fiber maturity measurements

Eric F. Hequet¹, Suman Lamichhane¹, and Vikki Martin²

¹Texas Tech University, ²Cotton Incorporated

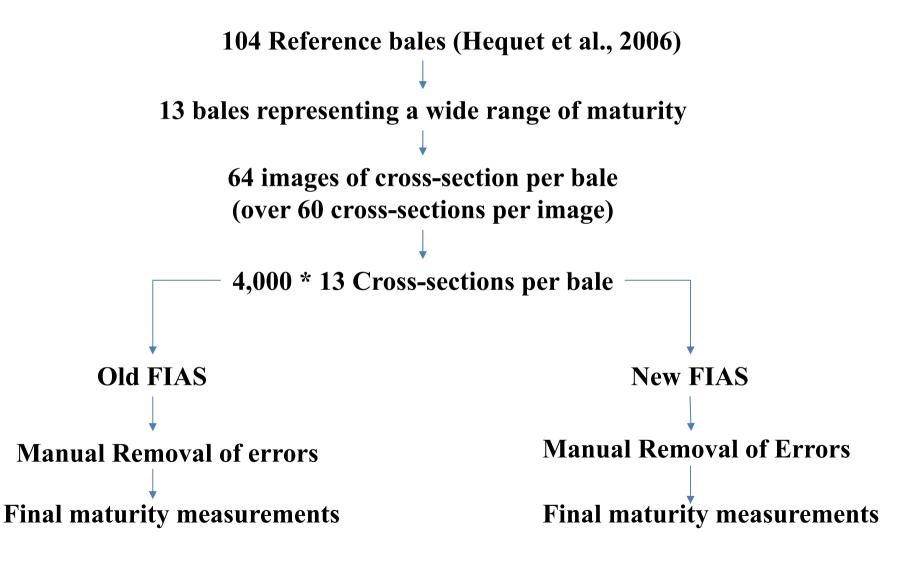
Hypothesis



- Evaluation of the new FIAS:
 - The new version of FIAS is more effective at measuring fiber cross-sections features, especially immature fiber cross-sections.

Materials and Methods





Errors



> There are four main types of errors:

Error	Description	Unprocessed image	Processed image
Type-A	Broken cross-section, or a trash detected as a regular cross-section		67 63
Type-B	Misestimated fiber perimeter		₹1 69 .63,
Type-C	Failed to identify the true lumen		70 6/1
Type-D	Failed to detect the fiber cross-section		56 59

Analysis of Errors



Bale-3156, Theta (θ) - 0.46

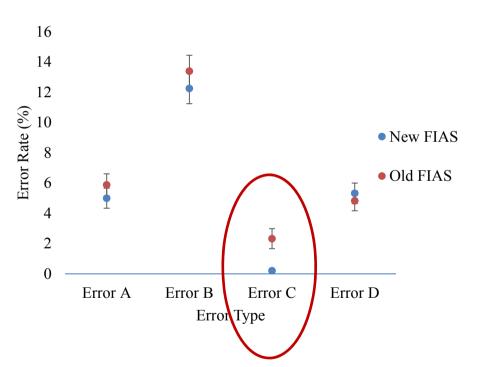
Daie-3130, Tileta (0) - 0.40							
	Error A	Error B	Error C	Error D	Total errors	Total Cross- sections	
New FIAS	91	163	7	122	383	4117	
Old FIAS	57	258	202	130	517	3838	
	Error Rate (%) 5 4 2 1 0				New FIASOld FIAS		
		Error A	Error B Err	or C Error D			

Error Type

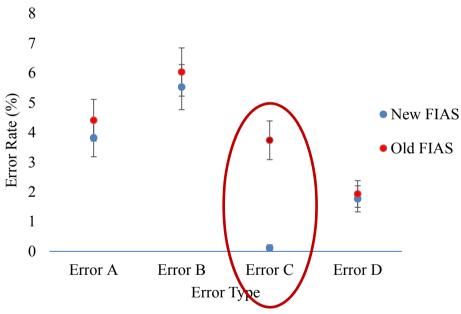
Analysis of Error





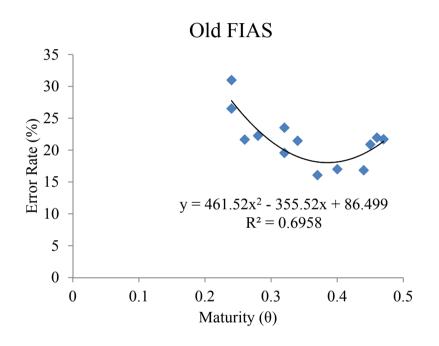


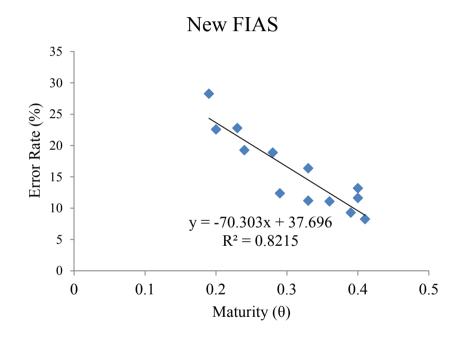
Bale- 2684, Theta (θ)- 0.33



Error Rate and Maturity







- Good correlation ($R^2 = 0.69$)
- Shows higher error rates for both mature and immature cottons

- High correlation ($R^2 = 0.82$)
- Error rate decreases when maturity increases

Analysis of Error

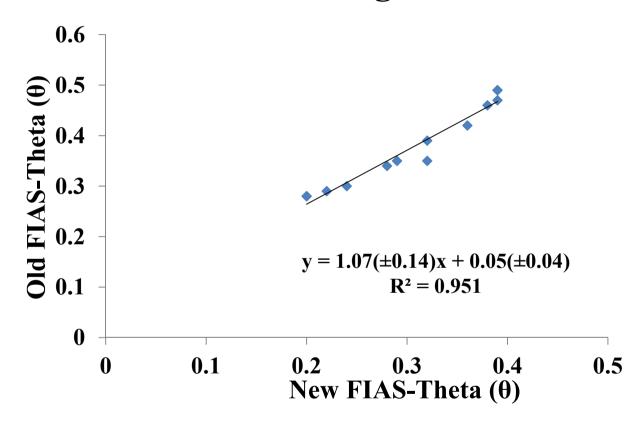


■ A noticeable difference was observed for error-C and a slight improvement for error-B, but no significant advancements were observed for both error-A and error-D.

Analysis of Average Maturity



Before removing the errors

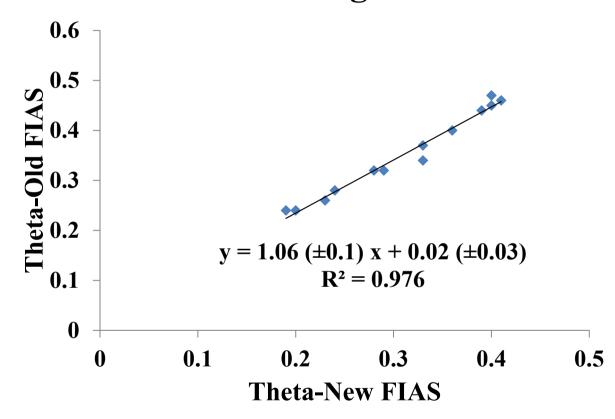


- High correlation ($R^2 = 0.95$)
- Significant difference between the two versions of FIAS

Analysis of Average Maturity



After removing the errors

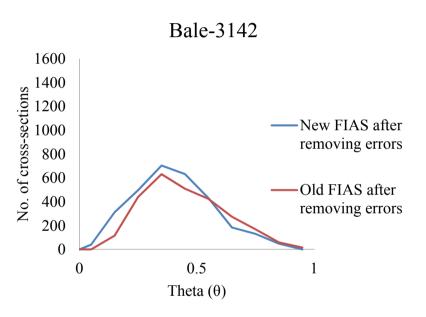


- Correlation value increased slightly and reached 0.98
- No statistical difference between the two versions of FIAS

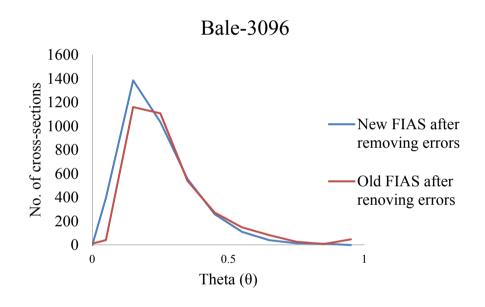
Analysis of Maturity Distributions



After removing the errors



Chi-square analysis, P < 0.05



Chi-square analysis, P < 0.05

■ The distributions obtained from the Old FIAS are shifted to the right and show a larger population of mature fibers.

Conclusions



- Excellent agreement between the two versions of FIAS in terms of average maturities ($R^2 = 0.98$).
- Maturity distributions between the two versions of FIAS differ significantly.
- The New FIAS is better at identifying fiber features.
- The New FIAS lowers the segmentation errors which reduces the measurement bias and the time required for their manual removal.

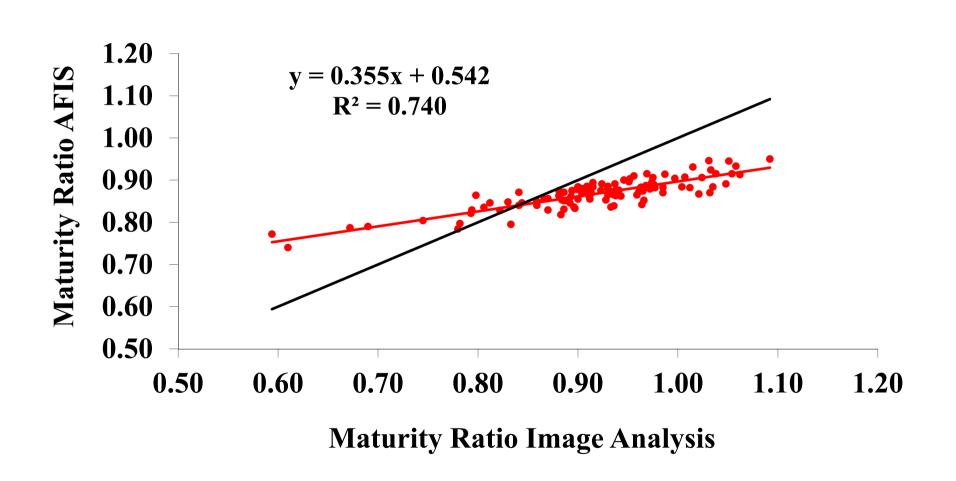
Next step



- Is it possible to use cross-sections data to calibrate both AFIS and Cottonscope?
 - Calibrate the averages
 - Calibrate the distributions
- The answer is: It should be possible to calibrate the averages but not the distributions.

Calibrate the AFIS maturity averages





Why is it impossible to calibrate the distributions?

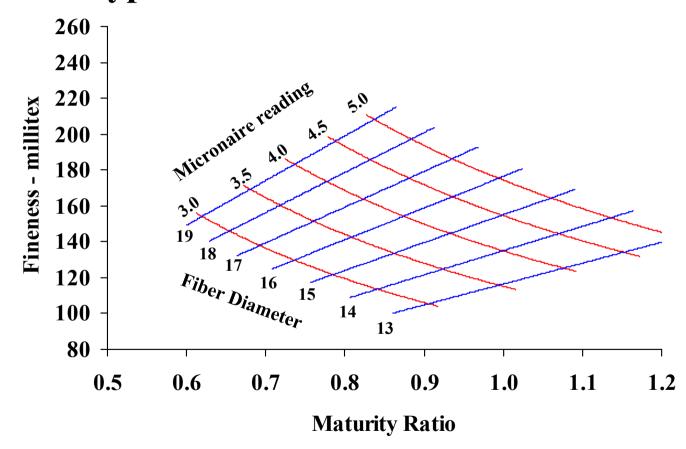


Cross-section method	AFIS	Cottonscope	
1 μm thick fiber cross-section	Single fiber	0.7mm fiber snippet	
1 μm		0.7 mm	
 Individuals cross-sections with different maturity levels. 	• 1 inch fiber has ~25,400 1µm fiber cross-sections each with a different level of fiber maturity.	 ~700 of 1 μm cross- sections, each having a different level of fiber maturity. 	
 Distribution of individuals fiber cross-sections. 	 Distributions of the average values on complete fibers. 	 Distributions of the averages values on fiber snippets. 	

Producing calibration cottons



• What type of cotton should we choose?



Range of both maturity and fiber diameter.

Producing calibration cottons



- 3 levels of fiber diameter
- 4 levels of maturity for each fiber diameter
- **12** bales
- Blend each bale using the International Cotton Calibration Standard Committee procedure for producing reference cottons.
- Produce card web
- Take 100 samples per bale

Producing calibration cottons



- Establish the regression equation to calibrate AFIS based on cross-section data (set of 104).
- Run the 100 samples per bale on 2 to 3 calibrated AFIS instruments.
- Big question here: do we use the calibrated AFIS as the reference or do we want to use cross-sections.
 Running 1200 samples with cross sections would be extremely time consuming and cost prohibitive.
- Establish the reference values.

Cottonscope specimen preparation

Andrew Abbott and Stuart Gordon ICCTM, Bremen March 2016

CSIRO MANUFACTURING

www.csiro.au





Outline

A guillotine is currently used to prepare cotton samples for testing by Cottonscope instrument.

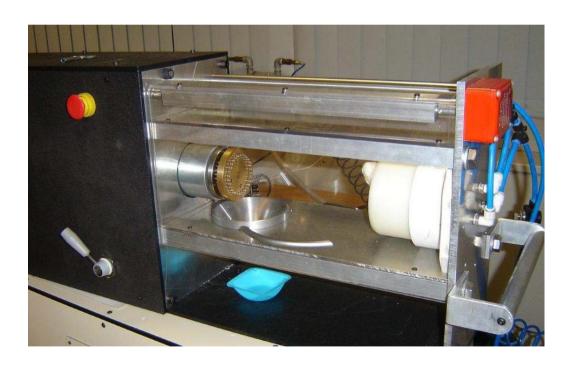
- Development and trials of a coring device
- Conclusions





Corer

- Can a corer produce small snippet sizes?
 (0.9 mm diameter core tip)
- 50mg of snippets required per core
- Safe to use





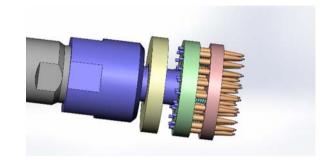
- Prototype satisfied specification
- Bulky
- Large sample lint size required

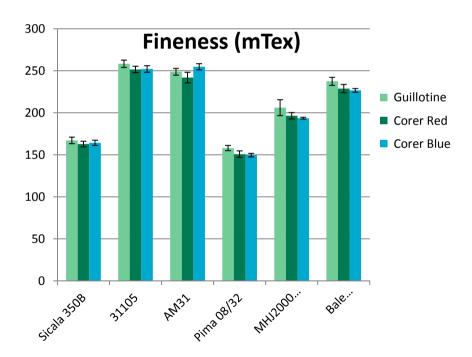


Corer for Trials

- Two redesigned corers suitable for independent trials
- Reduced sample lint size required
- Reducing diameter of sample chamber/piston mechanism

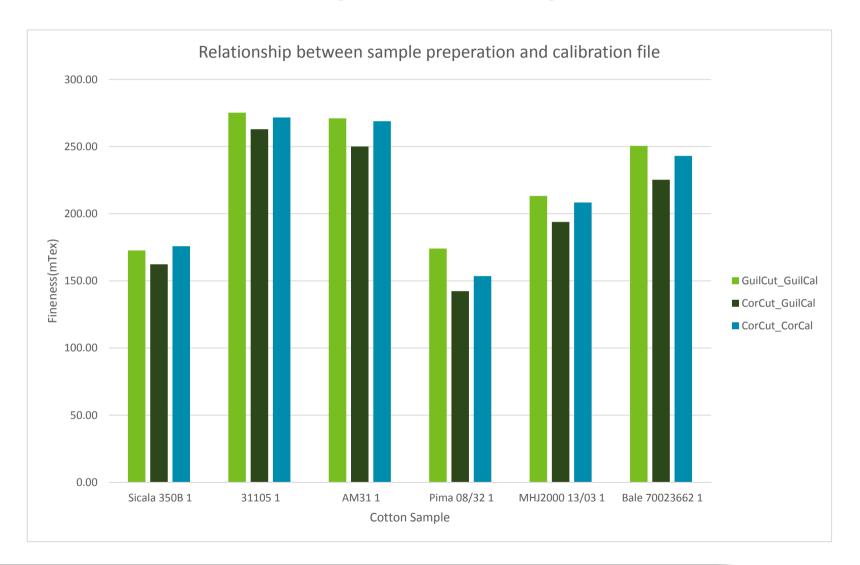








Corer for Trials (continued)





Trials

- BSC Electronics
- Texas Tech University
- Feedback summary

Pros

- Well made
- Easier to use than guillotine
- Measurements are comparable to guillotine
- 50mg snippet size is suitable
- Safe to use

Cons

- Bulky
- Large amount of compressed air required
- Large amount of lint required compared to guillotine
- Some snippets get stuck on coring tubes



Optimise Design from Feedback

The feedback and suggestions received enabled the engineering team at CSIRO to focus on the key areas for improvement.

To reduce the sample lint size required and to produce more snippets from less lint sample the following features will be improved:

- Reduce dead volume in lint chamber
- Pre-compress sample lint in chamber before coring
- Use visual markers to indicate position of full compression/coring
- Multiple core a compressed lint sample

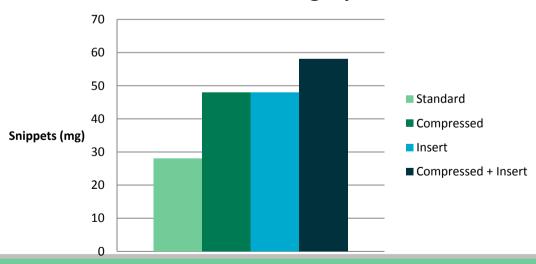




Conclusion

- Reduce sample lint required for corer
- Optimised design will reduce lint sample by half (30 g to 15 g)
- For very small lint samples an automated guillotine has been tested and will be developed further

Reduced Coring Tips







Thank you

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Acknowledgments:

- Vikki Martin (Cotton Incorporated)
- Mark Brims (BSC Electronics)
- Hy Hwang (BSC Electronics)
- Eric Hequet (Texas Tech University)



Recognition of Cottonscope, an instrument for testing cotton fibre maturity, fineness, ribbon width and micronaire

Draft method to ICCTM

January 2016

1. Instrument

- Instrument: Cottonscope (see Fig. 1)
- Target type of recognition: Quality assurance (cotton breeding, gins and mills) and industrial research.
- Prototype or full recognition: Full recognition



Fig. 1 Cottonscope instrument

2. General description: This test method covers the determination of cotton fibre maturity, linear density or gravimetric fineness (herein referred to as fineness), ribbon width and micronaire using the Cottonscope instrument. Samples are loose, chemically untreated fibre specimens taken before harvest, after ginning, during mill processing or unravelled from yarn or fabric.

Cottonscope is a proprietary instrument that measures the maturity, (gravimetric) fineness (herein referred to as fineness), ribbon width and micronaire of cotton fibre.

- **3. Target Group:** Low volume classification, quality assurance (in cotton breeding, gins and mill applications) and industrial research.
- **4. Function Principle:** Loose cotton fibres are cut into snippets no greater than 1.0 millimetre using a guillotine or mechanical corer. The snippets are weighed, dropped into the instrument's water filled bowl and dispersed by a magnetic stirrer so that they spread randomly across the instrument's camera viewing port, which is submerged in

the bowl and illuminated using polarized light. Colour digital images magnified 5X are captured by the camera and analysed by proprietary software to determine values of maturity, fineness, ribbon width and micronaire. The polarized light source that illuminates the snippets in the water bowl generates contrasting colour images between mature and immature cotton fibre snippets. Mature fibres are red and immature fibres are clear or dark grey (see Fig. 2).

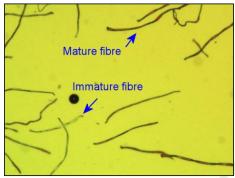


Fig. 2 Mature and immature fibres (as indicated) in the Cottonscope field-of-view

5. Usefulness/benefits:

Able to differentiate fine, mature cotton fibre from coarse, immature fibre.
 Micronaire, which has traditionally been used as a measure of fibre fineness, actually measures fibre specific surface area or surface area per unit weight. As a result its values vary concomitantly with both maturity and fineness (see Fig. 3). The situation arises therefore where cotton with the same micronaire value can have very different properties in terms of its textile quality and processing efficiency.

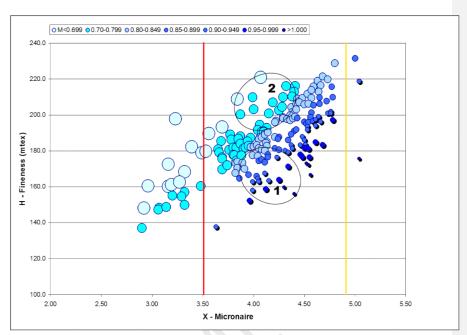


Fig. 3 Relationship between micronaire (X), fineness (H) and maturity (M). The points indicated in group 1 highlight cotton bales that are both fine and mature. The points indicated in group 2 are coarser and less mature. However, the cotton bales in both groups have the same ranges of micronaire.

- Fineness values are determined by direct principle, i.e. by the cut and weigh method.
- Maturity and ribbon width values are determined by direct principle, i.e. by interference colour according to ASTM Test Method 1442 and width analysis of polarized light microscope images respectively.
- Maturity and ribbon width values can be tested without pre-conditioning test samples.
- Cottonscope test specimens are small (50 mg) meaning that very small fibre samples, e.g. fibre from immature bolls or unravelled from yarn, can be evaluated.

6. Application Range of Testing:

Range of recognition: Cottonscope is calibrated to measure maturity, fineness, ribbon width and micronaire values on any form of raw cotton, e.g. from the plant (seed, boll or branch) through to intermediate mill products such as sliver and fibres that have been unravelled from yarn or fabric.

To date, harmonisation of the instrument's values has been formally measured on only one occasion. In this trial, three instruments in three laboratories were used to measure 104 international calibration cottons in three blind, randomized blocks. A total of 2808 tests were recorded in this trial. Data from this trial will be reported at the ICCTM meeting in Bremen March 2016.

Commented [jpg1]: This word has a strong meaning; isn't it an adjustment or an initial setting, that gives the level to the results? The calibration is 'made' for adjusting the 'day to day' or the 'operator to operator' operation if I remember well.

Calibration is a good word for relating the raw (image) data measured by the instrument on fibre with known values of fin, mat and mic properties. Reference or calibration cottons with a wide range of values are used in this process.

It is suggested that a check cotton be run on a day-to-day basis to ensure the calibration and instrument are working properly.

→could you mention this idea somewhere in the document? It is part of any harmonization process

Commented [jpg2]: From I articles I read, only tests on cotton raw fibres were investigated... is-it necessary to write this here?

We have unravelled fibre from griege yarn to determine fin, mat and mic values. This has not been published but nevertheless can be done. Intrinsically, the specimen is no different from any other (raw) fibre specimen. We think this ability ought to be recognized as part of the recognition.

→it could be included in this recognition as long as it has been proven that the same raw cotton Cottonscope data is not different than the one obtained from any unravelled fabric (care to all chemical treatments that could affect fiber shapes and thus their measurement) or greige yarn (preparation to weaving requires sizing or putting some kind of fabric for avoiding hairiness that couls also affect fiber shape and their measurement) made out of the same fibers.

Unless, still it is possible to mention that the instrument is recognized for raw cotton or for fiber unrawelled from greige yarns only at first, and that it is possible to unrawel fibers from other fabric or other than greige yarn to get the fibers on which making Cottonscope measurements is possible...

Additional range: Cottonscope can also be used to measure the fineness and ribbon
width of other staple fibres and/or filaments that can be cut into snippets and
dispersed in the instrument's water bath.

7. Results parameters and definitions:

- **Fibre maturity (M)** is defined as per the criteria described in ASTM Test Method D1442. The maturity (ratio) scale by this method ranges from 0 to 1.2. The value is low for immature fibres and high for mature fibres. The Cottonscope software calculates maturity ratio values for individual fibres captured by the camera and builds a histogram to represent the distribution of values in the test specimen. The shape of the histogram can also be used as a parameter to identify plant growth and processing consequences on fibre maturity.
- (Gravimetric) fineness (H) is measured as a factor of concentration of fibre snippets and their combined length dispersed in the instrument's water bowl. The water bowl has a fixed volume, which allows the concentration of fibre snippets in a given specimen to be determined. Only average values of fineness are given.
- Ribbon width (D) is defined as the width of the fibre at any point along its length. The value is closely related to the diameter or perimeter of the fibre cross-section. The Cottonscope software measures ribbon width for each fibre and builds a histogram to represent the distribution of values in the test specimen. The shape of the histogram can also be used as a parameter to identify plant growth and processing consequences on fibre ribbon width.
- Micronaire (X) is calculated from average maturity and fineness values using Lord's equation¹.

8. Testing procedure:

- Recommended number of tests: For unprocessed (raw) cotton that has not been blended, five sub-samples from different areas of the sample are typically required. The sub-samples are combined to produce a sample that can be presented for guillotining. Regimes for sampling fibre from cotton fruit on single plants or multiple plants in rows need to be determined using competent statistical analyses. For intermediate or semi-processed mill products such as card or draw frame sliver, three sub-samples from different areas of the sample are required. Fibres can also be unravelled or unpicked from yarn or fabric for testing. Sampling fibre from yarn or fabric should be determined using competent statistical analyses.
- Description: Sampled fibres are guillotined (see Fig. 4) or cored to produce snippets
 for testing. Each test specimen shall weigh 50.0 ±0.5 mg. Use a brush to thoroughly
 clean the preparation area, weighing tray and cutting device or guillotine of snippets
 before preparing the next sample. Weighed snippets are tipped into the
 instrument's water bowl and allowed to submerge and then disperse. Once the
 snippets are dispersed, start the test.

Commented [jpg3]: It is hoped that an example of printout is given here. At lest it would clarify the fact that Cottonscope delivers a distribution of MR and one results of fineness per tested specimen. In addition, it would clarify how are reported results when several measurements / specimen are tested per sample, and samples per bale or lot for instance.

Average and distribution data is reported on screen and to an excel/csv file. From the file the data can be formatted and printed in the way the user requires.

→therefore please paste a "print screen" picture in here. Thanks.

¹ Lord, E., Air Through Plugs of Textile Fibres, Part II. The Micronaire Test for Cotton, *J. Textile Inst.*, **47**, T17-T47, 1956



Fig. 4 Picture of benchtop guillotine used to prepare fibre snippets for evaluation

Necessary surrounding: The Cottonscope instrument should be located on a
vibration free table or bench top in a dry, low draft location away from direct
sunlight. The operating temperature should be between 5 and 50 degrees Celsius as
the electronic components may be affected outside this range.

Cottonscope instrument requires 240 V DC power.

9. Testing preparation time, sample preparation time and test time:

- Testing preparation time: Preparation of instrument for measurement without
 water change (once per week or as required) is less than five minutes. This period
 allows for the instrument's LED lights to warm-up and for the pump to reprime and
 check flow.
- Sample preparation time: Depends on sample. Samples for fineness and micronaire analysis are required to be conditioned as per ASTM Test Method D1776, i.e. 24 hours passive conditioning under standard conditions. Maturity and ribbon width values do not require samples to be conditioned. An experienced operator can prepare (guillotine) and weigh four 50 mg test specimens from a conditioned sample within 10 minutes. On the basis that three test specimens are required per average means that 50 to 60 samples can be measured per eight hour day.
- Test time: One test specimen (20,000 snippets) takes less than 30 seconds to be measured and discharged from the instruments water bowl.

10. Reference method, reference materials:

Reference material: Cottonscope values have been judged against maturity, fineness
and ribbon width values produced by tedious examination of individual, magnified
fibre cross-sections. Relationships with equivalent values by these and other older
test methods are highly significant^{2 3}, particularly if the number of cross-sections
analysed is high (>3000) and the cross-sections are carefully prepared and measured.

² Rodgers J, Delhom C and Fortier C, Rapid measurement of cotton fiber maturity and fineness by image analysis microscopy using the Cottonscope. Text. Res. Journal 2012; 82: 259–271

³ Paudel D, Hequet E and Abidi N, Evaluation of cotton fiber maturity measurements. *Industrial Crops and Products* 45 2012, pp 435-441

- Calibration material: Cottonscope algorithms are calibrated using known cotton standards, e.g. USDA AMS calibration cottons, measured on the manufacturer's standard instrument.
- How to calibrate: The instrument calibration is reasonably stable, however it is recommended instruments should be calibrated on a six monthly basis using the same or similar calibration routine within the Cottonscope software. The calibration uses cotton and polyester fibre references that cover the entire range of measurements for maturity (M), fineness (H) and ribbon width (D). A minimum of five reference or calibration samples is preferred for each variable. Examples of current calibration reference values are shown in Table 1. The calibration procedure is progressed using the instrument's software. Follow software prompts to initiate, store and select calibrations.

TABLE 1 – Example of Cottonscope calibration fibre values

	Reference Resul	•		
Sample ID	H (mtex)	М	D (um)	X
31105	268.4	0.890	16.52	5.48
gm-39	136.1	0.598	16.27	1.92
5740	160.7	0.785	15.42	3.36
5741	193.8	0.888	15.35	4.45
5742	248.5	0.895	15.96	5.06
PL7*	-	-	27.54	-
PL12*	-	-	17.99	-
PL14*	-	-	13.05	-

^{*}Polyester staple fibre. Other listed fibre is cotton.

11. Applicable Standard Test Methods:

- ASTM Test Methods: D123 Terminology Relating to Textiles;
- D1441 Sampling of Cotton Fibers for Testing;
- D1442 Maturity of Cotton Fibers (Sodium Hydroxide Swelling and Polarized Light Procedures);
- D1448 Micronaire Reading of Cotton Fibers;
- D1776 Conditioning and Testing Textiles and
- D7139 Terminology for Cotton Fibers

12. Test Result Repeatability/Reproducibility

• Repeatability: Repeatability tests (same specimen in water bowl with test repeated ad nauseum) were performed with a range of reference cottons run over several days. No deviation from the quality control lines was observed (slope = 0).

Commented [jpg4]: From this table, and using Lord's formulas, we can calculate Hs which would vary from 200 to 300 here, while cottons can be easily selected between 120 to 400 mtex. It seems that the 'calibration' misses low Hs values unless by interpolation (which adds errors).

What can you tell for answering this limit? From Gutknecht, 1981 : distribution of Hs

The user is able to calibrate the system with whatever samples they choose.

It is all very well to calculate the potential standard fineness of a cotton but this value actually never eventuates. The values represented in the calibration set represent a wider range of values than is typically seen in commercial cotton.

Commented [jpg5]: ==> Sorry to insist, but our 40 years of experience in breeding varieties tells us that Hs is useful for breeders, but it is not the discussion topic here. The topic is about the distribution of materials to calibrate the instrument in H values that seems not exactly covering the range of existing cottons.

Therefore, the best would be to describe to the Committee through this document the conditions for calibrating this instrument; The stake here is to have various reading level between Cottonscope and other methods, including reference ones. So please report on:

- how is made the calibration of the intrument, what result is based on abosolute measurement, what is based on calculated / corrected data by a calibration process,

 which data has been used for calibrating the Cottonscope; indeed, Hequet 2006 data was obtained using Bugao Xu software that has evolved along time, and 4 years ago there was a discussion on the new dataset obtained from the Hequet 2006 images; it is then of importance to tell which data has been used for calibrating the Cottonscope.

Commented [jpg6]: Linked to 8-Testing procedure and this paragraph, the question of sampling s is of importance at all levels: within-sample variability, between samples variability depending on what is supposed to be represented by this/these sample(s), and repeatability / reproducibility. What could be told in addition about sampling then?

50 mg is quite small for one bale of cotton, and many questions could be raised according to the representativity of such

See Precision measurements plus ICCTM presentation from 2014 (now referenced)

The difference between repeat samples (different specimen from same sample measured repeatibly) tested in a typical laboratory using well trained operators will acheive coefficients of variation for the following properties: M < 1.7%, H < 5.0% and D < 1.0%

Reproducibility: The method has not yet been widely controlled for acceptance testing. Inter-laboratory trials to date have shown agreement and precision is excellent if instrument calibrations and test procedures are properly coincided.

- Precision: The measurement of a consistent quality, machine picked cotton using a test regime of one in three bales (with two specimens tested per bale sample), provided a precision of between 4 and 5% for micronaire, between 1.2 and 1.5% for maturity, less than 1% for ribbon width and between 6.8 and 7.5% for fineness⁴. These values incorporate sample and instrument variance but not inter-laboratory variance. Precision is improved by increasing the number of sub-samples measured per bale. It is noted these values (for micronaire and maturity) were similar or better than high volume instrument values⁴.
- **Bias:** For reliable measurement of fineness, care is required to precisely measure the weight of the sample. The average sample size is 50 mg and a 1 mg error translates to a 2% error in the fineness result.
- Differences: It is advised if there are differences of practical significance between
 reported tests for two or more instruments or laboratories, comparative tests should
 be performed to determine any statistical bias between them, using competent
 statistical analysis. Ideally, these tests are performed using the same homogenous
 material.
- **13. Comparison to reference method:** Cottonscope values have been judged against maturity, fineness and ribbon width values produced by tedious examination of individual, magnified fibre cross-sections. Relationships with equivalent values by these and other older test methods are highly significant^{2, 3}.
- **14. Comparison to other test methods in Round Trials:** No formal comparisons in Round Trials, e.g. the Bremen Round Trials, have been completed, although comparisons of Cottonscope results with other test methods have been published in peer review literature see reference list appended to this proposal.
- 15. Manufacturer-independent check: NA

16. External influences/measurement uncertainty:

- If sample preparation and calibration proceed according to established procedures
 then random variation between test results of the same sample are minimized. A
 balance with an accuracy to four significant places (0.0000 grams) is required to
 obtain accurate and precise snippet weights (50.0 milligrams).
- Variation due to specimen preparation arises when loose fibre samples are unduly
 compressed during cutting with the guillotine resulting in clumped fibre snippets
 that then do not disperse properly in the instrument's water bowl. To ensure this
 does not happen, or to limit this occurrence, fibres need to be oriented

Commented [jpg7]: Will you provide new information during the meeting n that topic? If yes, could they be included here?

The data has been submitted to the ASTM Inter-Laboratory Studies committee for an independent assessment. However, happy to append our own internal assessment of this data.

→ Please provide data set that the Committee could examine into this document, and that potential customers will be able to read here.

⁴ Gordon, S., Precision of Cottonscope data, Presentation to ICCTM Meeting, Bremen 2014.

- predominantly 90 degrees to the guillotine blade in a thin loose bundle that does not exceed a linear density of four grams per meter (4 ktex).
- Variation in specimen preparation between the guillotine and pneumatic corer can be countered by developing instrument calibrations specific to the preparation method.
- Specimen preparation areas (guillotine and balance) need to be kept clean of excess fibre snippets to avoid cross-contamination.
- The daily measurement of a control cotton fibre is recommended to ensure instrument stability is checked routinely. There is no method prescribed in this standard for preparing a control cotton. However, it is noted that a daily control cotton can be prepared by obtaining a large enough amount of the same cotton and ensuring that it is uniformly blended. Sliver from the drawing process in a mill represents an excellent control cotton for the Cottonscope, or cotton from a single bale that has been mechanically opened and then thoroughly blended.
- Accurate test specimen weight is important for precise fineness values. For the average specimen size of 50 milligrams, a one milligram error translates to a 2% error in the fineness value.
- The specimen should be free of plant trash (leaf, stem and seed pieces), dust and other contaminants. Very small fragments of trash and dust do not immediately effect the instrument's results, however it is understood that these may affect the clarity of the bath over time and thus the clarity of the image required for measurement. When the water bath clarity is affected, the instrument's software provides a warning that either the light level is too low or that the measurements are affected by blockages (fibre clumps, bubbles and/or trash). If this occurs then (i) the camera viewing area should be cleaned with a small brush, (ii) the water in the bath should be changed and/or (iii) samples should be cleaned ahead of specimen preparation.

17. Maintenance and Service:

- Instrument area should be kept clean.
- Water should be replaced weekly or more frequently depending on sample and throughput. Water changes are required more often if trashy and/or dusty cotton is being measured.
- 18. Additional information: See Operation Manual
- 19. Technical Data/Instrument Settings: See Operation Manual
- 20. Manufacturer contact:
- 21. Responsible ITMF ICCTM Coordinator:

Proposed reviewer: Dr Jean-Paul Gourlot (CIRAD)

22. Additional information for reviewers:

Pierce F and Lord E, The fineness and maturity of cotton, J Text Inst, 1939; 30: T173—T210.

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- Long R, Bange M, Gordon S and Constable, G, Measuring the maturity of developing cotton fibers using an automated polarized light microscopy technique, Text Res J, 2010; 80: 463–471.
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- Rodgers J, et al, Rapid measurement of cotton fiber maturity and fineness by image analysis microscopy using the Cottonscope, Text Res J, 2012; 82: 259–271.
- Gordon S and Naylor G, Cottonscope: A new instrument for maturity and fineness measurements. (A) Instrument design, In: Proceedings of the 31st International Cotton Conference, (Friedrich Marquardt ed.). March 21–24, Bremen, Germany, 2012, pp. 133–142. Faserinstuit Bremen e.V., Bremen, Germany.
- Rodgers J and Thibodeaux D, Cottonscope: A new instrument for maturity and fineness measurements. (B) Experimental results and experiences. In: Proceedings of the 31st International Cotton Conference, (Friedrich Marquardt ed.), March 21–24, 2012, Bremen, Germany, 2012, pp. 143–153, Faserinstuit Bremen e.V., Bremen, Germany.
- Paudel D, Hequet E and Abidi N, Evaluation of cotton fiber maturity measurements, Industrial Crops and Products, **45** 2012, pp 435-441.

Advanced Laboratory for Fiber Inspection ALFI_MDTA 4

G. Kugler, Textechno H. Stein GmbH & Co KG

ITMF Meeting of ICCTM, Bremen 2016

Textechno H. Stein GmbH & Co. KG Mönchengladbach, Germany http://www.textechno.com

1



Textechno H. Stein GmbH & Co. KG

1. History

- MDTA3 and QuickSpinn Unit have been developed by ITV Denkendorf (Dr. Arzt)
- In HOLINGSWORTH Neu Bulach the units have been produced for USTER Technologies
- In 1995 USTER gave up to sell these Units and SDL overtook the sales.
- When TRÜTZSCHLER overtook HOLLINGSWORTH, the MDTA 3 rights have been sold to SYSSEN
- TEXTECHNO bought the technology for the production of MDTA 3 in 2009 from SYSSEN

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Textechno Textile testing technology

2. Application of MDTA 3

Delivers the following data & information:

- Clean ability and fiber cohesion
- opening behavior and stickiness
- Supplies information on tendencies and influences resulting from different raw materials
- Provides information for accurate forecasting of yarn properties and their process ability
- Enables cost-effective compositions of various fiber materials

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3



Textechno H. Stein GmbH & Co. KG

2. Application of MDTA 3

Analysis and

- Dust content
- Prediction of: Trash content
 - · Fibre fragment content
 - Number of trash particles, neps, and seal-coat neps per gram¹
 - Trash and dust categorization
 - Stickiness²
 - Hairiness

- · Cleaning behaviour
 - Cleanability
 - Cleaning efficiency of machinery
- Yam structure and appearance
- Yam strength
- Yam elongation
- Imperfection

NOTE: From MDTA3 & QUICK Spinn Unit catalogue

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4



3. Disadvantages of MDTA3

- Manufactured by a machine producer, not by laboratoty tester manufacturer.
- Main purpose of usage : Testing the Non-lint content, fiber fragments, dust.
- Regarding this matter: Problems with the repeatability and accuracy, because the control of feed-in belt speed, rotor speed and feeding roller speed was not possible,
- Variation of these settings take influence on the result!
- Suctions in to RotorRing and impurities chambers direction can not be controlled exactly.

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5



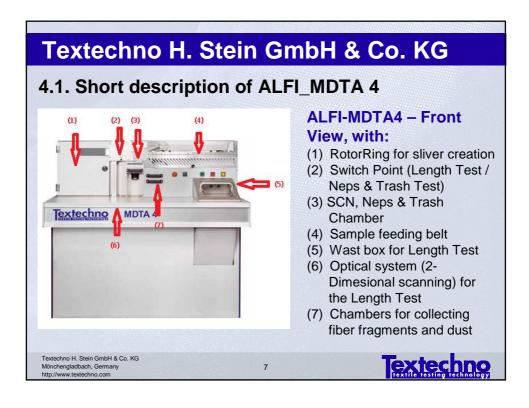
Textechno H. Stein GmbH & Co. KG

4. New system: ALFI_MDTA 4

- This development is a co-operation between the Textile Research Center ITV Denkendorf and TEXTECHNO GmbH & CO KG, Moenchengladbach
- New development of MDTA 4 was necessary in order to overcome with all the above mentioned disadvantages.
- Main purpose of new tester: Testing the Non-lint content, fiber fragments, dust like MDTA3 before, but with higher accuracy.
- Furthermore a system for the single fiber length testing has been developed and implemented in the new tester MDTA4.

Textechno H. Stein GmbH & Co. KG Mönchengladbach, Germany http://www.textechno.com





4.1. Short description of ALFI MDTA 4

The tester has following features:

- Both suctions are free variable
- speed of the moving belt is free variable
- speed of opening roller and feeding roller are variable

2. Fibre Length Test
Suction 1 100 % Suction 2 100 %
Feeding belt speed 0.3 tpm
Feeding roller speed 0.3 tpm
Opening roller speed 6000 tpm
Pre-feeding 1
Feeding blower frequency 0.2 turn Feeding blow length 0.5 s

Setting example for Fiber Length Test, to optimize the opening procedure

Textechno H. Stein GmbH & Co. KG Mönchengladbach, Germany http://www.textechno.com

Textechno textile testing technology

4.1. Short description of ALFI_MDTA 4

Following parameters are measured:

- Neps, SCN and trash content in gr and %
- Dust content and Fibre fragments content in gr and %
- Non-Lint content (according to ASTM)
- Trash -, SCN and Neps Count / g (with NTDA module)
- Fibre length distribution according to weight
- Fibre length distribution according to number of fibres
- Necessary work for opening bales/fibres (resistance against opening)
- Cleaning efficiency

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Textechno H. Stein GmbH & Co. KG

4.2. New feature for neps/trash testing:

Optionally part of ALFI_MDTA 4:

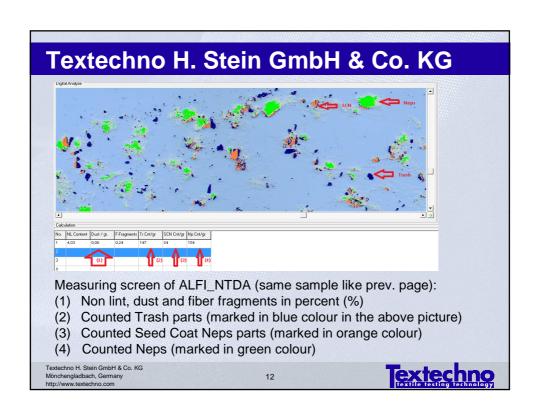
- ALFA NTDA module (for Nepsn Trash Testing):
 - consists of high resolution scanner and special image processing software.
 - Counts Neps, SCN and Trash parts per 1 gr,
 - Classifies Neps, SCN and Trash parts in 3 size classes (>0,5 mm, >0,75 mm, > 1,0 mm).
 - Sample size per test run 5 up to 10 grs (instead of 0,5 gr).
 - Operator can see with own eyes what he is going to test (refer next pages)

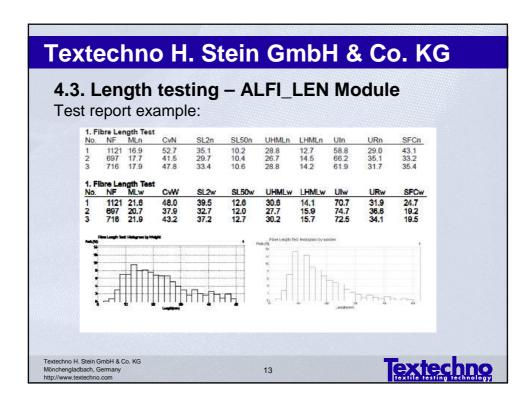
10

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Textechno textile testing technology





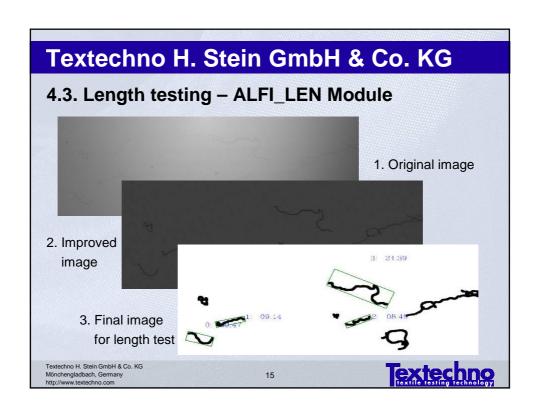


4.3. Length testing - ALFI_LEN Module

- The opend fibres are guided by an laminar air stream through a rectangular chamber with window size 7 x 9 cm.
- That window is observed by a high speed camera.
- The illumination is realised by a super light, flashing LED light source.
- The pictures what we are getting are store and evaluated one by one.
- The images are like shown on the next page...

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Textechno lexille testing technology



Length testing									
parison with diff	erent	testing c	ievic	es:					
Sample	Sample 1		Sample 2		Sample 3				
	ML [mm]	SF<12,5mm [%]	ML [mm]	SF<12,5mm [%]	ML [mm]	SF<12,5mr			
Testing device (location)									
Fiber length by number									
MDTA-4 (N)	24,2	12,1	22,5	16,3	23,5	10			
Almeter (ITV Denkendorf)	23,9	16,9	22,4	12,2	23,2	6			
Almeter (Rieter)	23,6	19,7	22,5	12,5	23,5	7			
AFIS (Rieter)	22,9	22,5	20,7	23,9	22,5	15			
ITV Single Fiber Test									
EFL (ITV)	25,2	15,7	21,5	22,2	22,9	11,			
Fiber length by weight									
MDTA-4 (W)	29,8	6,9	27,7	9,2	28,9	6			
Almeter (ITV Denkendorf)	29,4	5,9	26,2	4,5	26,8	2			
Fibrotest (ITV Denkendorf)	30,0	5.5	26,3	9.2	27,1	8			

5. Conclusion:

- With the ALFI_MDTA4 is a new testing device on the market, what measures the fiber length distribution according to number and weight of fibres as well as the percentage and numer of impurities, like trash, neps and SCN.
- Especially the short fiber content is due to the 2D measuring principle determined with a very high accuracy.
- In addition, for the measurement of the impurities of cotton, a complete new system is used, what makes the testing of the number of neps, SCN and trash parts more transparent.

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Textechno textile testing technology

Textechno H. Stein GmbH & Co. KG

Thank you for your attention.

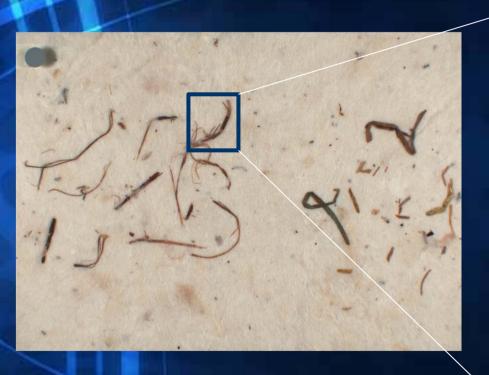
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High Resolution Imaging

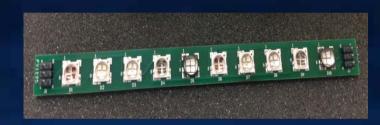




Basic Imaging Components for Cotton Classification



Digital Camera



LED Illumination





Computer Processing & Algorithms

Properties Measured by Future Imaging System

Current cotton classification:

Rd/+b color & area/particle count trash

Future cotton classification:



- Pixelated Rd/+b & L*a*b*
- Identification & quantification of specific types of trash (Leaf & Extraneous Matter)

Leaf EM

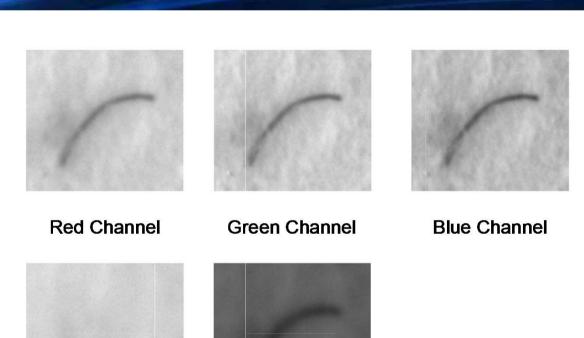
Color

Leaf, bark, grass, seedcoat fragments, prep, other

Imaging System Specifications

- Large area: 28 in² (181 cm²) vs. 9 in² (58 cm²)
- LED Illumination: visible & non-visible (NIR/UV)
- High-resolution image (2652x1768 vs. 640x480)
- Pixel analysis: visible color & non-visible (NIR & UV)
- High speed imaging/processing (≤12s)
- Quantification of particles:
 - Imaging system is not a classer
 - Percent Area & Particle Count for each EM type determined

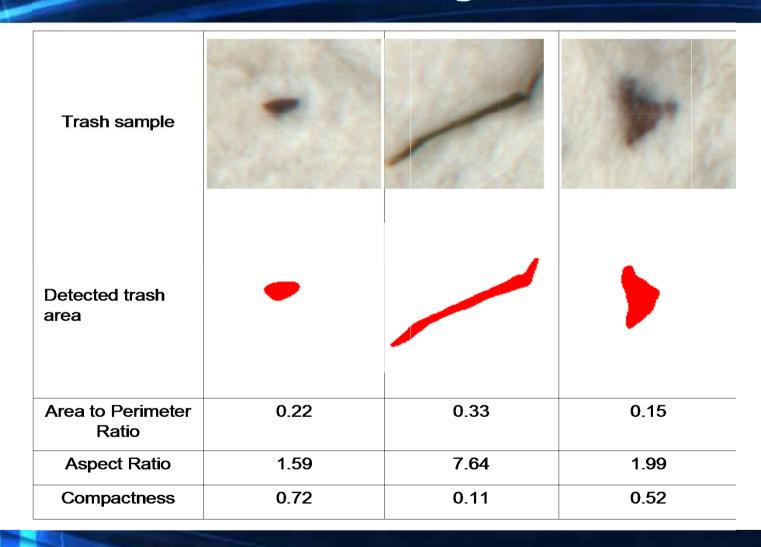
Particle Imaging



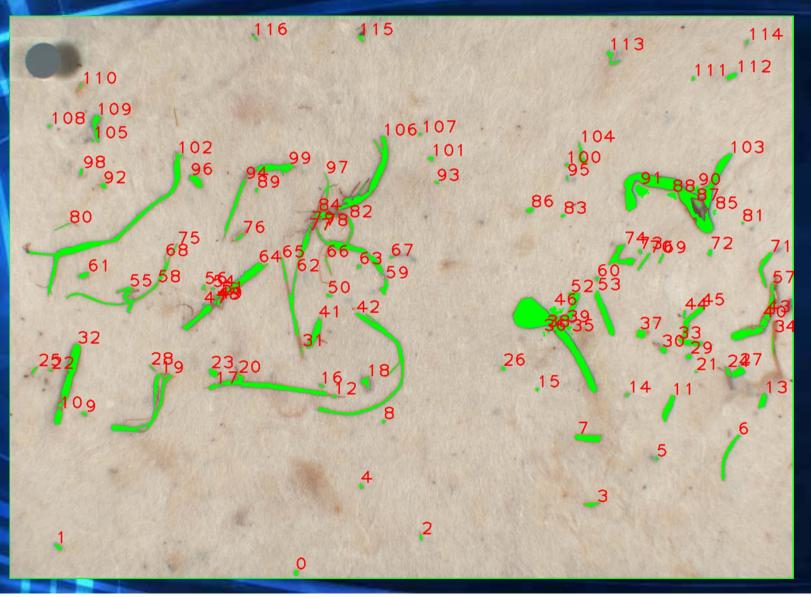
IR Channel

UV Channel

Feature Analysis



Every Particle Analyzed



Current Imaging Prototypes







Toyon



Steele



- Find what works best from the three manufacturers
- Continue algorithm development
- Develop standards for EM

Algorithm Development



1,000s of training samples measured



Sample Sets being developed





EM Sample Encapsulation



- Development of Imaging Instrumentation
- Algorithm Development
- Standards Development
- Instrument Conversion Table for Classer Calls
- Last step: Implementation in Classing System



RELATIONSHIPS BETWEEN HVI AND CCS AND TENSILE YARN STRENGTH

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There have been numerous researchers who elucidated the relationship between fiber properties and yarn properties. The quality of final yarn is largely influenced (up to 80%) by the properties of raw cotton. However, the level to which various fiber characteristics influence yarn quality is diverse, and also changes depending on the yarn manufacturing technology.

➤ Traditionally, four fiber parameters have been used to determine the quality value of cotton fiber. These are fiber strength, fiber length, fiber fineness and grade. The development of fiber testing instruments such as the High Volume Instrument (HVI) and the Advanced Fiber Information System (AFIS) has revolutionized the concept of fiber testing. With the HVI it is pragmatically possible to determine most of the quality characteristics of a two cotton bales within one minute.

► The Textechno CCS - Cotton Classifying System - a new generation of cotton testing instruments - is designed as a so-called MVI (Medium Volume Instrument), realizing a capacity of 20 tests per hour.

- In this paper, method of multiple regression analysis method was selected for establishing the relationships between fiber and yarn properties. The technological value of cotton was also determined by the two testing methods i.e., USTER- HVI and Textechno CCS.
- The ranking of cotton fibers produced by these two methods of testing was compared with the ranking of final yarn tenacity, and a rank correlation analysis was carried out.

M & M

▶ 8 Cotton varieties spun on different carded & combed yarn counts

Fiber Length (mm)	Varied from 28.18 - 36-13
Fiber Strength (G/tex)	Varied from 27.89 - 46.25
Fiber Fineness	Varied From 3.1 - 4.60
Carded Yarns (Ne)	30's & 40's
Combed Yarns (Ne)	80's, 100's , 120's, 140's

Yarn evaluation

- Tensile properties
- Single-yarn strength and breaking extension were measured on a Statimat ME "Textechno" instrument using a 500 mm gauge length and a 150 mm/min extension rate.
- Yarn evenness
- The yarn unevenness was determined on an UT4 evenness tester using a test speed of 400 m/min for 1 min. 10 readings were taken for each sample

- Statistical analysis
- Multiple regression analysis is the most common statistical method for estimation of the relationship between a dependent variable (Ŷ) and one or more independent variables (Xs). This method has the advantage of simplicity in describing the quantitative relationship between fiber and yarn properties

Results & Discussion

- HVI fiber properties and carded yarn strength
- As expected, a good prediction of yarn strength can be achieved by using Mike, HVI strength and Upper Half Mean (UHM):
- ► Yarn Strength = 3.1 + 0.126 UHM + 0.278 HVI Strength 0.186 Elongation + 0.52 Mike,
- ► (R-Sq = 83.9%, Adjusted R-squared = 80.5%, p<0.000, Standard error of estimate = 0.576509).

HVI fiber properties and combed yarn strength

- A good prediction of yarn strength can be achieved by using HVI fiber properties (micronaire Reading, HVI strength and UHM.)
- Yarn Strength = 13.6 + 0.283 UHM + 0.332 HVI Strength 0.140 Elongation 3.72 Mike,
- ► (R-Sq = 58.5%, Adjusted R-squared = 55.7%, p<0.000, Standard error of estimate = 8.43731).

CCS fiber properties and carded yarn strength

- As expected, a good prediction of carded yarn strength can be achieved by using HVI strength, Upper Half Mean (UHM) and the micronaire reading.
- ► The regression equation is:
- Strength = 5.5 0.156 UHM + 0.407 HVI Strength + 0.056 Elongation + 0.19 Mike + 0.107 Absolute STR (R-Sq = 80.7%, Adjusted R-squared = 75.3%%, p<0.000, Standard error of estimate = 0.648750).</p>

It means that better is the HVI strength and UHM. The elongation and absolute strength ranking the last properties could be affecting in yarn strength.

CCS fiber properties and combed yarn strength

Dobviously, fiber strength is the most important factor for yarn tenacity, also micronaire reading becomes the foremost property among those of CCS, in addition the data shown very high negative correlation coefficient between micronaire reading and yarn strength.

- ► The regression equation is:
- ► Strength = 15.8 + 0.880 UHM + 0.417 HVI Strength + 0.132 Elongation 2.01 Mike + 0.097 Absolute STR (R-Sq = 60.2%, Adjusted R-squared = 56.8%, p<0.000, Standard error of estimate = 1.82439).

CCS fiber properties and combed yarn breaking elongation

Prediction models dealing with the breaking elongation of cotton yarns are few in number. In linear regression analysis the relationship between dependent variable and each independent variable should be linear.

- ► Curve estimation analysis showed that the CCS properties value will relate linear to yarn elongation by the following regression equation form:
- ► Elongation = 0.91 + 0.134 UHM 0.0345 HVI Strength 0.0285 Fiber elongation + 0.129 Mike + 0.0093 Absolute STR, (R-Sq = 5.0%, Adjusted R-squared = 0.003%%, p<0.691, Standard error of estimate = 0.529757).

THANK YOU

LABORATORY COTTON FIBER MOISTURE MEASUREMENTS with the AQUALAB MICROWAVE INSTRUMENT

2016 ICCTM MEETING Bremen, Germany March 15, 2016

Not published !!

James Rodgers, Jimmy Zumba, Chris Delhom
USDA-ARS-SOUTHERN REGIONAL RESEARCH CENTER (SRRC), NEW ORLEANS, LA

Miniature and Small-Scale Spinning: Revisited

Christopher D. Delhom

USDA-Agricultural Research Service
Cotton Structure and Quality
New Orleans, LA USA

Why miniature and small-scale?

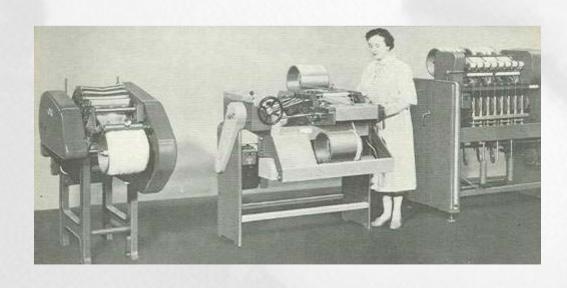
- High throughput hundreds to thousands of fiber to yarn samples
 - Breeder selections
 - Researchers
 - Production
 - Ginning
 - Fiber Quality
- Fiber alone doesn't tell the whole story
 - Yarn and Fabric are often needed

What is miniature and small-scale?

- Miniature
 - Traditionally 50-100 grams
 - At USDA-ARS 30-120 grams: 60 g is ideal
- Small-scale
 - Traditionally kilograms not bales
 - At USDA-ARS 360-720 grams
- Neither includes full pilot-scale processing (1/4 bales, etc)

Platt Brothers

- Platt Brothers
 - Fixed flats "mini-card"
 - Limited draft drawing system
 - Sliver to yarn ring spinning
 - Available via SDL Atlas within the last 10 years

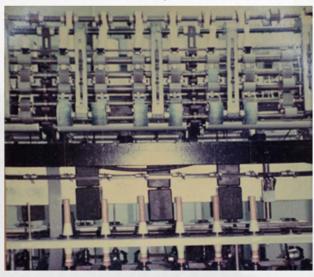






USDA-Knoxville

- Landstreet, et al
 - Modified full-size card
 - Custom-manufactured draw frame
 - Sliver to yarn ring spinning
 - Traditionally Ne 22s
 - In Use by USDA until ~11 years ago







CSIRO

- Hybrid of Platt and Full-Scale Equipment
 - 170g sample size
 - Platt card and draw frame
 - Full-size draw frame, roving frame, spinning frame









USDA-ARS Miniature-scale

- 60g typical sample size
 - Modified full-size card
 - Commercial draw box
 - Sliver to yarn ring spinning



- Typically Ne 22 or Ne 30, can produce Ne 50+





USDA-ARS Small-scale

- Multiple 60 g lots
 - Same carding drawing equipment
 - Each lot becomes one or more doublings
 - Double-creeled sliver on the roving frame
 - Ring spinning from roving on either commercial frame or Lab Spinner
 - No yarn size limitations



Data!

Measurement and Control of Drafting Forces: Using the Draftometer for Ring Spinning Improvements

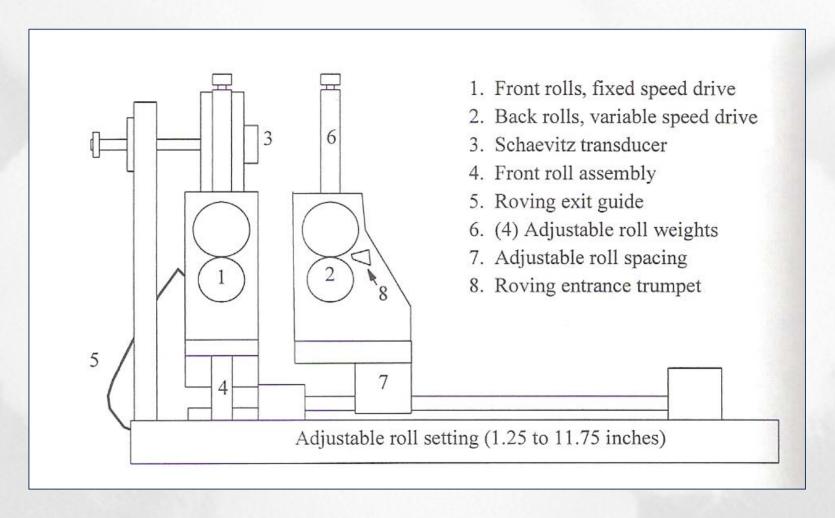
C.D. Delhom

USDA-Agricultural Research Service
Cotton Structure and Quality
New Orleans, LA USA

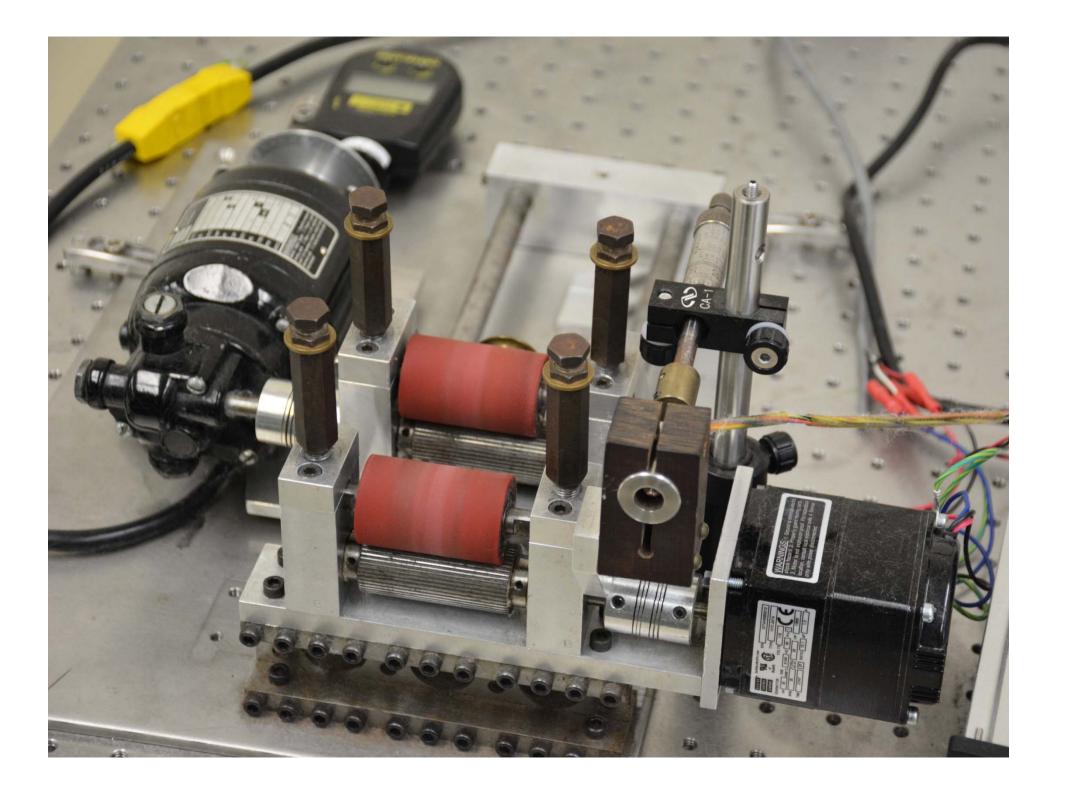
Draftometer?

- Measures drafting forces
- Used to determine critical draft
 - Critical Draft?
 - Draft at which the fiber strand becomes highly unstable
 - Also known as "stick-slip"
- ITT work concluded that break draft should be set 10% below critical draft
 - In lieu of changing break draft, roving twist can be adjusted to move critical draft at a given break draft

Draftometer



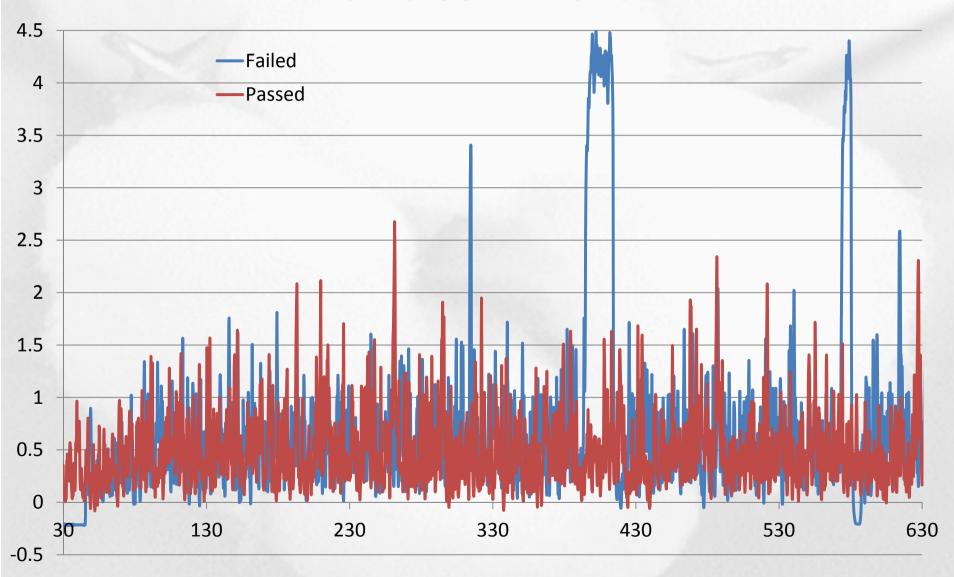
Schematic from "Short Staple Manufacturing" McCreight, et al



Critical Draft

- Factors known to impact critical draft:
 - Roving size
 - Twist
 - Tension
- Unknown factors:
 - Fiber quality
 - Length
 - Fineness
 - Surface characteristics?
 - Convolutions?
 - Frictional properties?

Critical Draft



Motivation

- Properly constructed roving produces more uniform yarns with decreased ends down
- Break Draft can be difficult to change
 - Gearing/roll spacing on spinning frame
 - Draft distribution concerns
- What is appropriate roving twist?

Draftometer is sensitive and time consuming

Previous Work

 Mill trials have shown occasional inconsistencies in draftometer results between replications of lots

 What role do fiber properties play in determining drafting forces?

Method

- Full bale quantities were carded and drawn
- Draftometer used to determine optimum twist level for 1.0 hank roving draft for each cotton
 - 7 twist levels of roving to be produced for each cotton
 - 1. Use twist gear for optimum twist level
 - 2. Critical Twist gear +1 tooth
 - 3. +2 teeth
 - 4. +3 teeth
 - 5. Critical Twist gear -1 tooth
 - 6. -2 teeth
 - 7. -3 teeth

Method

- 3 doffs of Ne 30/1 with 3.8 TM @ 16,000 rpm
- Ends down recorded
 - Quantity, position and type of ends down
- Yarn Quality
 - Uster Tester CV%, Tenacity, Classimat

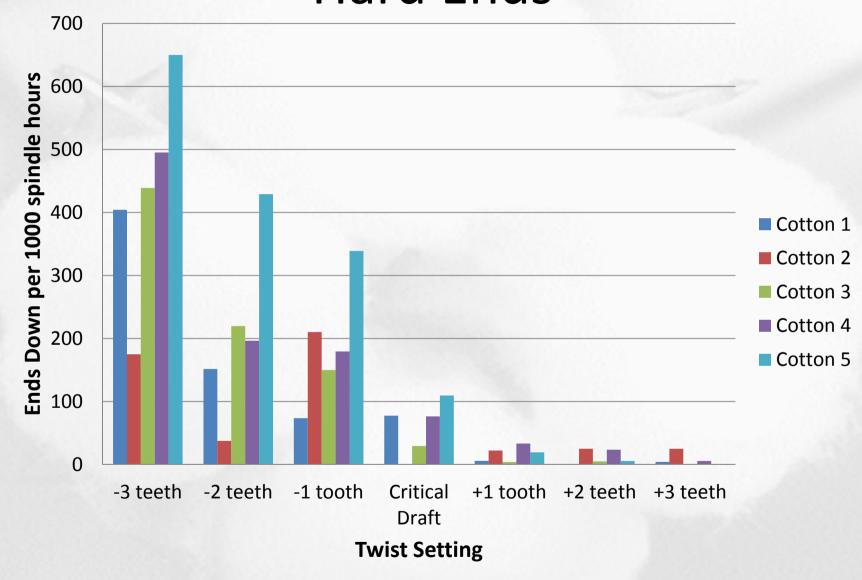
Draftometer Results

Cotton	Twist Gear	Twist Multiple
1	38	1.33
2	32	1.58
3	31	1.63
4	38	1.33
5	38	1.33

tpi = TM *(Roving Hank)^{1/2}

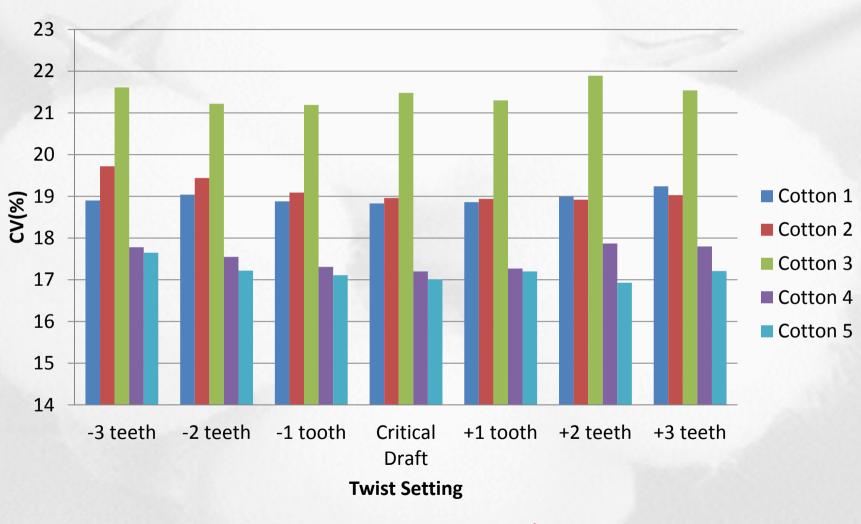
Twist gear as determined by Draftometer: Critical draft – 10% Break Draft fixed at 1.31

Hard Ends



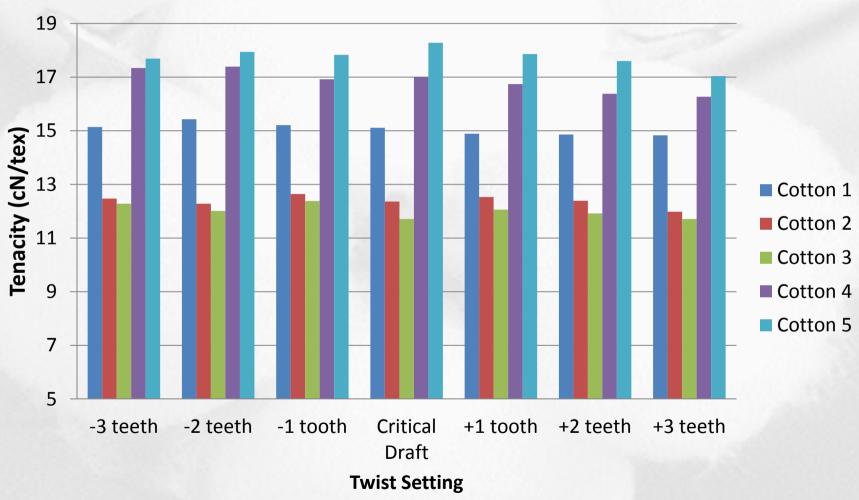
Less Roving Twist

Yarn Uniformity



Less Roving Twist

Yarn Strength



Less Roving Twist

Conclusions

- Further work is needed to asses the -10% recommendation
- Differences between front and back roving frame positions do exist due to tension
- Role of tension changes with package size needs to be examined
- No clear fiber property /drafting force interaction understood at this time
- More work is needed!