EFFECT OF WIRE POINT DENSITY OF CYLINDER AND STATIONARY FLATS AND FLAT SPEED ON FIBRE GROWTH

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ABSTRACT: Cylinder speed, the raw material to be processed and the production rate determines the requirement of wire points per square inch for an effective carding. The rib thickness of the cylinder wire controls the carding. Generally finer the fibre, the finer the rib thickness so the wire points per square inch are carefully selected. Stationary flats in the carding machine act as a pre carding and guiding elements which assist to separate trash, common dust and short fibres in pre-carding zone. Well design stationary flats applications not only open the material properly but also curtail imperfections. Similarly the speed of top moving flats on the cylinder affects the quality of the product. An increase in flats speed results in an increase in card waste. Ultimately all these factors strongly affect the fibre growth. Hence to study the effect of these fators on fibre growth this research was made and it was noted that the effect for different wire point density of stationary flat (F), cylinder (C) and flat speed (S) on the fibre growth was highly significant while all other interactions were non-significant.

Key words: *Stationary Flats, Cylinder, Moving Flats speed and wire density*

INTRODUCTION

One of the most important machines used in cotton spinning is carding engine. The process of carding can be defined as the reduction of entangled mass of fibres to a filmy web. The conversion of lap into sliver is achieved by applying the material in between closely spaced surfaces clothed with sharp points (cylinder and flats) and then to strip it in the form of a translucent web. Control of fibre in carding machine is the prime responsibility of card clothing. Hence the cylinder wire selection is of vital importance.

Cylinder speed, the raw material to be processed and the production rate determines the requirement of wire points per square inch for an effective carding. The rib thickness of the cylinder wire controls the carding. Generally finer the fibre, the finer the rib thickness. So the wire points per square inch are carefully selected.

If there are too many wire points across the machine they may cause blockage. Condition of a cylinder wire has a great impact on quality and processing efficiency. If the condition and design of the cylinder wire is poor the teeth will not be able to hold onto the fibre through carding zone, which allow the fibres to roll itself into nep. Sheikh (2002) stated that the point of the wire should be sharp for the reduction of nep contents. The front fixed flat system is a logical development and is applied to the front of the main cylinder which acts as a pre carding and guiding elements. It also assists to separate trash, common dust and short fibres in pre-carding zone and ultimately affecting the fibre growth. Shepard and Louis (1990) found that the kind of wire on the cylinder affected the amount of trash removed and the fibre length distribution. Likewise Chattha (1994) stated that more the short fibres removed more will be the value of fibre growth. The fibre growth has a positive effect on the smoothness of yarn. Well designed stationary flats applications not only open the material properly but also cut back imperfections. The imperfections in the yarn are considered the major yarn faults.

The top flats move slowly in the same direction of the cylinder but the wire points are always backward, which is opposite to the direction of the cylinder wires. The optimum flats speed is influenced by the staple of the material, the amount of trash in the material, the weight of lap fed, and the waste percentage desired to be removed. An increase in flats speed results in an increase in card waste affecting the fibre growth and eventually influencing the over all yarn quality. Nawaz *et. al.* (1998) stated that the card waste extraction is directly proportional to the flat speed. Khan (1998) also reported that the modified card gives significant results for producing fibre growth.

MATERIALS AND METHODS

The present research work was planned in the Department of Fibre Technology, University of Agriculture, Faisalabad and conducted at Crescent Textile Mills Ltd. Sargodah Road Faisalabad. The details of the material processed and methods applied to record the data for various quality characteristics are given in the next section.

Material Used: Lint cotton samples of variety MNH93 having 28.19 mm staple length, 27.77 g/tex strength, 4.63 micronaire value and 49.48% uniformity with 9.06% short fibre content were taken from the running stock of mills for this study. These fibre characteristics were estimated by High Volume Instrument (HVI 900SA), a fibre testing system manufactured by M/S Zellweger Ltd. Switzerland. Short fibre content (fibres having length less than 12mm) were determined by Advance Fibre Information System (AFIS-L) according to the instruction laid dawn in its operational manual supplied by M/S Zellweger Ltd. Switzerland; applying the standard methods (ASTM, 2005a).

Spinning process: Raw cotton specimen of MNH-93 variety was processed through Crosrol model (1998) blow room and card machine. The samples were prepared by setting the following parameters.

Stationery flats wire points per square inch	Cylinder wire point per square inch	Flat speed
F_1= 88,88,160,270	C_1 = 500	S_1= 6 ″/min
F_2= 88,160,160,270	C_2 = 585	S_2= 8 ″/min
F_3= 88,160,270,270	C_3 = 685	S_3= 10 ″/min

Fibre growth measurement: Card sliver samples were prepared for the above settings and were tested for the fibre growth (The small increase in the fibre length due to removal of fibre hooks at any drafting system) by Advance Fibre Information System (AFIS-L) module according to the procedure laid down in its operational manual supplied by M/S Zellweger Ltd. Switzerland, by applying the standard method (ASTM, 2005).

Analysis of Data: The data thus obtained will be analyzed statistically as suggested by Faqir (2004) using M-Stat microcomputer statistical program as devised by Freed (1992).

RESULTS AND DICUSSION

Fibre growth: The analysis of variance and comparison of individual means regarding fibre growth tabulated in Table 1 and 1a respectively, indicates that the effect for different wire point density of stationary flat (F) and cylinder (C) and flat speed (S) on the fibre growth was highly significant while all other interactions were non-significant.

The mean values of fibre growth at different wire point density of stationary flat F1, F2 and F3 were found as 0.78, 0.90 and 1.01mm respectively. The mean values differ significantly. These results reveal that fibre growth increases with regard to the high wire point density of stationary flats. These results get support by the research of Chattha (1994) who stated that more short fibre removed more would be the value of fibre growth.

TABLE 1. ANALYSIS OF VARIANCE FOR FIBRE GROWTH

S.O.V	D.F	S.S	M.S	F. Value	Prob
F	2	1.122	0.561	266.0842	0.000**
C	2	1.951	0.975	462.4143	0.000**
S	2	5.904	2.952	1399.4993	0.000**
FxS	4	1.001	0.000	0.0878	N.S
FXC	4	0.001	0.000	0.0615	N.S
SxC	4	0.003	0.001	0.3380	N.S
FxSxC	8	0.001	0.000	0.0351	N.S
Error	108	0.228	0.002		
Total	134	9.210			

C.V=5.09%, N.S=non significant , ** = highly significant

TABLE 1a. COMPARISON BETWEEN INDIVIDUAL MEAN VALUES FOR FIBRE GROWTH.

Stationary flat wire point per Square inch	Fibre Growth (mm)	Cylinder wire point per square inch	Fibre Growth (mm)	Flat Speed	Fibre Growth (mm)
F1	0.7889c	C1	0.7544c	S1	0.6467c
F2	0.9033b	C2	0.9011b	S2	0.8989b
F3	1.012a	C3	1.049a	S3	1.159a

Means having different letters differ significantly (5% level of significant

Under different wire point density of cylinder the best value of fibre growth was recorded at C3 (high point density) cylinder followed by C2 and C1 with their respective means, 0.75 , 0.90 and 1.04 mm. Significant differences were observed between these values. These results get conformation from the views of Shepard and Louis (1990) who found that the kind of wire on the cylinder affected the amount of trash removed and the fibre length distribution. Likewise Ratnam and Seshan (1987) stated that fibre growth was dependent on fibre length and its variability.

The mean values of fibre growth at different flat speeds were found as 0.64, 0.89 and 1.15mm respectively. Significant differences were recorded between S1, S2 and S3. These results indicate that the fibre growth was maximum at S3 (10″/min) flat speed due to more cleaning efficiency. These results get support from the research work of Nawaz *et. al.* (1998) who concluded that the card waste extraction is directly proportional to the flat speed. In the same line Roosli (1995) found that by the reduction of short fibres from card sliver noticeable advantages could be found in fibre growth.

CONCLUSIONS: Conclusions of prime importance drawn from the present research work is that,

1. Better results are found with the fine wire clothing and maximum flat speed due to effective opening, cleaning and removing of neps and short fibres

2. Better facilitation for efficient carding action due to improved cylinder input, higher wire point density and quicker elimination of fly particles produced sliver with excellent fibre alignment which finally produces a stronger yarn.

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