EFFECT OF TWIST ON PRODUCTIVITY OF FINE JUTE YARN PRODUCED BY MODIFIED RING SPINNING MACHINE

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ABSTRACT

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This research was done in Mechanical Processing Division of Bangladesh Jute Research Institute in 2008. An Apron Draft spinning machine was modified into ring system by incorporating rings and travelers instead of flyers. In this modification, delivery zone of the machine was left unchanged. Two rails were incorporated, one for carrying spindle and another one for carrying rings. An idle roller was installed at the rear end of the machine for transferring power from main roller to the spindles. The input sliver of the machine was varied from 2412 tex to 2756 tex (70 to 80 lbs/spy). Twists of the yarn were inserted from 236 to 394 tpm (turns per meter). A good number of trail runs were performed for determining the productivity and quality of yarn produced by the machine at different twists. Productivity of yarn of 103 tex and 138 tex through the machine were observed at different twists. It was observed that twists have an important influence on the productivity and quality of yarn.

Keywords: Ring spinning, Twist, Fine Yarn and productivity

INTRODUCTION

Jute is a natural cellulosic bast fibre (Atkinson, 1964). It is a textile fibre of good spinable character. At present there is a large number of synthetic fibres in the world textile market. Jute fibre has been facing a tough completion with synthetic fibres since their emergence in the world textile market. To overcome this competition it is necessary to produce fine jute yarn by developing/ modifying the existing jute machinery. Through this development, it may be possible to spin fine jute yarn, which can be used for diversification of jute, such as lightweight shopping bag, furnishing fabric, decorative fabric etc. As a result, jute fibre may be used in the production of fabric that may further enhance its used in various fields of textiles (Ranjan, 1985.).
Different organizations both home and abroad are trying to introduce diversified jute products in the market (Miazi, 1997, 2002, 2003 & Rahman *et al* 1996). With a view to earning foreign currency in substantial amount, fine jute yarn is very essential for the production of diversified jute goods. In this regard Bangladesh Jute Research Institute has carried out research works in the development of a technology for production of fine yarn. In these works, Gradella spinning machine has been used (Sheikh,1982). Moreover, the machine manufacturer is not making these machines for a long time. French Textile and Clothing Institute (IFTH) are doing research for production of fine and quality yarn from jute and other natural fibre like flax. N.S.C. (schlumberger) a machine manufacturer of France is making some machines for producing fine jute yarn, for example N.S.C. 232 ring spinning frame. But all these machines are not cost effective for jute fibre. Mechanical Engineering Department of Bangladesh University of Engineering & Technology has carried out a research work under Ph.D programme for production of fine yarn by using Apron Draft spinning machine (Miazi, 2002). In this work, adaptation of ring spinning in the flyer spinning system was studied and different parameters were optimized for production of fine jute yarn.

It was necessary to establish the optimum twist for fine yarn although twist varied with the variation of linear density of the produced yarns. In this study, the twist was optimized for 103 and 138 tex jute yarns. Twists of the yarns were inserted from 236 tpm (turns per meter) to 394 tpm for the determination of optimum twist for 103 tex and 138 tex jute yarn keeping all other parameters constant.

Productivity is an important factor for any production-oriented industry. In this view for achieving maximum productivity with better yarn properties (Ali, 1990). It was necessary to determine the optimum twist.
The aim of this study was to determine the twist for maximum productivity of fine jute yarn of 103 tex (3 lbs/spy) and 138 tex (4 lbs/spy) from the developed spinning system.

MATERIALS AND METHOD

BWB (Bangla white B) grade jute fibre was used in conducting the experiment. Yarns of linear density 103 tex (3 lbs/spy) and 138 tex (4 lbs/spy) were produced at various twists. Spinning performance of the machines as well as mechanical properties of the produced yarns was analyzed.

The back processing of the system was same as jute processing system. But linear density of the input sliver of the experimental machine was controlled within 2412 tex to 2756 tex (70-80lbs/spy) for smooth running of the machine for production of fine yarn. In each experiment twist was varied keeping draft, speed, ring size, traveller size constant. Yarns of 103 tex (3 lbs/spy) and 138 tex (4 lbs/spy) were produced for determination of

optimum twist for maximum productivity. The experiment was carried out at standard atmospheric condition of 65±2% RH and 20^0 C at experimental spinning mill of Bangladesh Jute Research Institute (Booth, 1968).

RESULTS AND DISCUSSION

Yarns of 103 tex and 138 tex were produced at different twists inserted in the yarns were 236, 275, 315, 354 and 393 tpm. At each twist, yarn was produced. Twist is an important criterion for a yarn of particular linear density. Purpose of twist is to bind the fibres together and hold in the ends of fibres. Appropriate twist is required for optimum strength. Insertion of more or less twist decreases the yarn strength. If a yarn is examined closely it will be found that the number of turns or twist varies from point to point along the length. This arises mainly from the fact that the yarn mass it self fluctuates from point to point. Yarn twist is inserted by rotating the lower end of the yarn about the upper end and the twist actually ascends from below into upper portions of the yarn and in this way runs up towards the drawing nip. The twist is transmitted by the lower fibres taking up a spiral formation and forcing those above them to conform to the same configuration. The fewer the number and less rigid the fibres, it is easy for the lower ones to force the upper ones to take up the same twist angle as themselves. It is the twist angle, which is the same along the length of the yarn. Because the twist is constant (or in more practical terms, the twist factor is constant) those parts of the yarn that are thin have more turns per unit length than those are thick.

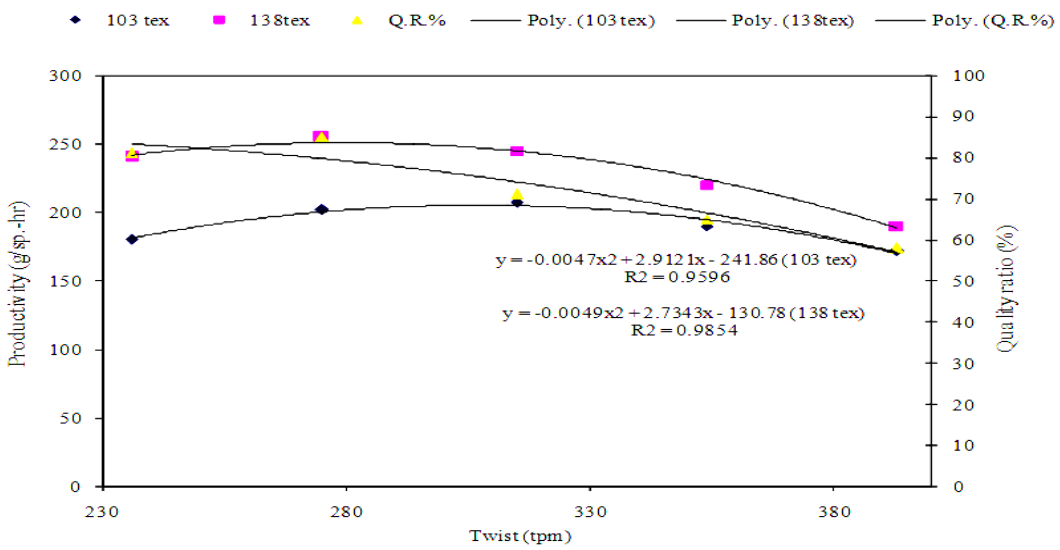

Figure 1. Twist vs. Productivity and quality ratio of 103 & 138 tex jute yarn

Results obtained in the experiment are plotted in figure 1. It is shown that optimum inserted twist for maximum productivity is 315 tpm for 103 tex jute yarn and 275 tpm for 138 tex jute yarn. Insertion of more or less twist than the optimum twist in the yarn increased the number of yarn breaks, which ultimately reduced the productivity. Moreover better quality ratio of the yarn was found at the maximum productivity region, below that region the quality ratio decreased with the decrease of productivity. It indicates that twist of maximum productivity produces better yarn through the experimental machine.

More over quality of produced yarn were compared with yarns produced from other machines. In this comparison it was shown that the quality ratio of yarn produced by the Spingard (gardella) spinning machine is 76.33% the quality ratio of yarn produced by the Bolleli ring spinning machine is 79.36% and the quality ratio of yarn produced by the N.S.C. ring spinning machine is 76%. On the other hand the quality ratio of yarn produced by the modified ring spinning machine is 72%. The quality ratio of yarn produced by the experimental is nearly the same as that for the yarns produced by other jute yarn producing machinery. Gradella, Bolleli, N.S.C. ring spinning machines are not cost effective for jute industry. Comparison of quality ratios of yarns produced by the different machines is shown in figure 2.

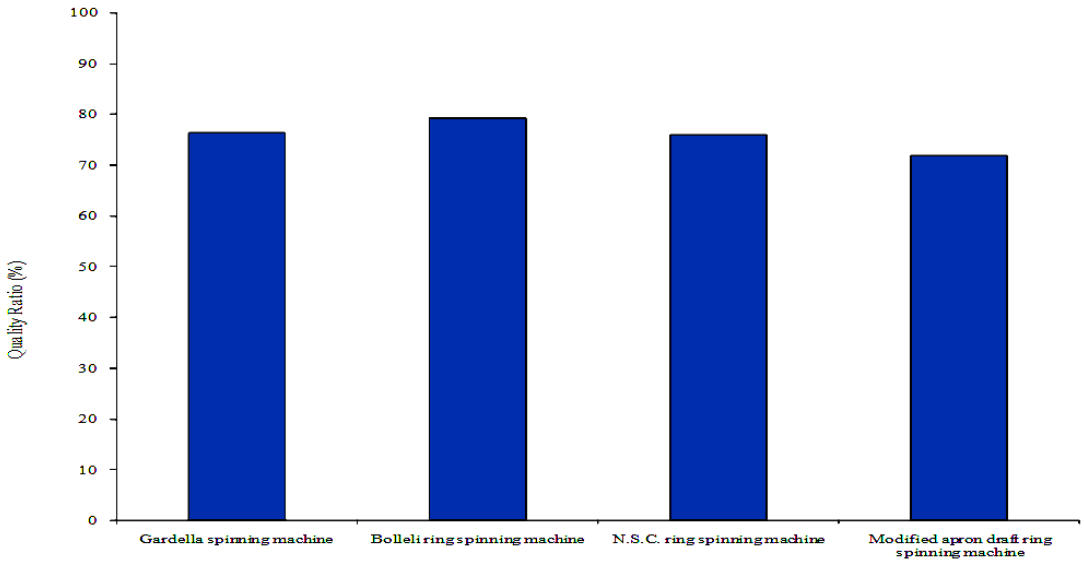

Figure 2. Comparison of quality of quality ratio of yarn produced by the modified apron draft ring spinning machine and other machines

CONCLUSIONS

The following conclusions can be drawn from the study. Apron Draft spinning machine can be converted into ring spinning. The machine is capable to produce jute yarn of 103 tex (3 lbs/spy to 4 lbs/spy). Optimum twist is essential for higher productivity. Application of twist other than optimum twist lowers the productivity of the machine. Optimum twist is 315 tpm for 103 tex and 275 for 138 tex yarn. Quality ratios of the produced yarns are satisfactory.

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