

Relationship Between Individual Fiber Length and Linear Density within-Sample

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Abstract

Sixty four bales of cotton from eight different locations were collected to investigate the within sample relationships between individual fiber length, maturity and linear density. The bales were sampled and fiber quality determined with HVI and AFIS. Then, combed ring spun yarns 30Ne were produced. During processing, lint samples from the raw material, combed sliver, and noils were collected. Fiber quality of these samples was determined with the AFIS PRO. Results obtained show drastic differences in fiber maturity and linear density between noils, combed sliver, and raw material. Fibers from the noils have a much lower maturity and linear density than fibers from the raw material and combed sliver. These results tend to confirm that the hypothesis of a constant linear density among length groups within-sample needs to be revisited.

Hypothesis

Different length groups within a sample do not have the same maturity and linear density. Fibers from the noils (shorter fibers) have lower linear density and maturity than fibers from the combed slivers (longer fibers).

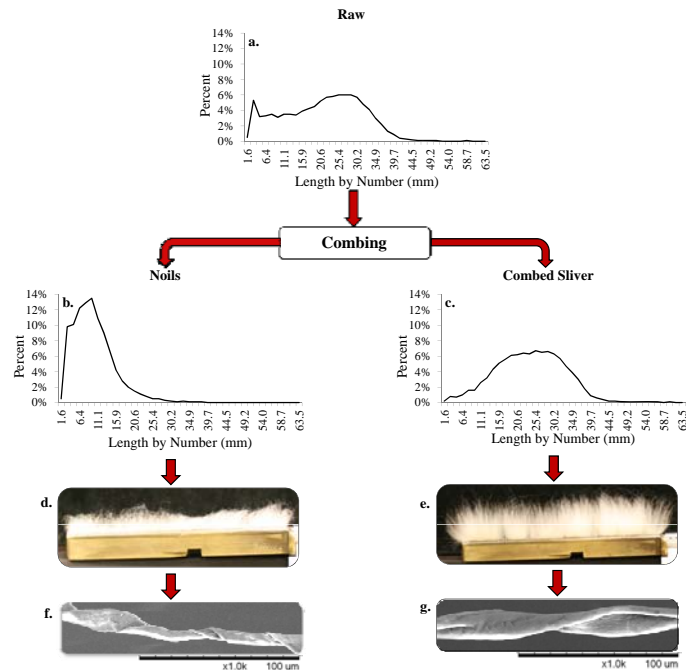
Objective

To demonstrate that linear density and maturity are not constant across length groups within-sample.

Results

Length Distribution

- The length histogram (by number) of raw cotton fibers shows a wide range of fiber lengths.
- The combler was used to separate shorter fibers (noils) from longer fibers (combed sliver).



Length distribution by number of Raw (a), Noils (b), and Combed Sliver (c).
Fiber beard of Noils (d) and Combed Sliver (e).
Scanning Electron Microscopy of fibers extracted from Noils (f) and Combed Sliver (g).

Introduction

Cotton is a naturally variable product with a wide distribution of length, maturity and linear density. The maturity of a cotton fiber is a measure of the cross sectional area of the cell wall relative to the area of a circle having the same perimeter. More mature fibers have a higher degree of cellulose deposition. Mature fibers possess greater strength while immature fibers easily break during processing, generating short fibers. Linear density, or gravimetric fineness, of a fiber is the mass per unit length expressed in millitex. Fine fibers have a lower linear density and break more easily during processing.

Materials and Methods

- Sixty four cotton bales were harvested from 8 different locations in 3 years (2008, 2009, and 2010).
- Cotton bales from 2008/09 were less mature than cotton bales from 2010.
- Cotton fibers were processed through the typical short staple ring spinning process, including opening, carding, drawing, combing, roving, and ring spinning.
- The fiber quality of raw material, combed sliver, and noils were determined with the AFIS.

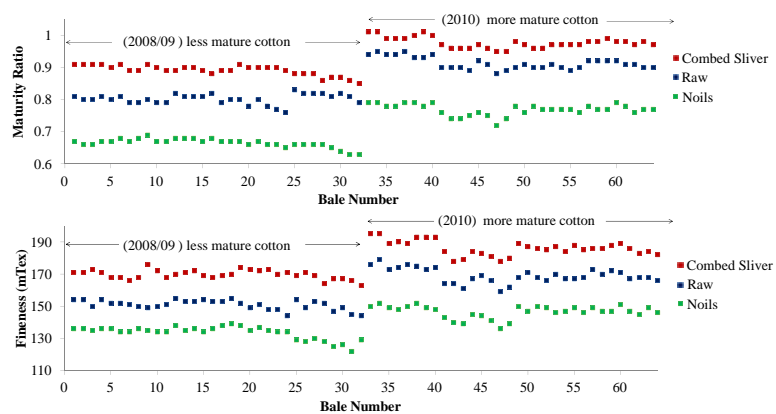


Figure 2. Scatter plot of maturity ratio and fineness of sixty four cotton bales.

Conclusions

- There are drastic differences in maturity and linear density between raw material, combed sliver, and noils.
- Fibers from the noils have a lower average maturity and linear density than fibers from the raw material, and the combed slivers.
- These results tend to confirm that the hypothesis of a constant linear density among length groups needs to be revisited.

References

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