Variability results of homogenized cottons by a new laboratory cotton homogenizing machine

Résultats de variabilité de cotonshomogénéisés par le nouveau ouvrier-mélangeur de fibres de coton

GOURLOT J.-P.
Arusha, January 2012

From a joint work by:
A partir d’un travail conjoint de :
Payet L., Gourlot J.- P., Azuara C.
Présenté à l’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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The homogenizing machine

Principles:

Outlet → Cotton fibres flow → Inlet

Speed ratio C → Speed ratio B → Speed ratio A

Distance

Adjustable distances

Flexible tube Venturi

Filtration dusts

Plastic bag 800 grams

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
Mixing cottons with the machine

- **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

Exp. 1A

LS

Homogenizing machine

SW

2x5x 40g
MIXED SAMPLES

"RAW" (stacked up) SAMPLES

SITC

x2
Mixing cottons with the machine: Protocol

Homogenizing machine

2x5x40g MIXED ++ SAMPLES

SITC

"RAW" (stacked up) SAMPLES

Exp. 1B
Mixing cottons with the machine: Protocol

- LS
- SW

Exp. 2A

Homogenizing machine

5x4x200g

MIXED SAMPLES

"RAW" (stacked up) SAMPLES

5x4x

SITC
Mixing cottons with the machine: Protocol

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

Exp. 2B

LS

SW

400g

Homogenizing machine

"RAW" (stacked up)

SAMPLES

MIXED ++ SAMPLES

5x4x200g

SITC

MIXING + DOUBLING
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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Variance</th>
<th>F ratio</th>
<th>Pr&gt;F</th>
<th>Trend to</th>
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<tbody>
<tr>
<td></td>
<td>Raw</td>
<td>M</td>
<td>Raw</td>
<td>M</td>
<td></td>
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<td>0.00544</td>
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**Exp 1:**

- **Mix small samples (40 g)**
- 1A: mixing
- 1B: mixing and doubling
Effect of machine on within-cotton variability: results

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

if > 1 → variability tend to decrease (to increase when in italic)
the higher, the more effect of mixing

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<td>0.05980</td>
<td>0.04802</td>
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<td>0.01127</td>
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</table>
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.
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- **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: West African 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

\[
N_{\text{raw,2008}} = 8 \quad \text{F-ratio: raw:homogenized} \\
N_{H,2009} = 10 \quad \text{if > 1 \rightarrow variability decrease}
\]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean Raw</th>
<th>Mean H</th>
<th>Variance Raw</th>
<th>Variance H</th>
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<td>28.57</td>
<td>0.062</td>
<td>0.011</td>
<td>5.9</td>
<td>0.01</td>
<td>decrease significantly</td>
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<td>0.004</td>
<td>1.8</td>
<td>0.20</td>
<td>decrease</td>
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• Variability is reduced after homogenizing procedure \rightarrow 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>
<th>Mean</th>
<th>Variance</th>
<th>MD significant?</th>
<th>F Ratio</th>
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<td>63</td>
<td>29.01</td>
<td>28.97</td>
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<tr>
<td>UI %</td>
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<td>59</td>
<td>82.57</td>
<td>82.34</td>
<td>0.324</td>
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<tr>
<td>Rd</td>
<td>74</td>
<td>74</td>
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<td>71.08</td>
<td>3.249</td>
<td>3.915</td>
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<tr>
<td>+b</td>
<td>70</td>
<td>70</td>
<td>12.63</td>
<td>12.62</td>
<td>0.364</td>
<td>0.389</td>
</tr>
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</table>

F-ratios in italic: inverted from raw:H to H:raw in order to get F >1

→ Open to discussion
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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
Note

- Possibility to see the machine
  + 1 machine at Faserinstitut Bremen, Germany
  + 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
More details in:
Plus de détails dans :


Thanks for your attention