Spinning of Cotton-Jute Blends on the Cotton System

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The feasibility of producing cotton-jute blends on cotton spinning machinery and the problems involved therein have been investigated. Jute fibres of two types, viz., jute caddies and jute staple, were used. In all cotton-jute caddie blends, the proportion of jute in the final product was less than the nominal value, the difference being more in the case of blends with higher proportion of jute. The loss of jute during processing was more in the case of jute caddies than for jute staple. It was concluded that up to 20% jute caddies could be blended with cotton for production of fabrics without any marked deterioration in yarn quality and such fabrics would be quite suitable for furnishings, curtain materials, etc.

Blending of different types of fibres so as to produce fabrics for meeting a diversity of end uses has become an established practice. In particular, the methods for the production of fabrics from blends of cotton with wool and synthetic fibres have reached almost a stage of perfection. However, blending of cotton with jute fibres had been practically ignored till recent times mainly due to the extreme differences in the length and fineness of the two fibres and the impracticability of processing jute as such on the cotton spinning machinery. Under a scheme of collaboration between the Cotton Technological Research Laboratory, Bombay, the Jute Technological Research Laboratory, Calcutta and the Central Sheep and Wool Research Institute, Malpura, a project was undertaken to study the blending of jute and wool with cotton using cotton spinning machinery with the main objectives of studying the feasibility of producing such blends, the qualities of the yarns produced and the suitability of such blends for preparing specific types of fabrics. The results of work carried out at this laboratory on cotton-jute blends are presented in this communication.

Materials and Methods

The jute fibres used for blending were of two types: (i) jute caddies, which are mainly coarse, short fibres that fall out as waste droppings during processing on jute machinery have been used for blending with coarse, short staple cottons like Wagad and Shyamali, and (ii) jute staple, cut on a staple cutter from jute tow to produce jute fibres about 25 mm (1 in) in length, have been used for blending with a superior cotton like L 147.

Preliminary Trials

Before taking up full scale spinning trials on blends of cotton and jute, preliminary trials were conducted to study the problems involved in processing such blends on cotton spinning machinery. Initially, small scale spinning trials were conducted on a flexible card with a low doffer speed. Since licker-in droppings were high, attempts were made to reduce these by closing up the under-casing and grid sections. This, however, led to loading and choking up of the licker-in. Also, processing on a flexible card led to increased cylinder, doffer and flat strips consisting of a major portion of the jute fibres. Though flat strips could be reduced by increased flat settings, it was not possible to reduce the cylinder and doffer strips. On reducing licker-in speeds to about 450 rpm, there were less licker-in droppings. The preliminary trials indicated that the use of metallic card clothing would be more beneficial. Further trials were, therefore, carried out on a semi-high production card working at conventional speeds.

Processing of blends beyond carding did not pose many problems. The main alterations that had to be made were the use of closer settings at the drafting zones and use of higher twist multipliers at the slubber and inter, when the proportion of jute fibres exceeded 30%. In general, it was found that droppings obtained in various processes have higher proportions of the jute fibres and hence this has to be taken into account while blending to get the required proportion of cotton and jute in the final blend. This also necessitated an accurate method for the quantitative estimation of the blend proportion. The method developed is reported elsewhere.

Final Spinning and Weaving Trials

Blends with jute caddies—Shyamali cotton with mean length 19.6 mm, Micronaire value 6.5 and breaking tenacity 47.7 g/tex at nominal zero gauge length was blended with jute caddies, in proportions of 75:25, 67:33 and 50:50 cotton-jute and samples of 6s
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yarn were spun using the CTRL microspinning technique. The spinning was carried out on a 3-roller ring frame and five twist multipliers ranging from 4 to 8 were used to find out the optimum twist multiplier.

Based on the yarn strength data obtained from the above trials, bulk spinnings were carried out using another coarse Indian cotton, Wagad (mean length, 19.3 mm; Micronaire value, 6.0; and tenacity, 42.3 g/tex at zero gauge) blended with jute caddies in the proportions 80:20 and 90:10 cotton-jute, using a twist multiplier of 6.0. The yarns were tested for single yarn tenacity and Uster evenness. These yarns were then used to produce a loosely woven plain fabric of 26 ends × 46 picks/in weighing about 280 g/sq m.

Blends with jute staple—L 147 cotton with mean length 25 mm, Micronaire value 4.3 and tenacity 43.4 g/tex at zero gauge length was blended with jute stapled to 25 mm fibre length. The blend proportions used were the same as for jute caddies and twist multipliers ranging from 4 to 8 were again tried and 16s yarns were spun using the microspinning technique. Based on these results, bulk spinning trials were carried out on 90:10 and 80:20 blends spun to 12 counts using a twist multiplier of 6.0 to get better ring frame performance.

Results and Discussion

Blends with jute caddies—Plots of yarn tenacity and elongation values for different blends of Shyamali with jute caddies against the twist multiplier are shown in Figs 1 and 2 respectively. The values for pure Shyamali cotton are also included. It is seen from Fig. 1 that as the proportion of jute caddies in the blend increases, there is a fall in tenacity values, which is expected. But the fall in tenacity is low for the 75:25 blend as compared to pure cotton. The optimum twist multiplier is about 6 for three of the blends with lower proportions of jute, whereas for the 50:50 blend, the optimum twist multiplier is about 7.

The breaking elongation figures plotted against twist multiplier in Fig. 2 show that the elongation increases with increase in twist for the blends and for pure cotton. As the proportion of cotton reduces, in general, the elongation also decreases. But the difference between the extension values of 75:25 and 67:33 blends was marginal; surprisingly, the values for the 67:33 blend were uniformly higher than for the 75:25 blend.

The yarn tenacity and Uster irregularity values obtained from full scale spinning trials on blends of Wagad and jute caddies are presented in Table 1. A drop in tenacity and a slight increase in irregularity are noticed for the blends as compared to pure cotton, but the differences are not high. Also, there is no difference between the values for the 90:10 and 80:20 blends, the quality values being more or less identical.

Blends with jute staple—The yarn tenacity and breaking elongation values for blended yarns of L 147 and jute staple are presented in Figs 3 and 4. It is seen that the results are in agreement with those for jute caddie blends presented in Figs 1 and 2. The following points are significant:

(i) In view of the superiority of the cotton used in these blends, pure cotton gives significantly stronger yarns at all twists than even the 75:25 cotton-jute staple blends, whereas in the case of blends with caddies, the tenacity values for Shyamali and 75:25 Shyamali-jute caddy blend were similar, especially at the optimum twist level.
(ii) The optimum twist multiplier is 5 for both cotton and blends containing 25% and 33% jute staple. For the blend with 50% jute, the optimum twist multiplier is higher at 6.

(iii) As in the case of blends with jute caddies, the tenacity and extension values decrease as the proportion of jute increases.

The test results for bulk spinning trials from L 147 - jute staple are presented in Table 1. The blended yarn quality was markedly inferior to the cotton yarn quality in terms of strength and regularity, as noticed in the microspinning trials. Also, as the proportion of jute...
staple in the blend increases from 10 to 20%, both tenacity and regularity fall. However, no difference in yarn appearance was noticed for the three samples.

Fabric trials—Preliminary trials for weaving of plain weave fabrics from the 6s yarn from blends of 80:20 and 90:10 cotton-jute caddies were also carried out, as mentioned earlier, mainly to investigate the problems involved in weaving. Hence, the fabrics produced were too limited in length to permit exhaustive fabric tests. Since a sophisticated small scale weaving machinery was not available, the fabrics were woven using the available reed-pick combinations and a reed width not commensurate with the warp width employed. Though trials were successful, the performance can be improved through a proper choice of sizing media and sizing conditions and also proper fabric constructions. The fabric properties which should, however, be viewed in proper perspective and considered as indicative and capable of being improved are given in Table 2. During shedding, a substantial portion of jute caddies was observed to fall out. As a result, the warp-way strength for 80:20 blend fabric was significantly lower, whereas the weft-way strength of the two blends remained unaffected and nearly the same.

Conclusion

The main objective of this study was to investigate the feasibility of producing blends of cotton and jute on cotton spinning machinery and the problems involved therein. It was pointed out earlier that during processing of the blends with caddies on cotton spinning machinery jute fibres constitute the major portion of the fibres that fall off as waste. Hence, the actual blend composition in the final yarn would not be the same as the nominal composition. To arrive at the actual blend composition, a reliable and quick quantitative method of estimation had to be evolved

Quantitative analysis of blend composition in the case of various blends with jute caddies revealed that in all blends, the proportion of jute was less than the nominal value, the differences being more in the case of blends having higher proportion of jute. Also, on comparing the caddies and jute staple, it was seen that the loss of jute during processing was greater in the case of jute caddies than for jute staple. Both these observations can be explained by the fact that jute caddies being substantially shorter, coarser and more irregular in length have greater tendency to fall off as waste if the drafting zone settings, etc. are wider to suit the cotton used. Also, the greater the proportion of caddies present in a sample the greater is the availability of the shorter fibres that can fall off and hence possibly the greater is the loss of jute with increased proportions of jute. In the case of jute staple, however, due to the uniformity of its fibre length as well as its equality with that of the staple length of cotton used in blending, the above phenomenon is not noticed. Thus, when blending jute with cotton due allowance has to be made for the proportion of jute to be mixed, depending on the nature of the jute fibre.

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References