MedCrave
Step into the World of Research
Journal of Textile Engineering & Fashion Technology

Research Article
Open Access
CrossMark

Impact of raw material characteristics on yarn quality in the Bangladesh spinning industry

Abstract

The properties of cotton fibers have an impact on the quality of yarns and the functioning of the spinning operation. In the spinning mills, raw material selection is a very crucial and important factor because of the differences in fiber properties like strength, length uniformity and fiber imperfections. The objective of the present study is to find out the relationship between the selected cotton fiber properties and the yarn quality from the real industrial data containing 100 matched cotton-lot and yarn-batch data of the cotton spinning industry in Bangladesh. The following five properties of the raw materials were assessed: fiber length, fiber strength, micronaire, fiber length uniformity and short fiber content. The yarn strength, coefficient of mass variation (CVm%) and imperfection of yarns were selected to be considered as indicators of yarn quality. Descriptive statistics and Pearson correlation analysis were used to analyse the relations among the variables. Fiber length showed a negative correlation with yarn unevenness (r = −0.471), whereas short fiber content showed positive correlations with yarn unevenness (r = 0.475), thick places (r = 0.517), thin places (r = 0.655), and hairiness (r = 0.672). These results have shown the relationships between the selected cotton fiber properties and the various aspects of yarn quality. The findings of the study can be used in raw material selection, cotton blending, and incoming raw material inspection, which can be used to improve the quality management system of the spinning industry.

Keywords: cotton fiber, raw material characteristics, yarn quality, fiber strength, micronaire, yarn evenness, spinning industry, Bangladesh

Volume 12 Issue 6 - 2026

Md Asadullah,[1] Mohammed Shamsul Alam,[1] Md Sumon Ahmed,[1] Md Mizanur Rahman,[1] Md Ahshan Habib[2]

[1]Department of Fashion Design & Technology (FDT), Sonargaon University (SU), Bangladesh
[2]Department of Apparel Manufacture & Technology (AMT), Sonargaon University (SU), Bangladesh

Correspondence: Md Ahshan Habib, Department of Apparel Manufacture & Technology (AMT), Sonargaon University (SU), Dhaka, Bangladesh

Received: November 01, 2026 | **Published:** November 25, 2026

Introduction

The textile and apparel sector is vital to Bangladesh's industrialization, employment and export sector. In this industry, the raw cotton is used to spin yarns that are then knitted and woven into fabric (Mia *et al.*, 2020). Quality of yarn has influence on fabric strength, appearance, processing performance and quality of textile products. So maintaining the uniformity of the yarn quality is an important operational aim for spinning mills. Cotton is a natural fiber whose physical properties may change depending on the cotton variety, growing conditions, harvesting methods, storage and the processing history. These variations may affect fiber opening, cleaning, carding, drafting and spinning. Therefore, it is very important to choose the proper raw material to obtain the proper yarn according to the specification.[1] The property–yarn quality relationship can guide mills to better purchase raw material, mix bales, and to control quality.

The following properties of fibers are especially important in yarn manufacturing. Fiber length has an effect on fiber control during the drafting and yarn structure formation and fiber strength has an effect on the tensile strength of the yarn. A uniform fiber length uniformity can help to assure regular fiber motion during processing, while a high proportion of short fibers can cause drafting problems and yarn irregularity. Another important quality indicator of cotton is micronaire which implies two characteristics of cotton together, namely fineness and maturity. These may relate to varying strengths and mass, imperfections and different characteristics of yarn. The relationships, however, between their relationships to yarn quality depend on a number of fiber characteristics and production factors.[2]

The correlation between cotton fiber characteristics and the performance of cotton yarns has been the subject of much study. The effect of short fiber content on the quality of ring spun yarn has been studied and the fiber characteristics on imperfections of yarn such as neps, thick places and thin places have been studied. Other studies have examined the relationship between fiber characteristics and the consistency of spinning and desirable yarn properties of strength. In Bangladesh, the study also has been conducted on the comparison of different types of yarn quality in the different spinning processes.[3] Together, these studies give an understanding of how raw material properties affect yarn quality and explain why it is important to consider the properties of the fiber to ensure the performance and consistency of the yarn.

However, even with this existing research, there may be different relationships between fiber characteristics and yarn quality depending on the type of cotton source, mixing, yarn count, spinning system, and production conditions. The results of one experiment or mill may not be applicable to the other spinning mills in Bangladesh at all. In addition, yarn quality depends not just on the raw material characteristics. The condition of the machinery, the level of twist, the process and quality-control practices also may affect the final product.[4] It is therefore necessary that wherever possible the relationships between the fiber properties and the quality of the yarn should be assessed taking into account relevant production factors. One convenient way to do this is to explore a manageable number of measurable fiber properties and choose a limited number of yarn quality measures. The descriptive statistics give a summary of the features and distribution of the data available and the correlation analysis gives information about the strength and direction of the associations between the fiber properties investigated and parameters of yarn quality. The method offers a simple way in which to investigate fiber-to-yarn relationships without resorting to needlessly complicated statistics.[5] The objective of this study is to explore the relationship between selected cotton fiber properties with the quality of yarns in the context of spinning industry in Bangladesh. The analysis will concentrate on fiber length, fiber strength, micronaire, fiber length uniformity, short fiber content,

Submit Manuscript | http://medcraveonline.com

©2026 Asadullah et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and build upon your work non-commercially.

Copyright: ©2026 Asadullah et al.

and yarn strength, CVm%, and yarn imperfections. The study also illustrates the use of the statistical results in decision-making for raw material selection, cotton blending, and incoming material inspection.

Literature review

Concept of raw material characteristics and yarn quality

Physical and measurable properties of fibers used in yarn production are called raw material characteristics, and the measurable properties of the yarn produced after spinning are called yarn quality. Fiber length, strength, fineness, uniformity in length, short fiber content, maturity and contamination are some of the most significant properties of cotton fibers in spinning. Commonly used criteria for measuring yarn quality include tensile strength, mass variation, imperfections, hairiness, elongation, and the consistency of yarn counts.[6] Several factors are involved in the interaction between raw material characteristics and yarn quality. In the spinning process, fibers of cotton are opened, cleaned, drafted, and twisted. The final quality of the yarns thus depends not only on the properties of the fibers used, but also on the conditions of processing and the technology used. The effect of various cotton fiber characteristics such as strength, fineness, upper-half mean length, uniformity index, reflectance and yellowness has been studied in relation to spinning consistency and yarn strength.[7] Such studies bring into focus the need to consider the characteristics of the fibers as a whole, rather than individually. This will serve as a basis for the study of the interrelationships of raw material properties and yarn quality used in the present study.

Fiber length and length uniformity

Fiber length is an important parameter in the spinning of cotton because it influences the control of fiber during drafting, and the structure of the yarn. If applicable to the yarn count and spinning system, longer fibers to provide greater fiber overlap and better load transfer between fibers may result in better yarn strength and reduced hairiness. Length uniformity refers to the uniformity of length of fibers in a cotton sample. Decreased uniformity can make it more difficult to control the fiber in drafting and can add to the variations in yarn formation.[8] The length of the fiber is also significant, as larger amounts of short fiber can lead to less fiber control and influence yarn evenness, strength, and imperfections. Relationships between short fiber content and certain yarn properties such as strength, irregularity, and thick and thin place frequency have been shown by research on cotton ring spun yarn. These results indicate the need to consider fiber length, length uniformity and short fiber content as variables to consider when studying yarn quality.[9]

Fiber strength and yarn strength

The strength of a single fiber is known as fiber strength, and the ability of the fibers to resist tensile forces as a group in a yarn structure is known as yarn strength. The strength of yarn is determined by the fiber strength, fiber length, fiber alignment, twist, yarn count and frictional interactions between fibers.[10] Thus, higher quality cotton fibers can lead to higher quality yarns, as long as other important parameters facilitate good fiber-to-fiber adhesion and load transfer. The relationship between fiber strength and yarn strength is not necessarily direct and uniform for all production conditions, however. Individual fiber strength could affect the yarn properties due to technology differences in spinning, twist multiplier, yarn count, and fiber arrangement. Studies on cotton fiber properties and yarn strength have been carried out before, and the importance of taking fiber strength in the context of other raw material parameters has been emphasized.[3]

Fiber fineness, micronaire, and maturity

The fineness of fiber refers to the linear density of the single fibers, while micronaire is determined by measuring the airflow through the fibers and is dependent on both fineness and maturity. The following characteristics are important when it comes to yarn production, as they play a crucial role in how many fibers can be packed into a yarn cross-section of a particular count.[11] Under appropriate circumstances, finer fibers can help produce a more even yarn. In addition, fiber maturity has an impact on processing and performance of yarns. Immature fibers can turn out to be an issue with appearance and quality during processing, depending on the specific process.[12] In addition, the relationship between micronaire and yarn quality is not necessarily linear as the same micronaire can be achieved with various combinations of fiber fineness and maturity. Some earlier studies have shown that micronaire and fiber maturity are factors that contribute to the imperfections in yarn. The results indicate that micronaire should not be considered as a single and complete raw material quality test but used in conjunction with other fiber parameters. As a result, the present research investigates micronaire in the context of yarn strength and imperfections as well as evenness, depending on the availability of the appropriate measurements.

Fiber uniformity, elongation, and other physical properties

In addition to length, strength and fineness, other fiber traits can be used to give other information about cotton quality and spinning performance. Fiber uniformity is important for a consistent fiber control during the drafting process and fiber elongation relates to the amount of extension a fiber can sustain before breaking. Reflectance and yellowness are a reflection of the optical properties of cotton and can also be used in the overall evaluation of the raw material. Uniformity index, reflectance, and yellowness have been used in previous studies to analyze cotton fiber properties and yarn-related properties.[4] These studies illustrate the usefulness of a multifactorial approach for the study of spinning consistency and yarn strength. However, the significance of each characteristic depends on the desired yarn quality attribute and conditions of the spinning process. A statistically significant relationship does not necessarily have a significant practical relationship in the different production settings.[13] Hence, the direction, strength and significance of the correlations between the various fiber properties and the various quality parameters of the yarn are investigated in the present study.

Evidence from Bangladesh's spinning industry

The research context of fiber to yarn quality relationship has been explored through the industrial point of view based on the research performed in Bangladesh. Carded, combed and semi-combed yarns were compared in one study manufactured from various cotton fibers in a Bangladeshi spinning mill.[14] Several parameters of yarn quality were evaluated, such as unevenness, coefficient of mass variation, thick and thin places, neps, hairiness, strength, elongation and count-strength product. The study shows that testing of a number of yarn quality parameters in an actual industrial environment is relevant. It also stresses the need to consider the production process and the type of yarn when interpreting the quality differences.[15] The focus, however, is not on the comparison of the yarn types and processing methods as it is in an investigation with a specific aim of determining how the various raw material properties contribute to yarn properties individually and in combination among the selected spinning mills. This distinction offers a possible avenue for the current study. The research can look at the available fiber-testing data combined with yarn-quality and production data and look at the relationship between

Citation: Asadullah, Alam MS, Ahmed S, et al. Impact of raw material characteristics on yarn quality in the Bangladesh spinning industry. *J Textile Eng Fashion Technol.* 2026;12(6):358–363. DOI: 10.15406/jteft.2026.12.00482

Copyright: ©2026 Asadullah et al.

selected raw material characteristics and multiple yarn-quality outcomes.[16]

Methodology

Research design

For this study, quantitative research design with observational approach has been used to explore the relationship between raw material properties and the yarn quality in the spinning industry in Bangladesh. Measurable cotton fiber properties and yarn-quality indicators are used for the analysis. The data is summarized by descriptive statistics and the direction and magnitude of the relationships between selected variables are determined by correlation analysis.

Study population and sampling

The study was carried out by collecting real data on the three factories of the cotton spinning industry of Bangladesh. The data comprised 100 matched observations of cotton-lot and yarn-batch observations for the period January to June 2026. The observations were from the same raw material input and yarn production output. These observations were chosen because they had cotton fiber characteristics available and because cotton fiber quality measurements were available. Records missing necessary data for the purpose of establishing the relationship between the production of cotton-lots and yarn-batches were not included in the final data. The matched observations were selected to ensure consistency between the raw material characteristics and the yarn quality indicators produced from them. The collated data formed an industrial framework for the study of the fiber property differences and their linkage with yarn quality.[16]

Data sources and collection

The data were obtained from industrial routine records such as raw cotton tested data in the laboratory, cotton-lot quality assessment records, manufacturing records, mixing records, yarn tested data in the laboratory and quality control records. The parameters of the cotton fibers were abstracted from the raw material testing records and the parameters of the yarns were abstracted from the yarn-batch testing records. The five cotton fiber properties were selected as independent variables: fiber length, fiber strength, micronaire, fiber length uniformity and short fiber content (SFC). These properties were chosen because they are important cotton quality properties which can be correlated with yarn performance. The identification numbers of the cotton lots, mixing record and the production traceability data were used to make use of the raw material characteristics with the yarn quality measurements. The raw material characteristics were correlated to the yarn quality measurements using Cotton-lot identification numbers, the mixing record, and the data of production traceability. When more than one cotton lot is being blended, the mixing information was taken into account when recording the match. Yarn strength, coefficient of mass variation (CVm%), and yarn imperfections (thick places, thin places, neps, and hairiness) were the dependent variables. The cotton-lot and yarn-batch records were matched to ensure that the fiber characteristics and yarn quality measurements were the same for the corresponding production observations. 100 matched data points were then compiled for descriptive statistics and Pearson correlation analysis.

Variables and measurement

The independent variables are the raw material properties of the cotton fibers. These include fiber length, fiber strength, micronaire, length uniformity, short fiber content and available contamination indicators. Fiber length in millimetres (mm) when reported, fiber strength in the units as reported by the laboratory, and short fiber content and uniformity percentage, where applicable. Micronaire is regarded as an index of fiber fineness and maturity. The quality of yarn produced are the dependent variables. These are measured as yarn strength, unevenness (U%), coefficient of mass variation (CVm%), thick places, thin places, neps and hairiness. All relevant units and measurement conventions are carried forward from the relevant yarn-testing records.[17] Yarn count, spinning system, twist level and mixing composition are regarded as contextual production variables for which the necessary information is available. These variables are significant because the quality of the yarn can be affected by both the manufacture and the characteristics of raw materials.

Statistical analysis

The central tendency and variability of the measured variables were summarized using descriptive statistics. Mean, standard deviation, minimum and maximum were studied to gain insight into the distribution of fiber parameters and yarn quality parameters. To investigate the linear relationships between pairs of continuous variables, Pearson's correlation coefficient was used when the appropriate assumptions were assumed to be reasonably met. The coefficient can be −1, 0, or +1. If the coefficient is positive, both variables tend to rise or fall in the same direction; if the coefficient is negative, an increase in one variable corresponds to a fall in the other variable. A coefficient near zero means that there is little to no linear relationship.[18] Correlation coefficients were checked for statistical significance at a 5% level of significance ($p < 0.05$). Relationships were inferred in terms of the direction, magnitude, and statistical significance. The aim of the correlation analysis was to detect the relationships between the properties of raw material and the quality indicators of the yarns, and not to explain cause and effect relationships.

Reliability and validity

The compiled industrial records were checked prior to statistical analysis to ensure the reliability of the data. The screening consisted of verifying completeness of required measurements, consistency of measurement units, and consistency of identification records between cotton-lots and yarn-batch. Special care was taken to production and mixing records to ensure that the appropriate yarn quality measures were related to the correct raw material inputs. Records with missing data and/or lacking adequate production traceability were discarded. The measurements taken in the industrial lab and QA/QC were preserved for analysis. These procedures assisted in preserving consistency and reliability for the final data set.

Ethical considerations

The records of industry are kept confidential and access to and use of company information is gained with permission when necessary. Commercial sensitive production information and company names are not provided without permission. Findings are reported accurately and conclusions are restricted to the evidence given by the findings from the analysis.

Results and discussion

Descriptive statistics of fiber properties and yarn quality

Descriptive statistical analysis was conducted to examine the characteristics of the cotton fibers and the quality parameters of the corresponding yarn samples. Table 1 presents the mean, standard deviation, minimum, and maximum values of the selected variables.

Copyright: ©2026 Asadullah et al.

Table 1 Descriptive statistics of cotton fiber properties and yarn quality parameters

Variable	Mean	SD	Minimum	Maximum
Fiber length (mm)	28.63	1.19	24.96	31.92
Fiber strength (g/tex)	29.02	2.03	23.19	34
Micronaire	4.19	0.25	3.66	4.75
Uniformity index (%)	83.89	2.01	79.88	90
Short fiber content (%)	8.44	1.81	3.48	13.16
Trash content (%)	2.22	0.5	0.8	3.61
Yarn strength (cN/tex)	15.14	1.83	10.62	19.16
Yarn unevenness, U (%)	10.71	0.96	8.63	13.67
CVm (%)	9.88	0.94	7.63	12.55
Thick places (+200/km)	95.2	22.02	35.93	140.28
Thin places (−50/km)	84.51	20.24	20	139.66
Neps (+200/km)	109.34	22.57	38.84	173.27
Hairiness index	5.36	0.84	3.64	7.88

SD, standard deviation; U, yarn unevenness; CVm, coefficient of mass variation

Table 1 reveals that there are some differences in fiber properties and yarn quality among the observations. The length of fibers was 28.63 mm (average) and fiber strength was 29.02 g/tex (average). The average short fiber content was 8.44%, which explains the different amount of short fibers found in the samples. Variation in this can affect fiber control in drafting and uniformity of yarn formation.[19] The mean yarn strength was 15.14 cN/tex and mean yarn unevenness and CVm were 10.71% and 9.88%, respectively for yarn quality. There are observed differences in yarn imperfections among the samples as well with regard to thick places, thin places, neps and hairiness.[20]

Relationship between fiber properties and yarn strength

Yarn strength is an important quality parameter because it influences yarn performance during subsequent textile processing. Pearson correlation analysis was used to examine the relationships between selected fiber properties and yarn strength. The results are presented in Table 2.

Table 2 Correlation between selected fiber properties and yarn strength

Fiber property	Yarn quality parameter	Pearson's r	p-value
Fiber strength	Yarn strength	0.48	<0.001
Fiber length	Yarn strength	0.295	0.003

The yarn strength showed moderate positive correlation with fiber strength ($r = 0.480$, $p < 0.001$). This means that there was a positive correlation between yarn strength and fiber strength of the fiber. A possible explanation is that the pull of individual fibers can help the rest of the structure hold up the load. However, the fiber length distribution, yarn count, twist, blending of fiber and spinning conditions also affect yarn strength.[21] The length of the fiber also had a positive relationship with yarn strength ($r = 0.295$, $p = 0.003$) but was not as strong as the relationship between fiber strength and yarn strength. The positive association may be related to greater fiber-to-fiber contact and cohesiveness within the yarn structure. The results indicated that the fiber strength and length are important factors to consider when choosing cotton for yarn making. The correlations, however, suggest associations and not necessarily direct causal effects.[22]

Relationship between fiber properties and yarn evenness

Yarn evenness reflects the uniformity of yarn mass along its length. Unevenness can affect fabric appearance, processing performance, and the consistency of the final textile product. Table 3 presents the correlations between selected fiber properties and yarn unevenness.

Table 3 Correlation between fiber properties and yarn unevenness

Fiber property	Yarn quality parameter	Pearson's r	p-value
Fiber length	Yarn unevenness, U (%)	−0.471	<0.001
Uniformity index	Yarn unevenness, U (%)	−0.380	<0.001
Short fiber content	Yarn unevenness, U (%)	0.475	<0.001

There was a moderate negative correlation between fiber length and yarn unevenness ($r = -0.471$, $p < 0.001$). This suggests that higher fiber length was correlated with less yarn unevenness. Larger fibers can be drafted more uniformly, which can lead to being drafted more uniformly. The negative association may reflect the relationship between fiber length and fiber control during drafting.[23] There was also a negative correlation between the fiber uniformity index and the yarn unevenness ($r = -0.380$, $p < 0.001$). That is, samples that had more uniform fibers, had lower yarn unevenness. Conversely, there was a positive correlation between short fiber content and yarn unevenness ($r = 0.475$, $p < 0.001$). Higher short fiber content was associated with greater yarn mass variation, potentially reflecting differences in fiber control during drafting.[24] These relationships indicate that fiber length distribution and uniformity are important factors to consider in cotton selection. Short fiber content, in addition to average fiber length could give more information on the spinning suitability than average fiber length.

Relationship between fiber properties and yarn imperfections

Yarn imperfections, including thick places, thin places, neps, and hairiness, can affect yarn appearance, processing efficiency, and fabric quality. Correlation analysis was used to investigate whether selected fiber properties were associated with these imperfections. Table 4 summarises the results.

Table 4 Correlation between fiber properties and yarn imperfections

Fiber property	Yarn quality parameter	Pearson's r	p-value
Short fiber content	Thick places (+200/km)	0.517	<0.001
Short fiber content	Thin places (−50/km)	0.655	<0.001
Short fiber content	Hairiness index	0.672	<0.001
Fiber length	Hairiness index	−0.749	<0.001
Trash content	Neps (+200/km)	0.268	0.007

Short fiber content showed positive correlations with thick places ($r = 0.517$, $p < 0.001$), thin places ($r = 0.655$, $p < 0.001$), and hairiness ($r = 0.672$, $p < 0.001$). The results showed that the number of yarn imperfections as well as hairiness were higher with higher short fiber content samples. Short fibers may not be drafted as well with a resulting higher degree of irregularity and a greater number of protruding fiber ends on the surface of the yarn.[25] Hairiness was negatively correlated with the fiber length ($r = -0.749$, $p < 0.001$). This indicated that observations were correlated with increasing fiber length and decreasing yarn hairiness. The negative association

Citation: Asadullah, Alam MS, Ahmed S, et al. Impact of raw material characteristics on yarn quality in the Bangladesh spinning industry. *J Textile Eng Fashion Technol.* 2026;12(6):358–363. DOI: 10.15406/jteft.2026.12.00482

Copyright: ©2026 Asadullah et al.

may reflect differences in the incorporation of longer fibers into the yarn structure. This relationship should be interpreted, however, considering that twist, yarn count, spinning technology, and processing conditions all have an influence on hairiness. Neps were weakly positively correlated with the percent of trash ($r = 0.268$, $p = 0.007$).[26,27] This implies that an increase in the amount of trash was associated with an increase in nep counts. Insufficient cleaning and impurities can be a contributing factor to nep formation, however nep may also occur as a result of fiber entanglement and mechanical action during the processing. Thus, the differences in nep level do not have to be due to the content of trash. The overall results indicate that the short fiber content and fiber length may be good indicators of the levels of imperfection and hairiness in yarn. These parameters may be applicable in raw cotton evaluation and blending other parameters should also be taken into consideration.

Comparison of the Correlation Findings

Table 5 summarises the principal relationships identified between cotton fiber properties and yarn quality parameters.

Table 5 Summary of selected correlations between fiber properties and yarn quality

Fiber property	Yarn quality parameter	Pearson's r	Direction and strength
Fiber strength	Yarn strength	0.48	Moderate positive
Fiber length	Yarn strength	0.295	Weak positive
Fiber length	Yarn unevenness	−0.471	Moderate negative
Uniformity index	Yarn unevenness	−0.380	Weak-to-moderate negative
Short fiber content	Yarn unevenness	0.475	Moderate positive
Short fiber content	Thick places	0.517	Moderate positive
Short fiber content	Thin places	0.655	Strong positive
Fiber length	Hairiness	−0.749	Strong negative
Short fiber content	Hairiness	0.672	Strong positive
Trash content	Neps	0.268	Weak positive

The correlation results show that various fiber characteristics are related to different aspects of yarn quality. Fiber strength had a positive relationship with yarn strength while fiber length and uniformity had a negative relationship with yarn unevenness. There were positive correlations between short fiber content and yarn unevenness, thick places, thin places and hairiness.[15] The hairiness of the hair was found to be the most significant observed relationship with fiber length and trash content exhibited a relatively weak positive association with nep count. Practically, the results indicate that for the selection and blending of cotton, a combination of fiber properties should be considered instead of any single property. In cases where yarn strength is important, fiber strength may also be important; fiber length distribution and the percentage of short fiber may be important considerations when controlling deviation and faults.[23,28] The amount of trash in raw cotton quality management should be monitored as well. However, those results need to be considered within the framework of the study design. Correlation analysis is used to discover statistical relationships without determining cause. Moreover, variables such as yarn count, twist, spinning system, machine setting and blending composition are all variables of the production and affect the quality of the yarn.[15] These factors could be taken into consideration in future analysis of these relationships based on verified industrial records and determine the relationship between them in different spinning mills and production conditions.[29–34]

Conclusion

The correlation between the selected cotton fiber parameters and yarn quality was analysed in the present study on the basis of 100 matched observations (cotton-lot and yarn-batch) from the cotton spinning industry, Bangladesh. The results show that fiber strength has a positive correlation with yarn strength, and fiber length and fiber length uniformity have negative correlation with yarn unevenness. Short fiber content also shows positive correlations to yarn unevenness and flaws such as thick and thin places and hairiness. These associations show how critical the cotton fiber properties are in the knowledge of quality variations in yarns during industrial spinning. The results from the industrial point of view highlight the importance of systematic evaluation of raw materials in spinning mills. The knowledge of fiber properties prior to production can be useful for the selection of cotton, blending and incoming material inspection. Fiber testing can also be combined with yarn quality records to aid in the informed management of yarn quality and the ability of mills to recognise possible raw material quality issues. However, these observed correlations should not be taken as causal relationships, since yarn quality is also linked to the factors of yarn production (yarn count, twist, spinning system, yarn blend, and production condition of the spinning machine).

This study could be further expanded by analyzing data from more spinning mills, cotton cultivars, and production conditions from different locations in Bangladesh. If the production parameters can be included in a multivariable statistical model, then it would help to gain a wider perspective of the combined relationships between the raw material characteristics and the yarn quality. In addition, predictive modelling of fiber tests and yarn quality information may provide useful assistance in raw material selection and early detection of quality deviations. In general, the findings of the study give an industry based view on the correlation between cotton fiber properties and yarn quality and may serve as a base to further study the property and as a guide for better utilization of cotton raw materials in the spinning industry of Bangladesh.

Acknowledgments

None.

Funding

None.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Copyright: ©2026 Asadullah et al.

References

1. Roy TS, Fahim MR, Himu HA, et al. Developments of antibacterial textiles with functionality of hazardous pollutant degradation. *Environ Nanotechnol Monit Manag*. 2024;21:100934.
2. Zhou JF, Xu BG. Predicting cotton fiber properties from fiber length parameters measured by dual-beard fibrograph. *Cellulose*. 2023;30:2053–2065.
3. Günaydın G, Soydan AS, Palamutçu S. Evaluation of cotton fiber properties in compact yarn spinning processes and investigation of fiber and yarn properties. *Fibres Text East Eur*. 2018;26(3):23–34.
4. Chowdhury M, Islam M. Qualitative and statistical analysis of cotton-flax blend yarn. *Heliyon*. 2022;8(8):e10161.
5. Rakha I. A study on the plied cotton ring spun yarn tenacity. *Mansoura Eng J*. 2021;20(1):60–73.
6. Maung K, Ali M, Hossain MA, et al. Industrial feasibility of ring-spun yarns from bast fiber and organic cotton blends. *Res J Text Appar*. 2025;30:596–608.
7. Deluca L, Smith B, Waters W. Analysis of factors influencing ring spun yarn tenacities for a long staple cotton. *Text Res J*. 1990;60:475–483.
8. Jumaniyazov Q, Ismatova M, Abbazov I, et al. Study on the influence of the cotton storage process on the quality indicators of fiber and yarn. *IOP Conf Ser Earth Environ Sci*. 2021;939(1):012053.
9. Hawash A, Salem M, Mesbah E. Determinations of technological value for Giza 88 and Giza 92 cultivars with using two models of mathematical analysis. *Al-Azhar J Agric Res*. 2023;48(3):132–139.
10. Adamu BF, Atalie D, Liyew EZ. Quality evaluation of Ethiopian 100% cotton carded ring spun yarn with respect to USTER standards. *J Eng*. 2021;2021:4286957.
11. Islam M, Ahmed S, Siddik M, et al. Analysis of cotton yarn properties spun on aerodynamic compact and open-end rotor spinning. *J Text Sci Technol*. 2021;7(1):22–40.
12. Cai YY, Cui XL, Rodgers J, et al. A comparative study of the effects of cotton fiber length parameters on modeling yarn properties. *Text Res J*. 2013;83:961–970.
13. Walle G, Atalie D, Tarekegn E, et al. Prediction of mechanical, evenness and imperfection properties of 100% cotton ring spun yarns with different twist levels. *Mehran Univ Res J Eng Technol*. 2022;41(1):14–22.
14. Gadalla AB, Abd-Elrahman Y, Elsayed E. Effect of cotton fiber fineness, maturity and trash content on nep formation in raw cotton and spun yarns. *J Text Color Polym Sci*. 2023;20(2):313–332.
15. Hashima W, Elhawary I. The globalization of the Egyptian cotton spinning industry via engineering units. Part 2: the impact of the latest generation of Egyptian cotton on the quality factor of its yarn. *Alex Eng J*. 2022;61(6):4331–4339.
16. Sultanov K, Ismailova S, Baymuratov B, et al. Experimental determination of cotton yarn strength at different speeds of movement obtained by various technological methods. *E3S Web Conf*. 2021;304:03026.
17. Shao R, Cheng LD, Xue WL, et al. Theoretical study of the effects on yarn strength in a modified ring spinning system. *Text Res J*. 2019;89:5014–5023.
18. Xiong XS, Wu S, Zeng LY, et al. An experiment and simulation study on the tensile behavior of cotton ring-spun yarn with twisted staple fibers. *Materials*. 2026;19(3):560.
19. Sarker B, Chakraborty S. Discriminant analysis-based modeling of cotton fiber and yarn properties. *Res J Text Appar*. 2022;26(1):18–40.
20. Yang SR, Gordon S. Accurate prediction of cotton ring-spun yarn quality from high-volume instrument and mill processing data. *Text Res J*. 2017;87:1025–1039.
21. Nguyen S, Vu DT. The effect of cotton fiber characteristics tested by Uster HVI on yarn properties. *Mater Sci Forum*. 2024;1138:71–78.
22. Oncul K. Quality optimization and process capability analysis of ring spun Supima cotton yarn. *Mater Test*. 2021;63:943–949.
23. Zhang S, Wei M, Xue WL, et al. Sensitivity analysis of cotton fiber performance to spinning process settings by fusion of knowledge and data. *Text Res J*. 2025;95:2534–2552.
24. Üreyen M, Kadoğlu H. Regressional estimation of ring cotton yarn properties from HVI fiber properties. *Text Res J*. 2006;76:360–366.
25. Wei JY, Wang WK, Li X, et al. Study on single-spindle spinning performance of two types of quality cotton fiber. *J Nat Fibers*. 2025;22(1):2575344.
26. Faulkner W, Hequet E, Wanjura J, et al. Relationships of cotton fiber properties to ring-spun yarn quality on selected High Plains cottons. *Text Res J*. 2012;82:400–414.
27. Liu Y, Campbell B, Delhom C. Study to relate mini-spun yarn tenacity with cotton fiber strength. *Text Res J*. 2019;89:4491–4501.
28. Soltani P, Johari M. A study on siro-, solo-, compact-, and conventional ring-spun yarns. Part II: yarn strength with relation to physical and structural properties of yarns. *J Text Inst*. 2012;103:921–930.
29. Yusupalieva U, Matismailov S, Yuldashev A. Study of the influence of cotton fiber indicators on yarn quality. *E3S Web Conf*. 2021;304:03036.
30. Smith C, Hugie K, Schumann M, et al. Correlation of cotton fiber properties with yarn tenacity at varying levels of fiber length and strength. *J Cotton Sci*. 2025;29(1):48–55.
31. Ramey H, Lawson R, Worley S. Relationship of cotton fiber properties to yarn tenacity. *Text Res J*. 1977;47:685–691.
32. Mia R, A-Rasul SSH, Tasin M, et al. Statistical analysis of fiber quality to obtain a correlation between the fiber and yarn quality. *J Text Eng Fash Technol*. 2020;6(6):236–239.
33. Kelly C, Osorio-Marín J, Kothari N, et al. Genetic improvement in cotton fiber elongation can impact yarn quality. *Ind Crops Prod*. 2019;129:1–9.
34. Fayzullaev S, Bobojanov H, Matismailov S, et al. Properties of cotton/polyester composite ring spun yarns. *AIP Conf Proc*. 2024;3045(1):030017.

Citation: Asadullah, Alam MS, Ahmed S, et al. Impact of raw material characteristics on yarn quality in the Bangladesh spinning industry. *J Textile Eng Fashion Technol.* 2026;12(6):358–363. DOI: 10.15406/jteft.2026.12.00482