Variability results of homogenized cottons by a new laboratory homogenizing machine

Payet L., Gourlot J.-P., Azuara C.

ITMF, Bremen, March 2010
Plan of presentation

- Introduction
- Homogenizing machine description
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- Conclusion
Plan of presentation

• **Introduction**

• Homogenizing machine description

• Effect of machine on mixed cottons

• Effect of machine on homogenized cotton

• Conclusion
Introduction

• Scope of the study
  – Prepare cottons for round tests
  – Several cottons covering a range of characteristics are tested
  – Goal: Compare every lab result to the labs mean result
    ➔ Avoid raw material variability impact on laboratory results
Introduction

• For any participating cotton
  – proper reading level within a chosen range for
    the required characteristics (many samples, many repetitions)
  – low variability
    • If good level, and low variability ➔ cotton selected
    • If not, according to given thresholds
      – Cotton rejected
      – **Cotton could be homogenized**

• CFC/ICAC/33 project, Regional round tests in Africa
Introduction

• The homogenizing machine should ensure
  – a gentle processing (mean unchanged)
  – a decrease in within-cotton variability

  – an easy processing
  – an easy sampling of cotton fibre masses to be sent to every participating lab
Plan of presentation

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- **Homogenizing machine description**
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- Conclusion
The homogenizing machine

Principles:

Outlet  Cotton fibres flow  Inlet

Speed ratio  Speed ratio  Speed ratio
C        B        A

distance  distance  distance

Adjustable distances

Flexible tube Venturi

Filtration dusts

Plastic bag 800 grams

Device to remove the pression between pairs of cylinders

Feeding table

Device to remove the pression between pairs of cylinders
The homogenizing machine

Picture:
Plan of presentation

- Introduction
- Homogenizing machine description
- **Effect of machine on mixed cottons**
- Effect of machine on homogenized cotton
- Conclusion
• Objective
  – Mix 2 types of cottons
  – Observe a difference of variability between “raw” and mixed samples

H0: homogenizing machine reduces the variability of two cottons chosen to be drastically different on their length and strength properties when mixed together

Exp. 1 small samples (40 g)
  - 1A: mixing
  - 1B: mixing+“doubling”

Exp. 2 larger masses (4 kg)
  - 2A: mixing
  - 2B: mixing+“doubling”
Mixing cottons with the machine

- **Materials**
  - Cottons: LS and SW stacked up on the feeding table
  - Homogenizing machine:
    » Speed ratios fixed
    » Distances between pairs of cylinders
    » Pressure between cylinders
    » Pressure drop in venturi

- **SITC testing:**
  - HVI 1000 M700
  - 2 Mic, 6 LS, 6 CT on 40g or 200g samples
Mixing cottons with the machine: Protocol

This project is co-funded by the European Union and the Common Fund for Commodities.

Exp. 1A

LS

SW

Homogenizing machine

2x5x40g MIXED SAMPLES

"RAW" (stacked up) SAMPLES

20

40

SITC
Mixing cottons with the machine: Protocol

Homogenizing machine

2x5x 40g MIXED ++ SAMPLES

"RAW" (stacked up) SAMPLES

LS

SW

Exp. 1B

SITC
Mixing cottons with the machine: Protocol

Exp. 2A

LS

400g

400g

x5

Homogenizing machine

5x4x200g

MIXED SAMPLES

"RAW" (stacked up)

SAMPLES

SW

SITC
Mixing cottons with the machine: Protocol

Exp. 2B

LS

SW

400g

x5

Homogenizing machine

5x4x 200g

MIXED ++ SAMPLES

"RAW" (stacked up) SAMPLES

SITC
Effect of machine on within-cotton variability: results

• Results
  – Example: strength
**Effect of machine on within-cotton variability: results**

**F-ratio:** raw:mixed

if $>1 \rightarrow$ variability tend to decrease
the higher, the more effect of mixing

**Mix small samples (40 g)**

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<th>Mean</th>
<th>Variance</th>
<th>F ratio</th>
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1B: mixing and doubling

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**Effect of machine on within-cotton variability: results**

**F-ratio**: raw:mixed *(inverted when in italic)*

if $>1 \rightarrow$ variability tend to decrease *(to increase when in italic)*

the higher, the more effect of mixing

### Parameter Summary

<table>
<thead>
<tr>
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**Exp. 2**

- Mix larger samples (4 kg)

---

2A: mixing

2B: mixing and doubling
Effect of machine on within-cotton variability: discussion

• The homogenizing machine enables a decrease in variability for the 6 CSITC criteria (UHML and Str) so the mixing effect can be considered as efficient.

• Mixing effect is more important for the procedure involving small samples.

• Additional doubling enables a greater decrease in variability, for both experiments involving small or larger quantities mixed.
Plan of presentation

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• Homogenizing machine description
• Effect of machine on mixed cottons
• **Effect of machine on homogenized cotton**
• Conclusion
Homogenizing cotton with the machine

- Test in partnership with BBB
  - BCRT2008-4 and BCRT2009-4(H): same cotton

- Objective
  - BCRT2009-4: Homogenize large masses of cotton (50 kg) from one bale
    Procedure: machine+doubling described for Exp.2 (12 times)
  - Observe a difference of variability between material before and after homogenization
    H0: homogenizing machine reduces within-cotton variability
Homogenizing cotton with the machine

• Materials
  – Cotton: Westafrican Guinea Conakry (RM 40)
  – BCRT2009-4: Homogenizing machine
    » Speed ratios fixed
    » Distances between pairs of cylinders
    » Pressure between cylinders
    » Pressure drop in venturi
  – Internal experiment in one laboratory:
    • SITC testing: HVI 1000 M1000
    • 10 tests (1 Mic, 2 LS, 2 CT)
Effect of machine on within-cotton variability: results and discussion

- Internal procedure to evaluate within-cotton variability

N(raw,2008) = 8
N(H,2009) = 10

F-ratio: raw:homogenized
if > 1 → variability decrease

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<th>Parameter</th>
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<th>H</th>
<th>Raw</th>
<th>H</th>
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<td>0.20</td>
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- Variability is reduced after homogenizing procedure → evaluation of the true inter-lab variability (due to laboratory practices, independently from cotton)
Interpretation of inter-laboratory variability

- Complementary results (from RT):
  - Over 187 (2008-4) and 141 (2009-4) participating laboratories
  - Inter-lab variance results 2008-4 (Raw) and 2009-4 (H):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
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F-ratios in italic: inverted from raw:H to H:raw in order to get F >1

→ Open to discussion
Plan of presentation

• Introduction

• Homogenizing machine description

• Effect of machine on mixed cottons

• Effect of machine on homogenized cotton

• Conclusion
Conclusion

The homogenizing machine ensures:

- a decrease in within-cotton variability while mean values remain unchanged (gentle process)

- when associated to an easy doubling process, sampling 4 kg of cotton fibre masses is easy before sending samples to participating labs
Other possible studies

• Focus on homogenizing:
  – Testing on many types of cotton
  – Testing successive ways-in

• Other applications than RT
  – Opening+sampling in one laboratory?
  – Sticky cotton?
or many couples of cottons (mixing)
• Possibility to see the machine at Faserinstitut Bremen
  + 1 machine at RTC West (CERFITEX, Ségou, Mali)
  + 1 machine at RTC East (TBS, Dar Es Salaam, Tanzania)
  + 1 prototype at CIRAD, France

• Acknowledgements:
  – CFC/ICAC/33 project
  – A. Drieling, FIBRE
Thank you for your attention
Exp. 3: Protocol

=> 5 layers of 800 g. each
Exp. 3: Protocol
Exp. 3: Protocol

=> 5 slices
Exp. 3: Protocol

=> 4 levels
Exp. 3: Protocol

= 20 samples of 200 grams each
Fine study of E2 by AFIS

![Graph showing frequency distribution of length (L) for different categories: LS, SW, raw, and H. The x-axis represents length (mm) from 0 to 60, and the y-axis represents frequency (%). The graph includes error bars for each category, indicating variability.](image-url)
Fine study of E2 by AFIS

Frequency (%)

Length L(w) (mm)

LS
SW
raw
H+ doubling
H

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