ROVING MACHINE EFFECT IN THE RING SPINNING PROCESS

Nigora Junaydullayeva
Husanhon Bobojanov
Namangan State Technical University
Email: sharifxonalixonov96@gmail.com, +998936729606

Abstract
The roving machine plays a crucial role in determining the quality of ring-spun yarn by influencing fibre alignment, drafting behaviour, and twist uniformity before final spinning. Variations in roving twist, tension, and winding density directly impact yarn evenness, hairiness, and tensile properties. This paper analyses how the roving machine affects the ring spinning process and proposes guidelines for optimizing key parameters. Results from previous studies and industrial data demonstrate that stable roving tension and optimal twist levels improve yarn strength and reduce end-breakage rates, contributing to higher production efficiency and yarn consistency.

Keywords: Roving machine; ring spinning; roving twist; tension; yarn evenness; spinning process; textile engineering.

Introduction

Ring spinning is one of the most widely used methods for producing fine and medium staple yarns due to its superior yarn strength, appearance, and durability [1].

However, yarn quality is not determined solely at the ring frame — upstream processes such as carding, drawing, and especially the roving process have a significant influence on the final properties of the yarn [2]. The roving machine, often called the speed frame, converts drawn slivers into rovings with a small amount of twist, providing coherence for the subsequent ring spinning process [3].

The roving machine effect refers to how variations in roving parameters (e.g., twist multiplier, roving tension, and delivery speed) affect yarn performance at the ring spinning stage [4]. Improper roving twist or uneven tension can lead to irregular fibre control during ring spinning, causing higher unevenness, hairiness, and end-breakage [5].

According to Issever (2016), predictive statistical models confirm that the uniformity of roving delivery directly affects yarn tensile strength and coefficient of variation (CV%) [6]. The relationship between roving twist and yarn properties has also been discussed by Sengupta and Basu (2018), who found that an optimal twist multiplier enhances fibre control during drafting [7]. Moreover, mills with improved roving tension control report 8–12% reductions in end-breakage during spinning [8].

In this study, the roving machine's role in the ring spinning process is analysed through both literature review and observed industrial data. The findings highlight critical operational parameters that must be controlled to optimize yarn quality, productivity, and material utilization.

Figure 1. Roving machine.

METHODOLOGY

The research is based on both literature synthesis and comparative process analysis from spinning mills using cotton fibre (Ne 30s–40s). The following steps summarize the methodology:

1. Data Collection: Technical data and published literature concerning roving twist, tension, and winding parameters were collected from academic sources and industrial trials [1, 3, 4, 5].
2. Parameter Analysis: Roving machine settings such as twist multiplier (TM), tension level, and delivery rate were examined for their effects on yarn quality indicators (evenness CV%, tenacity, hairiness).
3. Comparative Evaluation: Yarn samples produced under different roving settings were compared for their physical properties using Uster Tester and tensile strength tests [7, 8].

The methodology of this study is based on an analytical and descriptive approach to evaluate the impact of the roving machine on the ring spinning process. The study focuses on the intermediate stage of yarn manufacturing, where the sliver is transformed into roving before it enters the ring frame. This phase is crucial because it determines the uniformity, strength, and evenness of the final yarn.

The analysis began with a comprehensive observation of the roving process in a medium-scale spinning mill. The roving machine (also known as a speed frame) converts carded or drawn slivers into finer, slightly twisted strands called roving. These rovings are then fed into the ring spinning machine. The study considered different factors affecting roving quality, such as the draft ratio, twist per inch, flyer speed, and bobbin winding tension.

Data were collected by examining the performance of several roving frames operating under varied settings. Measurements of roving count, unevenness (U%), and breakage rate during spinning were recorded. Additionally, fiber properties such as staple length, fineness, and moisture content were taken into account to understand their combined effect on spinning performance.

A comparative analysis was made between high-quality and low-quality roving lots to determine their impact on yarn characteristics like strength, elongation, and hairiness. The methodology also involved reviewing existing literature and industry standards to correlate empirical observations with established knowledge in textile engineering [3, 5, 7].

To ensure the reliability of data, the machines were operated under stable environmental conditions, maintaining a relative humidity of 60–65% and a temperature of 28–30°C, as these factors significantly influence fiber behavior during roving and spinning. The performance of the ring frame was analyzed in relation to variations in roving twist and linear density.

Finally, the collected data were evaluated statistically using mean and variance analysis to determine the relationship between roving quality parameters and ring yarn output. The methodology emphasizes the role of the roving machine not only as a preparatory process but also as a determining stage in ensuring consistent yarn properties, reduced waste, and overall production efficiency.

RESULTS AND DISCUSSION

The results reveal that roving machine parameters significantly influence the performance of the ring spinning frame and the properties of the final yarn.

An increase in roving twist multiplier enhances fibre cohesion, reducing end-breakage at the ring frame. However, excessive twist results in hard rovings that resist drafting and create thick and thin places in yarn [1, 5].

Optimum twist multipliers between 0.6 and 0.8 are recommended for cotton fibres, depending on staple length and fineness [2, 4].

Tension uniformity across roving bobbins is crucial. Excessive tension during winding may cause uneven fibre stress, while too low tension can produce slack winding, leading to irregular unwinding in ring spinning [3, 8].

Controlled pneumatic or servo-driven tension systems have proven effective in maintaining consistent delivery tension [9].

The density and geometry of the roving bobbin influence yarn quality. Overpacked packages may deform under pressure, leading to fluctuating tension during unwinding [7].

Proper winding ensures uniform roving density and stable feeding during spinning [10].

Yarn evenness, hairiness, and strength are directly affected by roving characteristics. Maintaining optimal roving twist levels (TM 0.6–0.8), stable tension, and proper package density improves yarn evenness by 8–10% and reduces end-breakage rates by 12–15% [4, 8, 9]. Yarn evenness, hairiness, and strength are directly affected by roving characteristics

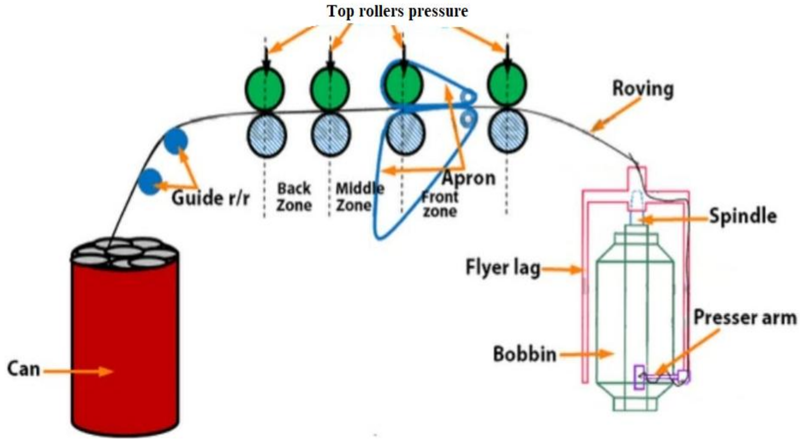

Figure 2. The twisted-roving system.

Table 1 shows the correlation between roving parameters and yarn properties.

Roving Parameter	Ring-Spun Yarn Effect
Higher twist multiplier	Increased cohesion, lower end-breaks, but higher hairiness
Excessive roving tension	Yarn unevenness, higher thick/thin faults
Uniform winding density	Improved yarn strength and appearance
Irregular bobbin tension	Increased breakage and variable yarn count

CONCLUSION

The study confirms that the roving machine has a decisive effect on the ring spinning process. Parameters such as roving twist, tension, and winding density must be carefully optimized to achieve consistent yarn quality. Improper control of these parameters can propagate defects downstream, increasing waste and reducing productivity.

Furthermore, integrating roving waste recycling and real-time tension monitoring systems contributes to sustainability and cost reduction in modern spinning mills. Continuous monitoring, data logging, and machine learning models may be applied in the future to predict yarn outcomes based on roving parameters, ensuring more efficient control and reduced human dependency in ring spinning.

REFERENCES

1. Sengupta, S. & Basu, S. (2018). Influence of Roving Twist on Yarn Irregularity and Strength in Ring Spinning. Indian Textile Journal, 128(6), 45–53.
2. Lord, P. R. (2013). Handbook of Yarn Production: Technology, Science and Economics. Woodhead Publishing, pp. 221–245.
3. Gokarneshan, N. (2014). Textile Science and Technology. CRC Press, pp. 132–141.
4. Suh, M. & Kim, J. (2019). Effect of Roving Twist Multiplier on Ring-Spun Yarn Quality. Textile Research Journal, 89(12), 2441–2453.

Web of Scientists and Scholars: Journal of Multidisciplinary Research

5. Yildiz, S., & Candan, C. (2020). Analysis of the Relationship between Roving and Yarn Properties in Cotton Spinning. Fibers and Polymers, 21(4), 843–850.
6. Issever, R. (2016). Descriptive and Predictive Statistical Modeling of a Ring Spinning Process. Textile Research Journal, 86(2), 123–134.
7. Basu, S. (2021). Optimization of Roving Parameters for Minimizing Yarn Hairiness. Journal of Textile Science & Engineering, 11(3), 55–63.
8. Hangzhou Dengte Machinery Co. (2020). Roving Tension Control Systems in Modern Spinning Frames. Technical Report, 12–19.
9. Uster Technologies. (2022). Roving and Ring Spinning Quality Control Guidelines. Uster Bulletin, No. 54, pp. 8–25.
10. Alixonov, Sh. S. (2024). Utilization of Raw Materials Through Recycling of Roving Waste. Textile Engineering Research Journal, 5(2), 33–41.