SUITABILITY OF US COTTON FOR VORTEX SPINNING

Eric F. Hequet
Fiber and Biopolymer Research Institute, Texas Tech University
Lubbock, TX

Abstract

We need to produce cotton that fits the dominant market, i.e., Asia and ring-spun yarns. It means we need cotton with fibers that are long, uniform, mature, fine, strong, and with low contamination levels. It should be the strategy for the short-term but not for the long-term. Indeed, labor costs in Asia are increasing. It is forcing spinning mills to consider potential alternative spinning technologies such as air jet/vortex spinning. If cotton could be adapted to air-jet spinning, its throughput would make it competitive with rotor spinning (faster than rotor). It could produce yarns competitive with ring spun yarns in some market segments such as the 30Ne, the primary target market for U.S. cotton (the range of possible yarn counts is narrower than for ring spinning). However, because of poor fiber length distribution compared to synthetic fibers, cotton is not the fiber of choice in the air jet spinning market. Therefore, this project aims to determine the impact of fiber properties on vortex yarn quality.

The correlation coefficients among the main yarn quality parameters for carded ring spun yarns, and carded vortex yarns are relatively good on commercial bales. Nevertheless, it should be noted that several correlation coefficients are below 0.8, indicating that about one-third of the variability observed is not explained. It is the case for Elongation, CVm, and importantly for Thick places where about 70% of the variance observed is not explained. It means that cottons that perform well in ring spinning may not perform well in vortex spinning. The main fiber properties of interest for vortex yarn tenacity are length distribution, HVI strength, and standard fineness. Fiber length distribution appears to be the main contributor for work-to-break, number of thin places, and yarn hairiness. High correlations are also observed between yarn neps, number of thick places, and NCT Seed coat fragments.

Not surprisingly, combing results in better tensile properties, but aggressive combing improves only marginally yarn quality. In terms of delivery speeds, the slowest delivery speed gives the best results.

Samples provided by Wayne Smith (Texas A&M) gave excellent vortex results. What is remarkable is that they are far superior to the Uster 50% statistics for combed yarns while these samples were only carded. These lines were grown in College Station in 2020 and will be available for a complete evaluation in 2021.

In conclusion, it appears that fiber length distribution and fiber diameter are the most critical fiber attributes to obtain high-quality vortex yarns. Smaller fiber diameter translates automatically into a better bundle strength. It could be of interest to verify if increasing individual fiber strength (Favimat testing) could improve even more yarn quality. Finally, it appears that high seed coat fragment count, determined with the NCT, translates into a drastic increase in the number of thick places per km.

Acknowledgements

The authors want to thank Cotton Incorporated for funding this project.