International Committee on Cotton Testing Methods (ICCTM)

Progress Report 2021

Proceedings of the Virtual Plenary Meeting of the ITMF-International Committee on Cotton Testing Methods (ICCTM)

Tuesday, March 16th, 2021
13:00-16:30 hrs. (Central European Time)
07:00-10:30 hrs. (US Central Standard Time – daylight saving)
23:00-02:30 hrs. (Australian Eastern Standard Time)

At the Bremen Cotton Exchange, Bremen, Germany
& worldwide

Chair:	Axel Drieling, Faserinstitut Bremen e.V., Germany
Vice Chair:	Mona Qaud, Uster Technologies AG, Uster, Switzerland
Secretariat:	Dr. Christian Schindler, ITMF, Zurich, Switzerland

Preface

The International Textile Manufacturers Federation (ITMF) founded in 1904 is an international association for the world's textile industries, dedicated to keeping its world-wide membership constantly informed through surveys, studies and publications and through the organisation of annual conferences, participating in the evolution of the industries basic raw materials and their application, through specialised committees, with the overall objective of creating growth and prosperity in all aspects of industry.

The International Committee on Cotton Testing Methods (ICCTM) is a non-profit technical subcommittee of ITMF. The main function of the Committee is to encourage research and development for enhanced cotton testing methods, to recognize suitable test methods and instruments, to identify reference test methods, to harmonize cotton testing results and to discuss testing related problems.

The mandates of the Committee are:

1. Encourage research into the basic science needed to develop commercially useful tests.
2. Encourage the development of enhanced testing methods.
3. Recognition of instruments and testing methods that are beneficial for the cotton value added chain, being able to perform within allowable tolerances, and achieving results that correlate with a reference method.
4. Identification of reference methods.
5. Harmonize cotton testing results by means of
    a. proposition and support for the international standardization of test methods
    b. development of guidelines for testing
    c. technical evaluations using world-wide round tests.
6. Discussion of problems related to testing of cotton fibre properties and their relations to cotton processing.

Introduction

Axel Drieling, chair of the ICCTM, welcomed the members and observers of the ITMF International Committee on Cotton Testing Methods (ICCTM) in Bremen, which took place this year as a virtual meeting, and was held before the virtual International Cotton Conference Bremen. More than 65 persons attended this year's meeting from many different countries like Australia, China, India, Switzerland, USA, etc.

As the meeting was recorded the attendants were informed in the beginning that they could turn off their camera on their device if they did not want to be part of the recording.

Axel Drieling presented the agenda of the meeting. Preceding the individual group meetings, we had elections, followed by the session in the fields of Instrument Recognition, Colour, Fineness & Maturity, Spinnability, High Volume Instrumentation & Length, Stickiness, Neps & Trash. Traceability was a new topic which was discussed during the meeting.

Interested parties are always welcome to ask for membership at the ITMF by sending an email to secretariat@itmf.org. Members have access to the ITMF-ICCTM-Website, which allows the members of the Committee to find all relevant documents, including all presentations of this meeting, and also addresses and the option to send emails to all members.

Elections

Due to the retirement of James Knowlton (USDA) in 2020, the chair of the Neps/Trash was vacant. From the USDA, we obtained the nomination of Ms. Gretchen Deatherage, who is responsible for the Standardization at USDA AMS in Memphis. No other nominations were received. The nomination was seconded by a few members of the committee. The vote was without abstains and without dissenting votes. Hence, Ms. Gretchen Deatherage was elected as a member of ICCTM Executive Committee mainly responsible for Neps/Trash.

Since 2012, no specific tasks are listed anymore, but a joint Executive Committee is looking after all relevant topics. The ICCTM Executive Committee consists now of the following persons:

- Mr. Axel Drieling (Chairman)
  Faserinstitut Bremen e.V. (FIBRE), Germany,
  contact: drieling@faserinstitut.de
- Mrs. Mona Qaud (Vice Chair)
  Uster Technologies, Uster, Switzerland,
  contact: mona.qaud@uster.com
- Dr. Stuart Gordon
  CSIRO, Waurn Ponds, Geelong, Australia,
  contact: stuart.gordon@csiro.au
- Dr. Jean-Paul Gourlot
  CIRAD, Montpellier, France,
  contact: jean-paul.gourlot@cirad.fr
- Dr. Malgorzata Matusiak
  Lodz University of Technology, Poland,
  contact: malgorzata.matusiak@p.lodz.pl
- Dr. Marinus van der Sluijs
  TTS, Geelong, Australia,
  contact: sluijs@optusnet.com.au

And as a new member

- Ms. Gretchen Deatherage
  USDA AMS, Memphis, USA
  contact: gretchen.deatherage@usda.gov

The Steering Committee comprises the following members:

- *Dr. Terry Townsend* *(Coordinator of the Steering Committee) Cotton Analytics, USA*
- *Mr. Darryl Earnest* *USDA-AMS, Memphis, USA*
- *Mr. Karsten Fröse* *Bremer Baumwollbörse, Germany*
- *Mr. Kai Hughes* *ICAC, Washington D.C., USA*
- *Mr. Andrew Macdonald* *ITMF Spinners Committee, Brazil*

Recognitions (coordinated by Dr. Jean-Paul Gourlot)

Mr Branca informed Axel Drieling before the meeting that the preparation work for the recognition was not finalized up to now due to the Corona-pandemic. Mr Branca is continuing this work and is hoping to present at the next opportunity.

Colour (coordinated by Dr. Malgorzata Matusiak)

	Presentations	
	Author	**Topic**
2	Dr. Malgorzata Matusiak, Lodz University of Technology	Introduction into Colour measurement

Dr. Malgorzata Matusiak introduced the different methods of colour assessment in cotton fibers. Besides the subjective way of trained cotton classers also instrumentation is used, such as modules insides SITC-instrumentation (Uster Technologies, Premier, Mesdan, MAG) which determine the +b and Rd value and calculated the Color Grade thereof. Other instruments such as manufactured e.g. by Textechno, Datacolor, or Hunterlab determines the color values L*, a* and b* values with a spectrophotometer. Potential future topics in color measurement she sees in monitoring and improvement of reproducibility and repeatability of HVI color measurement, in establishing the relationship: **Rd, +b vs. L*, a*, b*** and the development of new methods and instruments for color.

The full interpretation guide, including the introduction to the color testing methods, is available here: CSITC-website; ITMF-website, ICAC-website.

Fineness / Maturity (coordinated by Dr. Stuart Gordon)

	Presentations	
	Author	**Topic**
3	Dr. Stuart Gordon, CSIRO, AUS	Cross sectional variation along fiber length

Dr. Stuart Gordon gave an update of changes in methods and instrumentation to measure cotton fiber fineness and maturity. No new commercial instrumentation for measuring these properties has been introduced over the last three years. An ASTM draft standard for the Cottonscope instrument has been reviewed and made ready for a final ballot.

Dr Gordon provided results from a small recent study examining the measurement of fineness and maturity along the length of fibres and the assessment of instrumentation that could be applied. Measuring fineness and/or maturity along the length of a fibre is difficult via traditional cross-sectional (XS) analysis approaches but could provide additional information on managing fibre development and resulting processing properties such as dyeing ability

and fibre breakage. Fibre samples for this study came from the field (same variety at different times of sowing (TOS)) and Texas Tech's reference cottons.

Samples were assessed using the Cottonscope and SIFAN 4 instruments. Cottonscope specimens were cut and partitioned in quartile lengths from the tip to the base from seed-cotton samples. It was found linear density in the TOS samples, as measured by the Cottonscope, differed from 120 mtex at the tip to 160 mtex at the base along the fibre length with ribbon width similarly differing from 14.5 um to 15.2 um. Maturity values also reflected similar albeit smaller changes from tip to base. Individual fibre samples from the Texas Tech reference cottons were also examined using the SIFAN 4 without knowledge of their tip or base direction and also showed a taper. Coarser, more mature fibres had less taper between the base and tip.

Measuring fibres using the SIFAN 4 and 5 was made difficult by fibre static build up and the instrument's clamp design, originally intended for wool, which reduced the measurement length of nominally >30 mm fibres to 8 to 10 mm. Improvement in the clamp design would make the SIFAN a valuable tool in assessing the XS properties of single cotton fibres, especially with the SIFAN 5's ability to measure single fibres at eight different angles and using a polarized filter to perhaps determine fibre maturity.

Dr Robert Long from CSIRO Agriculture and Food and his work on the development of a NIR method for measuring cotton boll maturity, to be presented later in the main conference, was also introduced.

Spinnability (coordinated by Dr. Marinus (René) van der Sluijs)

	Presentations	
	Author	**Topic**
4	Dr. Marinus van der Sluijs, TTS, AUS	Demands from spinning to cotton testing

As this topic deserves a lot more time to discuss fully, Dr. Marinus v.d. Sluijs opted to only report a few points. The production of yarns is mainly conducted on three different spinning systems (Ring, Rotor and Air-jet) of which Ring is the most popular due to its versatility and superior yarn quality. The basic principle of yarn manufacturing is in essence to first align a certain number of fibers, then to insert twist to provide strength, and finally to wind the yarn onto a package for use in fabric manufacture. These processes are fairly straight forward providing that the equipment is well maintained, set-up correctly, the correct atmospheric conditions as well as importantly having the desired fiber quality. Fiber quality plays a major role because:

- Raw material accounts for 50 to 70 % of yarn manufacturing costs.
- Purchasing the right cotton at the right price makes the difference between profit and loss.
- Fibre quality must be accurately known to guarantee yarn quality.
- Consistent lay downs based on fibre quality is essential for efficient mill operation.

There are also some further complexities to consider:

- Production of non-traditional yarns (slub, core, technical, mélange, fancy, low twist, compact)
- Blends with other natural fibers
- Blends with MMF

In terms of test methods; the development of the various methods can be distinguished into four distinct phases:

1. The first being that of 'hand and eye,' i.e., subjective quality designations.
2. The second phase (1920-50) saw the development of classical methods, i.e., direct (if time-consuming) measurement (i.e., Stelometer, Comb sorter).
3. The third phase arose from the demand from the industry for quality-control methods (1950-70), produced numerous and rapid methods for mill use, many of these utilizing indirect measurements of fibre properties (i.e., Fibrograph, Micronaire).
4. The current phase is the development of completely automated, fast methods (i.e., HVI, AFIS).

Currently, cotton is still classified by using all of the above-mentioned test methods and although some new test instruments have been released over the last few years of concern is that no new instruments have been developed to take over from HVI and AFIS which are almost 50 and 40 years old, respectively.

From a spinning perspective the most important fiber quality parameters are length, strength, fineness (micronaire), trash and color which are therefore the most relevant parameters to purchase and sell cotton. There are however other fiber properties such as neps, short fiber content, seed coat fragments, elongation, stickiness, maturity and fineness, or contamination which are also important, with some being directly influenced by the more important parameters.

In the future it is hoped that testing methods will replace the subjective measurements and that online measurements will become more common, and that universal testing instrumentation will be developed to enable the testing of a variety of fibers. Also, fiber quality testing could be done as early as possible, e.g., in the field or at the gin. Testing and test results should be comparable for cotton and other fibres that are processed with cotton. Finally, the need to train more textile technologists and more education and training on fiber quality at the beginning of the cotton textile chain, i.e., breeders and growers would be hugely beneficial.

High Volume Testing (coordinated by Axel Drieling)
Length/Strength (coordinated by Mona Qaud)

	Presentations	
	Author	**Topic**
5	Dr. Guntram Kugler, Textechno, DE	Tensile tests on Cotton fibres – Relation between strength and elongation
6	Eric Hequet, Texas Tech, USA	Stability of HVI Calibration Standards for Bundle Elongation Measurements
7	Chris Delhom, USDA, USA	Elongation Round Trials

Dr. Guntram Kugler of Textechno reported on the Fibrotest, where the effective bundle weight of the fiber sample is measured gravimetrically (in mg) – that allows to calculate the linear density (tex) – and apply the pre-tension of 5cN/tex onto the bundle (fitting to ISO 2062, ASTM D2256). Test on 8 US upland cotton samples were performed over 5 days, and data of HVI 1000 and Fibrotest compared. The corelation of Strength Favemat and Elongation Fibrotest showed a clear connection of the two – whereas the data of Strength of Favimat against Elongation of HVI was for 7 samples rather between 8-9%, one sample at 5.5% Elongation.

Another trial was performed with 25 Egyptian samples. With Fibrotest a correlation between strength and elongation was seen. Based on those trials, they suggest a formula to predict the elongation from other data, such as Strength and Micronaire.

Dr. Eric Hequet of TTU, Texas reported for few years on some projects on measurement of fiber elongation. Fiber elongation is heritable and can be improved through breeding methods – and in the end will also improve the work-to-break behavior of the fiber. However, while HVI testing does provide a measure of fiber bundle elongation, it is not calibrated, so measurements between instruments cannot be compared reliably. High and low elongation calibration cottons were produced by the FBRI and tested on 3 HVI's.

Uster calibrated with a one-point calibration before the tests were performed → the tests that were conducted after calibration the HVI's exhibits comparable elongation levels, and the calibration is stable over a long period of time. However, Dr. Hequet strongly suggests using a two-point calibration to improve stability and comparability over multiple instruments.

Chris Delhom of USDA-ARS presented a joint study in conjunction with Cotton Incorporated (Vikki Martin), and TTU Lubbock (Eric Hequet), based on the elongation calibration samples from TTU. He presented the sample before and after calibration, which showed that a Elongation calibration clearly levels the results, and clearly lowers the day to day variation within one instrument, but also between variation from instrument to instrument. The respective results of Elongation round trials were presented by Chris Delhom during the Bremen Conference.

Stickiness (coordinated by Dr. Jean-Paul Gourlot)

	Presentations	
	Author	**Topic**
8	Dr. Jean-Paul Gourlot, CIRAD, F	Stickiness Round tests and future planning
9	Dr. Gabriele Salvinelli, Mesdan, IT	Summary of 2020 recognition to committee

In total, 8 Round tests were organized since 2017 by CIRAD, Faserinstitut Bremen and the Bremen Cotton Exchange with the lead of Dr. Jean-Paul Gourlot who presented the findings. The methods used in this were mainly: Benedict, Caramelization, Clinitest, Contest-S, H2SD, KOTITI, Minicard, Qualitative and Quantitive methods, Reactive spray, and SCT. As each method shows its values on a different scale, it is difficult to compare mean and variability values in the tests for comparing instruments within methods, or between methods. In these conditions with raw data being on different levels, choosing the 'best' methods cannot rely on CVs of the measurements between methods as CV values depend on the mean observed values. Therefore, Dr. Gourlot proposed to re-scale the laboratories raw results using a common scale to compare results (mean and variability) of the involved methods. As an additional topic, even if it is difficult to produce reference materials, attempts are ongoing to check if stickiness level of these materials remain stable and useful over a period for stabilizing raw results over time. Finally, he also called for laboratories to participate in the round trials and if possible, to propose sticky materials to be then shared in the future round-trials (all past RT results are on https://www.itmf.org/committees/international-committee-on-cotton-testing-methods). Another presentation on the RT programme was also given in the main conference focussing on the lessons that can be drawn up to this point in time.

Dr. Gabriele Savinelli summarized the recognition of the Contest-S method (the recognition process requires the description of the method and of its results according to a given format). Repeatability and reproducibility results were presented based on samples taken from materials that were homogenized. All materials and samples covered the whole detection range of the Contest-S method and were tested several times. Results showed good relationships to other thermo-mechanical methods and to the reference method.

A possible contamination effect from sample to sample was also tested by alternating tests of sticky and non-sticky materials on the instrument; this experiment proved that contamination

did not occur between successive samples. In sum, repeatability, reproducibility, contamination tests passed, and no dependency of the operators could be detected using Contest-S. So Contest-S was recognized in the virtual meeting in March 2020 and in a subsequent e-mail vote by the ITMF-ICCTM, and obtained the 'recognition certificate' (the recognition full document can be found on https://www.itmf.org/committees/international-committee-on-cotton-testing-methods). Dr. Salvinelli also presented the instrument in the main conference focusing on the correlation between instruments.

Neps/ Trash (coordinated by Gretchen Deatherage)

	Presentations	
	Author	**Topic**
10	Gretchen Deatherage, USDA, US	Summary of Activities for Trash Measurement

Gretchen Deatherage shared some information on updates for the trash measurement within USDA. The instrument classing of the leaf grade has been fully implemented since 2011 for the US cotton crop. The cotton testing instruments utilize a window size of 9 in^2 (58 cm^2) to measure the trash percent area and trash particle count.

In 2014, Universal HVI Cotton Trash Standards became available, which are images of cotton under glass, and represent standard values for trash percent area and trash particle count. Next steps for improving trash measurement include detection of extraneous matter, i.e. bark and grass contents of the samples. For that, a larger measurement window, high resolution imaging, and a high-speed analysis of the captured images has been investigated along with analysis of visible and non-visible (NIR /UV). Three prototypes of imaging systems were evaluated during 2015-2018: QES, Toyon and Steele. All met current colour and trash measurement standards. However, the algorithm for extraneous matter remains a challenge, and the NIR and UV imaging showed mixed results. In 2019, two next generation prototypes by QES LLC were acquired for colour/trash imaging and are currently being evaluated. The data output is comparable with the current USDA trash measurement. There are plans to examine even larger measurement areas, examine the extraneous matter detection algorithms, and also begin the development of extraneous matter standards for establishing thresholds and assessing the performance of detection algorithms.

Traceability (coordinated by Axel Drieling)

	Presentations	
	Author	**Topic**
11	Karsten Fröse, FIBRE, DE	Overview of traceability tools
12	Gediminas Mikutis, Haelixa, CH	Traceability with a DNA spray
13	MeiLin Wan, Adnas, US	Traceability – multilayer approach *(Not available)*
14	Stefan Ziegler, WWF, DE	Traceability with Isotope

Karsten Fröse gave an overview of the different approaches. Traceability from field to fabric is difficult due to the blending of fibers in the different process stages – there is a need for easy and reliable tools to recheck the materials used. There are the producers on one side – who need to show that they comply with certain standards, and there are the retailers on the other side, who need to keep the trust into the brand. On the brands view, they fight against copies of products, want to ensure that legal requirements are met, to finally be able to keep consumers trust and thus keep the price premiums and hold market shares.

Either by adding markers to the materials (DNA as by Haelixa and Applied DNA Science or marked fibers by Fiber Trace and Taylorlux) or add certain particles into the materials, to be able to identify and quantify a type of cotton. The other option is by checking the characteristics of fibers (DNA: Barbadense, GMO), or the Isotopes (as used Oritain, WWF) or check protein characteristics of the fibers.

Gediminas Mikutis from Haelixa showed that there is a challenge for linking the physical product with the information of origin (certificates, ERP info) – a change, a mix-up or exchange cannot be detected. Therefore, they mark the fibres with a spray that has a unique DNA, that can be marked at farm, gin or spinning mill, to be able to re-identify the material in case of claims. So, each physical product can be identified also at a later stage in process.

The marker could be sprayed as a fine spray at the bale opening stage or alternatively later in the yarn dyeing process or fabric finishing process. The verification can be done by "flushing out" the marker as a PCR test, without destroying the product. The marker is protected and passes all process steps from mechanical and chemical treatments that are typical in textile processing from farm to end-product (including washing, oxidizing, bleaching, dyeing): Example: http://clearview.cactus-ag.ch/):

MeiLin Wan from Applied DNA Sciences, Inc. gave an introduction to their certainty assurance platform. Focus is on molecular DNA testing, providing the service now for over 10 years specifically in textiles, micro circuits, and luxury goods. So far more than 300 million pounds of genotyped cotton (Costco, Bed Bath & Beyond) have been included (also recycled PES by Walmart or Amazon) and they partner with Louis Dreyfus for 9 years.

Their platform is CertainT, for a wide range of materials, viscose, hemp, cotton, leather, wool, in flock and yarn stage. The concept is to link the fibre to the to the finished product, in an end-to-end process. The material is tagged, can be tested in lab or field (Genotyping, Isotope, NGS), and then the material can be traced via their cloud data. The approach is multi layered, started in DNA, and genotyping the material in addition, and incorporated the isotope analysis. Key point is that not everything fits to everything, therefore they use a multi-layered approach of combining the analysis for each specific purpose.

A tagging system in cotton, supported by Louis Dreyfus, works at the gin, and applies a molecular tag at the gin, besides bale ID, type, variety, date, time, location. Portable testing will be required in the future, and Applied DNA works on production testing, to prove that the material is what it claims to be.

Summarizing, a multi layered solution is needed for being able to cover different prerequisites and necessities.

Stefan Ziegler explained how WWF (World Wide Fund for Nature) is tracing the origin of cotton fibres. As different origins of crops have different chemical signatures, due to climate, soil, which are imprinted in the cell tissue, this is like a fingerprint on the fibres. So, the Isotope distribution values show the regional structure due to different climate conditions. Based on some samples from 11 countries, 55 cotton samples were analysed, and showed well clustered results, and it could be traced in the correct country of origin to 73-100% of the cases. However, there still can be false positive values. Experiments were done in the food / nutrition business, and they try to apply this method for textile materials.

Bremen Round Trial additions

Axel Drieling mentioned that the Faserinstitut Bremen is planning to add gravimetric trash testing from 2021 on in the ICA Bremen Cotton Round Trials. This will mean to send larger quantities of material to some of the participants.

Closing of the Plenary Meeting and Final Remarks

Axel Drieling summarized the findings and discussions of the Meeting.

The Plenary Meeting of the ITMF-ICCTM will take place two to one days prior to the Bremen Conference at the end of March 2022 in conjunction with the International Cotton Conference Bremen – hopefully as an in-person meeting in Bremen, Germany.

He also stated that the Committee is publishing its HVI Testing Guideline in several languages on these websites: CSITC-website; ITMF-website, ICAC-website. In 2020, an additional guideline for interpreting cotton properties and test results has been finalized and published in addition. This includes mentioning the existing test methods, comparisons to manual classing, use for cotton production, ginning, trading, spinning mills and textile processing. The coordinators of the ITMF-ICCTM are the main contributors for this guideline in addition to the support from Ms. Vikki Martin and Mr. Chris Delhom.

The Executive Committee and its Chairmen will be happy to see all interested people in Bremen, Germany, in March 2022.

Dr. Schindler thanked the Chairpersons, Axel Drieling and Mona Qaud, for the preparation and organisation of the meeting and the Task Force Coordinators for their support.

Axel Drieling	Mona Qaud
Chairman	Vice Chairwoman

P.S. The individual presentations of the meeting that are mentioned in this Progress Report can be downloaded in the members section of ITMF-ICCTM: (https://www.itmf.org/committees/international-committee-on-cotton-testing-methods).