COMPARATIVE STUDY OF CROSROL CARD MK5D VERSUS MODIFIED CARD MK6 FOR ULTIMATE EFFECT ON YARN QUALITY

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Cotton yarn plays a major role in determining the characteristics of the fabrics. The carding segments prior to the revolving flats exert a large impact upon sliver & yarn quality. It ensures opening, thinning, spreading & uniform distribution of fibre flocks over the total surface area of the cylinder. The use of such additional carding segments reduces the number of imperfections. The present study reports the results on yarn evenness and yarn lea strength.
Keywords: Crosrol MK5D and Mk6 high production cards, cotton yarn quality

INTRODUCTION

In ring spinning various processes are involved from opening of cotton to the packing of yarn. Cotton processing machine that mechanically process the cotton fibre are designed with the intent of minimizing fibre damage. Nevertheless opening, cleaning and blending equipment shorten the staple length while increase the short fibre content and neps. Main cylinder is the backbone of the carding machine and major parts are mounted on it. Carding action takes place between cylinder and stationary flats, but the major carding action takes place between cylinder and revolving flats. In pre-carding zone, the functions of stationary flats provide extra opening of the tufts transfer to the cylinder from taker-in. They also act as a barrier to large, hard trash particles such as seed coats, protecting the wire of the revolving flats from damage, particularly at high cylinder speed. This enables finer wire to be used for revolving flats and thereby improves the cleaning effect of the interaction between cylinder and revolving flats. Crosrol MK5D single high production card is equipped with 89 revolving flats, 36 in working 8 stationary flats (four at pre carding zone and four at post carding zone), cylinder speed is 425 rpm to 770 rpm, production rate up to 200lbs/ hr. And Crosrol MK6 single high production card equipped with 85 revolving flats, 28 in working 10 stationary flats (five at pre-carding zone and five at post-carding zone), production rate up to 220 lbs/hr. The higher the cylinder speed the higher the short fibre content and yarn irregularities. Awan (2000), likewise, Zafar (2005) narrated that the yarn will be more uniform at suitable (optimum) main cylinder speed. Oxtoby (1987) stated that the main factor involved in the formation of short term irregularity are random fibres arrangement and imperfect fibre control in roller drafting leads to drafting waves varying in amplitude and length. While Leifeld (1996) stated that for achieving higher quality values, the material transferred by taker-in onto the cylinder should be obtained in a more open form and more uniformly across the width. Anonymous (2004) stated that the system with some fixed flats improved fibre transfer from main cylinder to doffer and thereby leads to improve in yarn quality. Similarly Chattaha (1994) stated that the system with fixed flats improved the lea strength value of yarn. Likewise Rusca (1970) reported that increase in short fibre degrade yarn strength, uniformity and appearance. In general yarn strength decreased about 1.0 percent for each 1.0 percent increase in short fibre. And Lawrence (2003) expressed that short fibre content has negative effect on yarn production, yarn process and on the yarn quality.

MATERIALS AND METHODS

The process details and methods applied to record the effect of different number of stationary flats at front and back carding zones with changing the cylinder speed is described as under. The raw cotton MNH-93 samples were conditioned in the standard atmosphere before actual physical testing. Cotton used for this investigation was of the following physical characteristics.
Staple length = 27.17mm, Uniformity ratio = 46.72 percent, Fineness = 4.73 Microgram/inch. Short fiber content = 19.47% and Trash content = 7.5 percent.

The following changes were made at card machines and record its effect on yarn quality

No. of back (pre) stationary flats	No. of front (post) stationary flats	Cylinder speeds (rpm)
B1 = 5	F1 = 5	C1 = 500
B2 = 4	F2 = 4	C2 = 600
B3 = 3	F3 = 3	C3 = 700

Yarn Evenness

The yarn of 30^s prepared at each setting was subjected to the following physical tests. Yarn evenness (U%) is determined by measuring the variation in capacity occurring as yarn passes through the condenser and recorded in terms of mean linear irregularity (U%) and the coefficient of variation in yarn mass (CV%). Equipment employed was Uster Evenness Tester (UT-3), which simultaneously measure the imperfections viz., thin, thick places and neps per thousand meters of yarn. **Yarn Lea Strength:** Lea strength tester was used to find the yarn lea strength in pounds. The lea of 120 yards was fed to the instrument according to ASTM (1997a). **Statistical Analysis:** The data was analyzed statistically as suggested by Steel and Terrie, 1980 using M-Stat microcomputer statistical program as devised by Freed (1992).

RESUTLS AND DISSCUSSION

Yarn Evenness

The mean values for yarn evenness obtained after statistical operation are shown in Table 1(a) and 1(b). The results show that the back stationary flats (B), front stationary flats (F) have highly significant effect, while cylinder speed (C) has significant effect upon yarn evenness. The only one interaction B x F generates highly significant effect upon yarn evenness, while all other possible first and second degree interactions i.e. B x C, F x C and B x F x C proved to be non-significant.

Table 1(a). Comparison of individual treatment means for yarn evenness

B Mean	F Mean	C Mean
B1 = 12.73 a	F1 = 12.86 a	C1 = 13.42 c
B2 = 13.20 b	F2 = 13.37 b	C2 = 13.18 a
B3 = 13.95 c	F3 = 13.65 c	C3 = 13.28 b

Note: Any two values not sharing a letter in common differ significantly at ∝=0.05 level of probability

Table 1(b). Comparison for the Interaction B x F for yarn evenness

F1	F2	F3
B1 = 12.00 a	12.95 b	13.24 e
B2 = 13.08 c	13.15 d	13.38 f
B3 = 13.51 g	14.02 h	14.33 I

B= Back Stationary Flats, F= Front Stationary Flats, C= Cylinder Speed

Duncan's multiple range tests for comparison of individual mean values of back stationary flats (B) at back carding zone for yarn evenness concluded that the values of yarn evenness obtained as 12.73 percent, 13.20 percent, 13.95 percent at B1, B2, B3, respectively. These results also show that the back stationary flats have significant effect for yarn evenness. Maximum value of yarn evenness was obtained by using maximum number of flats at back carding zone. These findings are fully justified by the previous researcher like Leifeld (1996) who stated that for achieving higher quality values, the material transferred by taker-in onto the cylinder should be obtained in a more open form and more uniformly across the width. And material transferred by taker-in onto the cylinder should be obtained in a more open. Similarly Lawrence (2003) expressed that short fibre content has negative effect on yarn production, yarn process and on the yarn quality. As regard to the front stationary flats (F) revealed that highest value of yarn evenness 13.65 percent at F3 followed by the value 13.37 percent at F2 and the lowest value recorded 12.86 at F1 tabulated in Table-1(a).These values show that significant difference with one another. Duncan's multiple range tests for comparison of individual means for cylinder speed (C) revealed the highest value is 13.42 percent of yarn evenness at C1 followed by 13.28 percent at C3 and the lowest value 13.18 percent of yarn evenness obtained at C2. These results generate a significant effect upon yarn evenness as Jamil (1999) stated that the carding process directly affects the quality of yarn. Better the maintenance and speed setting of card better will be the sliver and yarn quality. In this trend Awan (2000) sated that the higher the cylinder speed short fibre content increase as a result the yarn irregularities increased. Likewise Zafar (2005) narrated the yarn will be more uniform at suitable (optimum) main cylinder speed, previously Oxtoby (1987) stated that the main factor involved in the formation of short term irregularity are random fibres arrangement and imperfect fibre control in roller drafting leads to drafting waves varying in amplitude and length.

Yarn lea strength

The analysis of variance of data regarding yarn lea strength produced highly significant effect of back (B) and front (F) stationary flats upon yarn lea strength while significant effect of cylinder speed (C). The B x F also generate highly significant effect upon the data while all other possible interactions i.e. B x C, F x C and B x F x C remained non-significant.

The mean values pertaining to the lea strength at B1, B2, and B3 are 111.88 lbs, 109.64 lbs, 109.00 lbs respectively. These results show significant difference with each other and results are correlated by Anonymous (2004) who found that the system with some fixed flats improved fibre transfer from main cylinder to doffer and thereby leads to improve in yarn quality. Similarly Chattah (1994) stated that the system with fixed flats improved the lea strength value of yarn. Likewise Rusca (1970) reported that increase in short fibre degrade yarn strength, uniformity and appearance. In general yarn strength decreased about 1.0 percent for each 1.0 percent increase in short fibre. The individual comparison of treatment means for mean lea strength of front stationary flats (F) for different numbers were recorded as 110.65 lbs at F1, 110.27 lbs at F2 and 109.59 lbs at F3 shows in Table-2(a). These values also show significant difference to each other, and fully correlated by Sasser (1991) found that fibre strength is a useful predicator of yarn strength. As Sheikh (1999) stated that the fibre properties such as length, uniformity of length, fineness, fibre strength, and elongation along with spinning conditions contribute to yarn strength.

The individual comparison treatment of mean values of cylinder speed (C) for yarn lea strength is shown in Table-2(a). The maximum mean value of yarn lea strength 110.58 lbs is recorded at C2, followed by the value110.14 lbs at C1 and the lowest value 109.79 lbs at C3, which clearly show significant difference to each other for yarn lea strength as Ahmad (2002) mentioned that the modern high-speed machinery has resulted in over all quality. In the same trend Zafar (2005) narrated that the lea strength is an important property of yarn, which is maximum at optimum speed of cylinder.

The individual comparison of mean values concerning to yarn lea strength due to interaction of back and front stationary flats B x F represented by Table-2(b) The over all range of yarn lea strength is 107.55 to 112.38 ponds. The best value is obtained under the combination of B1F1 (i.e maximum stationary flats at front and back carding zone), which is 112.38 pounds followed by the combinations B1F2 and B1F3 with a value of 111.81 and 111.44 pounds respectively. Anonymous (2004) mentioned that the system with some fixed flats improved fibre transfer from main cylinder to doffer and thereby leads to improve in yarn quality.

Table 2(a). Comparison of individual treatment means for yarn lea strength

B Mean	F Mean	C Mean
B1 = 111.88 a	F1 = 110.65 a	C1 = 110.14 b
B2 = 109.64 b	F2 = 110.27 b	C2 = 110.58 a
B3 = 109.00 c	F3 = 109.59 c	C3 = 109.79 c

Note: Any two values not sharing a letter in common differ significantly at ∝=0.05 level of probability

Table 2(b). Comparison for the Interaction B x F for yarn lea strength

F1	F2	F3
B1 = 112.38 a	111.81 b	111.44 c
B2 = 110.71 d	110.64 e	107.55 I
B3 = 108.87 g	108.36 h	109.78 f

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