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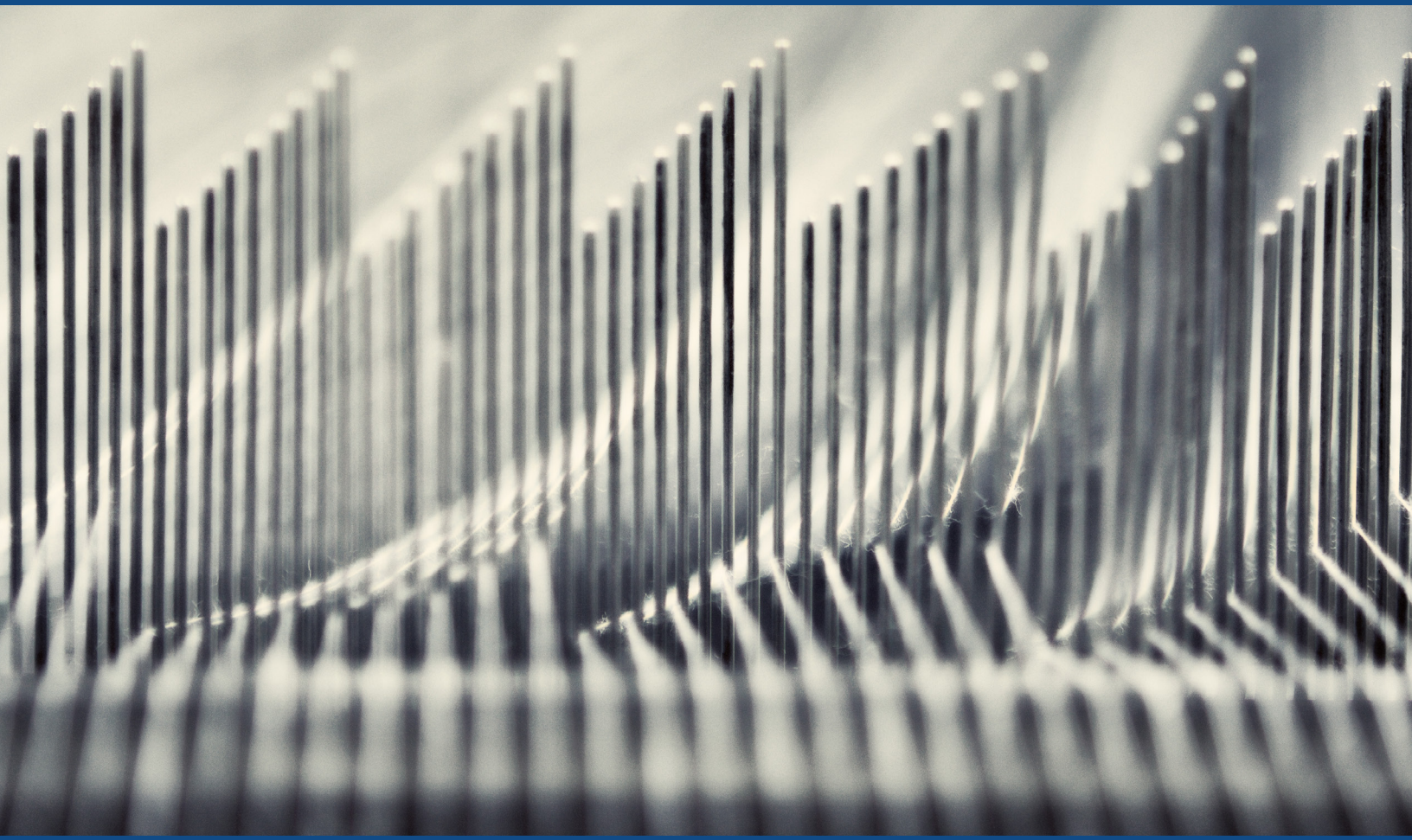
AN EVALUATION OF THE

# FIBER PROCESSING ADVANTAGES

## OF USING U.S. COTTON IN KNITTED FABRIC/GARMENT MANUFACTURING

A RESEARCH WHITE PAPER FROM COTTON COUNCIL INTERNATIONAL



STUDY CONDUCTED BY TRIBLEND CONSULTANTS AND CUSTOM TECHNICAL SOLUTIONS

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## BACKGROUND

In the fall of 2016, Yehia Elmogahzy and David Sasso conducted experiments at a spinning mill in Asia. This was a company undergoing major expansion to accommodate new exporting demand of high quality combed ring-spun yarns.

As a part of this expansion, the mill had to identify higher quality (less contaminated) cotton than it had previously used; three different cottons were used: (a) Mix 1, 100% U.S. cotton bales; (b) Mix 2, 100% Indian cotton bales (Shankar-6 type); and (c) Mix 3, a blend of 1/3 each Australian, Uzbekistani, and Pakistani cotton bales. (The third mix was what the company planned to use and they moved forward.)

The spinning system used was ring spinning and the yarns produced were combed yarns of two different counts: 20's and 26's intended for single-jersey knit fabrics.

## CONTROL PROCEDURES

In order to make sure that a fair comparison was conducted between the different cottons, a serious attempt was made to maintain similar average values of basic fiber properties in the three cotton mixes. All cotton bales were tested using the HVI system and the AFIS available in the company's laboratory.

The HVI fiber properties (micronaire, length, and strength) of the three cotton mixes (shown in Appendix I) show the 3 mixes were virtually equal. Other fiber properties (also shown in Appendix I) that are largely influenced by production and storage conditions showed some variations, but generally were close enough to each other to ensure that differences in performance were largely due to the quality of the cottons based on origin.

## CONTROL PROCEDURES

All of the experimental trials were conducted on the processing line depicted in Appendix II.

**THE STAGES WERE:**

1. ROTARY BALE PLUCKER
2. AXIFLOW PRE-OPENING AND CLEANING UNIT
3. MULTI-MIXER
4. LVS
5. FINE CLEANING AND OPENING UNIT
6. CHUTE FEED SYSTEM
7. CARDING MACHINE
8. BREAKER DRAWFRAME
9. UNILAP AND COMBING MACHINE
10. COMBER NOIL

With these controls (fiber quality and processing) in place, the experimenters believe that differences in performance are related to cotton country of origin, rather than variations within each country.

## FINDINGS—PROCESSING PERFORMANCE

The processing performances of the 3 cotton mixes were evaluated on 3 criteria:

1. Change in fiber neps and seed coat neps during processing
2. Trash removal during processing
3. Change in short fiber content during processing

# U.S. COTTON HAD THE BEST NEP PERFORMANCE

U.S. cotton had the lowest percentage of nep increase during opening and cleaning, the highest percentage of nep removal during carding and combing, and finished with only 55% of the neps as Indian cotton and 47% that of the Australian/ Uzbekistani/ Pakistani blend.

Seed coat neps followed the same pattern as total neps, with U.S. cotton (2 seed coat neps per gram) at 57% the level of Indian cotton and only 25% of the three country blend.

| | **100% U.S. cotton** | **100% Indian cotton** | **AUS/Uzbek/ Pakistan cotton** |
|---|---|---|---|
| Starting neps/g | 229 | 163 | 228 |
| Increase during opening and cleaning/g | 64 (29%) | 152 (93%) | 166 (73%) |
| Carding nep removal/g | 237 (81%) | 227 (72%) | 284 (72%) |
| Combining nep removal/g | 38 (67%) | 55 (63%) | 68 (66%) |
| Combed sliver neps/g | 18 | 33 | 38 |
| Ending vs. starting neps/g | 8% | 20% | 17% |
| Combed sliver seed coat neps/g | 2 | 3.5 | 8 |

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# U.S. COTTON HAD THE BEST "TRASH REMOVAL DURING PROCESSING" PERFORMANCE

Despite starting with the lowest trash content of the three mixes, U.S. cotton had the largest reduction in trash through opening and cleaning and carding and ended with the lowest trash content in the combed sliver, 49% less than Indian cotton and 60% less than the Australian/ Uzbekistani/Pakistani blend.

| | **100% U.S. cotton** | **100% Indian cotton** | **AUS/Uzbek/ Pakistan cotton** |
|---|---|---|---|
| Initial Trash Content/g | 44.8 | 71.8 | 76.7 |
| Reduction in trash content upon opening and cleaning | 20% | 11% | 14% |
| Trash after opening and cleaning/g | 35.8 | 63.9 | 66.0 |
| Reduction in trash during carding | 89% | 88% | 85% |
| Trash after carding/g | 3.9 | 7.7 | 9.9 |
| Reduction in trash during combing | 75% | 75% | 75% |
| Trash after combing/g | 1.0 | 1.9 | 2.5 |

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# U.S. COTTON HAD THE BEST "TRASH REMOVAL DURING PROCESSING" PERFORMANCE

The U.S. cotton also showed highest cleaning efficiency, as indicated by the lower lint content/higher trash content in in comber noil samples.

| | **100% U.S. cotton** | **100% Indian cotton** | **AUS/Uzbek/ Pakistan cotton** |
|---|---|---|---|
| Lint Content in comber noil waste | 55% | 62% | 61% |
| Visible Trash | 37% | 23% | 21% |
| Invisible Trash | 8% | 15% | 18% |
| Cleaning Efficiency | 45% | 38% | 39% |

The ability to use U.S. cotton that starts with lower trash and can be cleaned more efficiently than cottons from other origins means that product produced from that cotton will be of higher quality and produced at lower operating costs.

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# U.S. COTTON PERFORMED SIGNIFICANTLY BETTER AT REDUCING SHORT FIBER CONTENT (SFC) DURING PROCESSING

With ring-spinning or air-jet-spinning, short fibers arriving to the spinning machine will produce weaker and irregular yarns if they are not removed during spinning preparation, particularly during the combing operation.

The U.S. cotton used in this experiment started with slightly lower Short Fiber Content but in each step of preparation improved its relative standing. After combing. U.S. cotton had 25% less SFC than Indian cotton and 37% less than the Australian/Uzbekistani/Pakistani blend.

| | **100% U.S. cotton** | **100% Indian cotton** | **AUS/Uzbek/ Pakistan cotton** |
|---|---|---|---|
| Initial SFC (%) | 23.7% | 24.8% | 26.0% |
| Change in opening and cleaning | +2% | +13% | +2% |
| SFC after opening and cleaning | 24.2% | 28.0% | 26.5% |
| Change in carding | -1% | -4% | -2% |
| SFC after carding | 23.9% | 26.9% | 26.0% |
| Change in combing | -63% | -56% | -46% |
| Final SFC (%) | 8.9% | 11.8% | 14.0% |

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## CONCLUSION

This experiment clearly shows that U.S. cotton performed better than competitive cottons during processing in all 3 criteria: nep removal and final nep content, trash content removal and final trash level, and the lowest level of Short Fiber Content after opening, carding and combing.

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