Optimization of Nep Generation & Fibre Rupture in Blowroom/Card and its Impact on Yarn Quality

By:

Sonawane Rupesh, P. P. Raichukar, Sapan Mukherjee, M.S.Anjane & R.D.Parsi

NMIMS MPSTME, CENTRE FOR TEXTILE FUNCTINS, SHIRPUR

Optimization of Nep Generation & Fibre Rupture in Blowroom/Card and its Impact on Yarn Quality

By: Sonawane Rupesh, P. P. Raichukar, Sapan Mukherjee, M.S.Anjane & R.D.Parsi

Centre for textile functions (CTF), NMIMS MPSTME Shirpur Campus, Shirpur

Dist- Dhule, Maharashtra

Abstract

The Blow room plays an important role in the opening, cleaning, homogeneous mixing and blending, optimum process parameters are required to minimize/control the fibre rupture and lower the nep generation. Material transportation to chute for sub sequent process is also carried out while blow room is in action. By keeping view of this concept in mind, a project work has been carried out in sequence of different machines in blow room like Varioclean, Flexiclean and the subsequent process carding, by conducting trials with different process parameters at each stage. The main object of this study is to achieve better sliver and yarn quality by implementing different settings at different machines cited above.

Keywords
Beater speed, Grid bar setting, Beater to grid bar setting, Nep generation, Fibre rupture, Yarn Quality.

Introduction

The blow room contributes only about 5 to 10 % to production costs in the ring spinning mill. From a cost accounting point of view, the installation itself is not a relevant cost factor; however, the loss of raw material that arises here is a factor. Blow room machines must eliminate foreign matter, the blow room eliminates only about 50% of the incoming impurities, the history of the development of this section is rather surprising- opening and cleaning are carried out today with almost the same equipment as 150 years ago and more. In case of Blow room due to high beater speed higher the fiber ruptures, higher the cleaning efficiency, higher the NEP generation. Therefore Fiber rupture should be checked for each opening point. 2.5 % span length should not drop by more than 3%. If the uniformity ratio drops by more than 3%, then it is considered that there is fiber rupture. High fan speed, which will result in high velocity of air, will increase neps in cotton NEP is increased in the blow room process. The increase should not be more than 100%.

1.1 Neps (Degree of Sensitivity-3)

This gives an estimate of neps; the cross-section of such a nep is 200% greater than the average value.

1. A small but sharp thick place is defined as neps.
2. NEP is a small thick fibrous mass which shows up clearly on the yarn.
3. The NEP is a thick place whose length is shorter than 4 mm or not more than 1 mm. when the cross section of the yarn exceeds above 200% of the average value, than the fault is classified as a nep at 3 sensitivity levels.

1.1.1 Neps can be divided in to two categories

1) Raw material Neps:
   The raw material neps in cotton yarn are primarily the result of vegetable matter and immature fibers.

2) Processing Neps:
   Processing neps are produced at ginning stage. Type of card clothing, setting of the card flats workers and strippers and production speed.

a) The ginning process has quite an enormous influence on the number of neps in cotton yarn.

1.1.2 Diagram of Neps

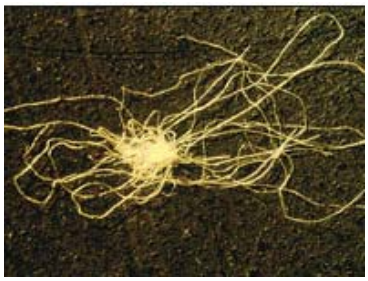


Fig. 2.5 Fibre NEP

Fig. 2.6 Seed coat NEP

1.1.3 Neps formation in Blow room

1) Cotton with too high or low moisture.
2) Rough or blunt blades and bent pins or beaters.
3) Damaged and rusty grid bars.
4) Too high or low beater speed.
5) Slack or too tight fan belts.

1.1.4 Some causes of fiber damaged in the blow room

1) Very high beater speeds.
2) Too close setting between the feed roller nip and the beater.
3) Bent or damaged beating edges or pins.

4) Too many beating points.

1.2 Carding

Richard Marsden, in "cotton Spinning" (1891), says of carding, "It is the final stage of cleaning, wherein the minutes impurities foreign to the material and all immature fibre, leaf and broken seed ought to be removed."

Nasmith, the "The students cotton Spinning" (1893), speaking of carding says, "The operation resolves itself in to one of cleansing by removal of any remaining 'motes', short fibres or 'neps'"

W.S. Taggart in "cotton Spinning" (1902) makes the following statement regarding carding "each improvement made has kept in view the one principle of separating each individual fibre and combing it in such a manner as to free it from both its foreign and natural impurities."

1.2.1 Some causes of Neps formation in Carding

Worn gear wheels, narrow under casings, allowing lumps of waste to doffers, eccentric or worn feed roller bearings, too high a tension draft, jerky motion of calendar roller, too fine web faults in the coiler.

Setting of the coiler base, size of the coiler trumpet not suitable to the hank fed roller, weighing not acting properly, uneven feed to the nose of the fed plate, worn clothing and improper setting and humidity.

Uneven heights of wire clothing due to improper mounting, less fed roller grip due to failure of feed roll weighing, bent feed roller and bent surface of feed plate

1.2.2 Important settings in carding

1) The setting between cylinder and doffer is the closest setting in the card. This setting mainly depends upon the cylinder speed, hank of the delivered sliver and the type of wire. Cylinder speed up to 360, the setting should be 0.1mm. For cylinder speeds more than 450, the setting ranges from 0.125 to 0.15.
2) If the setting between cylinder and doffer is very close, the wires will get polished and this will affect the fibre transfer. If the setting is too wide, the fibres will not be transferred to doffer from the cylinder, hence cylinder will get loaded. While processing synthetic fibres cylinder loading will badly affect the yarn quality. Moreover, it is difficult to improve the wire condition if the loading is severe. The only solution would be to change the wire. Therefore enough care should be taken while processing synthetic fibres.
3) The most critical setting in a carding machine is between cylinder and flat tops. While processing cotton, it can be as close as 0.175 mm provided the mechanical accuracy of flat tops is good. Since most of the cards are with stationary flats at the licker-in side, the setting from the back to front for flats can be 0.25, 0.2.0.2, 0.2, 0.2mm.
4) Closer the setting between cylinder and flats, better the yarn quality. Neps are directly affected by this setting. Of course, very close setting increase the flat waste. For

processing cotton the setting can be 0.25, 0.2, 0.2, 0.2, 0.2mm. For synthetic fibres it can be 0.3,0.25,0.25,0.25,0.25mm

1.2.3 Following are the two types of hooks present in card sliver

1. Trailing hook. 2. Leading hook.

The bulk of fibres as they leave the doffer are found to have hook at their rear end (back end) are 'Trailing Hooks" and the fibres are found to be hooked at their forward ends termed 'leading hooks'.

Proportion of the fibre hooks in the card sliver
Trailing hooks = 55 % both ends hooked = 15%
Leading hooks = 15 % No hooks =15 %

Machine vibration, improper settings, and disturbing air current in the drafting zone have adverse effects and fresh hooks tend to appear. Hook formation tendency is proportional to the length as well as fineness characteristic. Due to the natural reversal of material at each stage of processing, the hooks can be fed either as leading or trailing. Major hooks as leading hook should be presented to comber; otherwise trailing hook increases the waste percentage at comber. The increase in waste is not because of the comber extracting more short fibre, but because of hooked long staple fibre go into waste. Even number of passages (two or four machines) should be provided between carding and comber for presenting major hooks as leading to the comber. Similarly, Odd number of passages should be provided between card & Ring frame to feed major hook as trailing hook, to the Ring frame.

2. Materials and Method

Plan of Work The Project contain following points.

Variables

1) Beater speed & Grid Bar setting in Varioclean.

2) Beater to Grid bar setting (mm) & Feed roll to Beater setting (mm) in Flexi clean.

3) Flat speed in Carding.

During trial everything are be the same such as machine no., process parameters, spindle no., & same type of process are follow in Flexi clean sample & Carding sample.

Table 2.1 Process Parameters of MCU (100%)

Department	Description	Settings
Blow room		
Bale plucker	Tr. Speed	**9 m/min**
	Depth	**3 mm**
Take of roll	Speed	**1500 rpm**
Vario clean	Opening roll speed	**500 rpm**
	Grid bar setting	**9,9,9,9**
Unimix	Beater Speed	**420 rpm**
	Lattice Speed	**50 m/min**
	beater-tr.bar	**4 mm**
	Lattice to Evener roll	**20 mm**
	Conveyer Speed	**0.55m/min**
	Waste plate	**2.0,2.5,3.0,3.5,4.5**
Flexiclean	Beater Speed	**420 rpm**
	Beater-tr.bar	**4 mm**
	Feed roll Speed	**9.5 rpm**
	Waste plate	**2.0,2.5,3.0,3.5,4.0**
Carding	Sliver hank	**0.13**
	kg/hr.	**31**
	Delivery speed	**115**
	Cylinder speed	**430**
	Licker in speed	**855**
	Flat speed	**322 mm/mts**
	Flat gauge	**0.25,0.25,0.2,0.2,0.2**
	S F D	**0.25**
	S F L	**0.35,0.3,0.25**
	Mote knife	**15 mm**
	FP to lickerin	**1**
Ring frame	Count	**9.52 Tex (62s Ne CW)**
	Avg Speed	**21000**
	TPI/TM	**33.94/4.31**
	Spacer	**3**
	Ring traveller	**16/0 EL1 UDR (Max)**
	Bottom roll gauge	**42.5 – 65**
	Top roll gauge	**50 – 67**
	Winding length	**5.676**
	Break draft	**1.14**

Table No.2.2 Afis Results and Yarn Quality of First trial

Project trial:- In Varioclean				
	Fibre Properties			
Mixing	MCU-5 (100%)			
Mic value	3.7			
Mat	0.86			
UHML	30.81			
UI	85.11			
SFI	6.59			
G/TEX	31.91			
Elongation	5.89			
Rd	80.37			
plus b	8.34			
Following are the Project trials to be carried out discussion with				
the technical staffs				
Beater speed(rpm)	500	500	700	700
Grid Bar setting	9999	7777	9999	7777
Varioclean Afis Results				
Nep(cnt/g)	194	144	181	227
SCN(cnt/g)	28	26	12	22
SFC(n)	22.9	21.1	27.4	26.5
UQL (mm)	30.89	30.76	29.8	28.9
From above trials, forward two trials up to Yarn stage which are				
having Optimum Quality				
Beater speed(rpm)	500	500		
Grid Bar setting	9999	7777		
Unmix Afis Results				
Nep(cnt/g)	215	175		
SCN(cnt/g)	24	11		
SFC(n)	28.1	22.6		
UQL (mm)	30.20	30.60		

Beater speed(rpm)	500	500
Grid Bar setting	9999	7777
Flexiclean Afis Results		
Nep(cnt/g)	289	289

SCN(cnt/g)	20	12	
SFC(n)	28.8	23.6	
UQL (mm)	30.7	30.8	
Chute Feed Afis Results			
Nep(cnt/g)	339	294	
SCN(cnt/g)	19	17	
SFC(n)	26	23.5	
UQL (mm)	30.2	30.8	
Card sliver Afis Results			
Nep(cnt/g)	93.83	77.66	
SCN(cnt/g)	28	9	
SFC(n)	23.11	23	
UQL (mm)	30.43	30.50	
Cop stage Results:-			Improved %
U %	11.08	10.75	2.97
CV(10 mtr)	2.46	2.33	5.28
Thin (-50%)	11.6	3.8	67.24
Thick (+50%)	63.1	55	1.81
Nep (+200%0	140.9	114	19.09
Total (IPI)	215.6	172.8	18.46
Hariness	3.98	3.95	0.75
RKM	19.35	19.65	1.52
RKM cv%	8.8	8.6	2.27
Elongation	3.14	3.79	17.15
Elong cv%	13.4	10.6	20.89
SYS	184.3	187.2	1.54

Table 2.3 Afis Results and Yarn Quality of Second trial

In Flexiclean machine there are three trials taken such as Beater to Grid Bar setting in mm				
See the effect of Card Sliver Quality & Forward up to the Yarn Stage				
Card sliver Afis Results				
Beater to Grid Bar setting in mm				
Propeties	3 mm	4 mm	5 mm	
Neps(cnt/gm)	71	81	80	

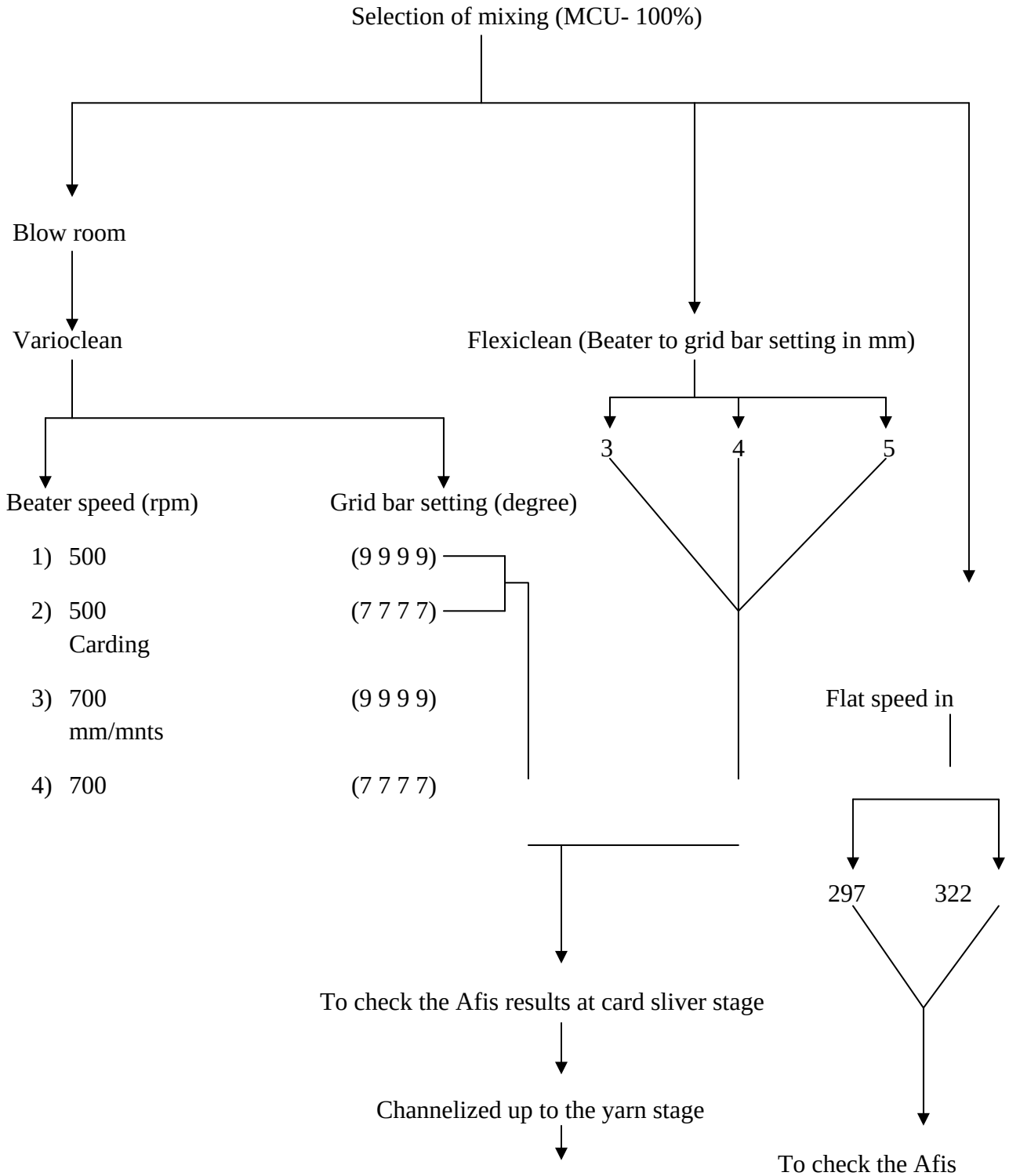
SCN(cnt/gm)	9	11	11
SFC(n)	19.06	20	23
UQL (mm)	30.3	30.1	30
IFC%	4.63	5.4	5.63
Cops stage Results (Beater to Grid Bar setting in mm)			
	3 mm	4 mm	5 mm
U%	10.98	11.17	11.15
CV (10 mtr)	2.75	2.8	2.89
Thin (-50%)	8.8	10	10.3
Thick (+50%)	50.3	55.8	64.5
Nep (+200%)	111.5	127	134.8
Total (IPI)	174.4	192.8	209.6
Hairiness	3.83	3.95	4.29
RKM	19.38	18.85	18.43
Elongation	3.6	3.59	3.51
SYS	184.6	179.6	175.8

3) Card sliver results by changing the Flat speed

Table No. 2. 4 Card sliver Afis results of Third trial

Card sliver Afis results at different flat speed in mm/minutes	297	322
Neps (cnt/gm)	58	58
SCN (cnt/gm)	5	4
SFC (n)	21.2	21.3
UQL (mm)	28.97	29.32

Plan of Work (Flow Chart)



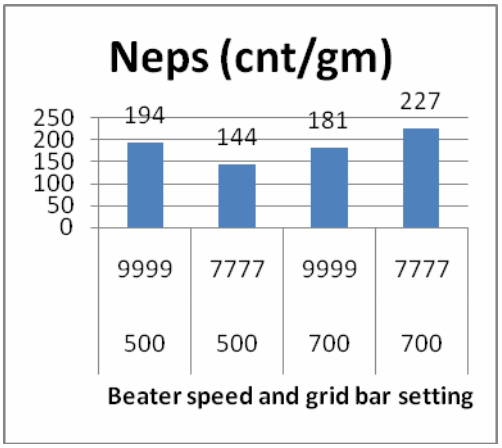
To check the yarn quality Results at card sliver stage
Finally the settings are implemented for particular mixing

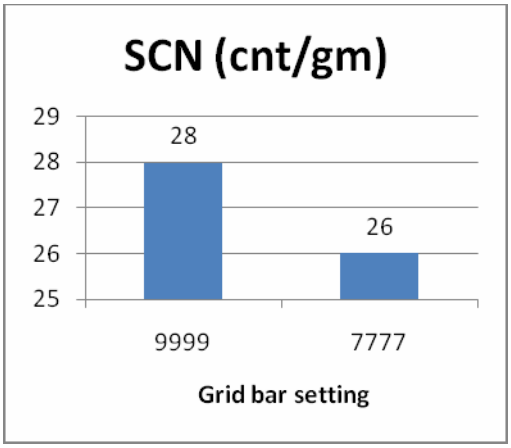
3. Results and Discussion

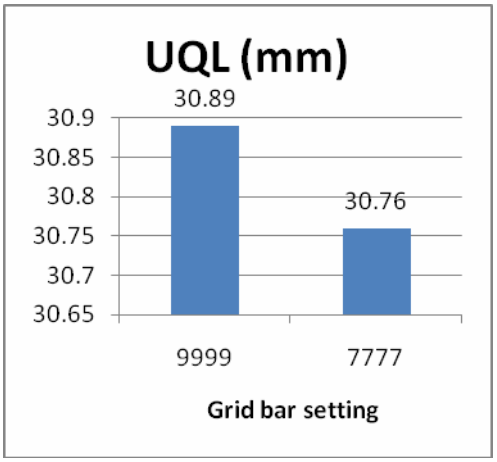
All Graphs are having following codification, Afis Results up to the card sliver stage.

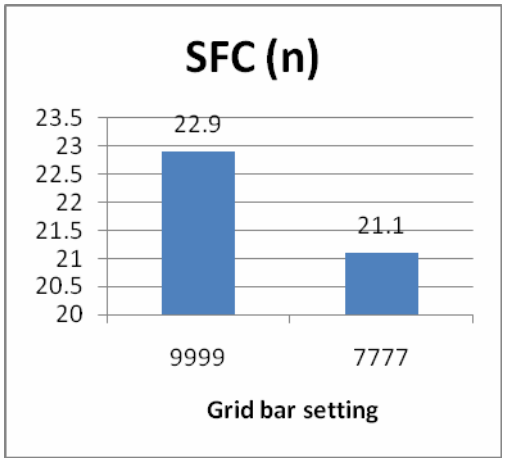
In **Varioclean** four trials are taken from that two trials are channelized up to the yarn stage such as **Beater rpm** is 500 & **grid bar setting** is (9999) are the regular setting & 500 rpm & (7777) grid bar settings are the Implemented settings.

1) **Varioclean**

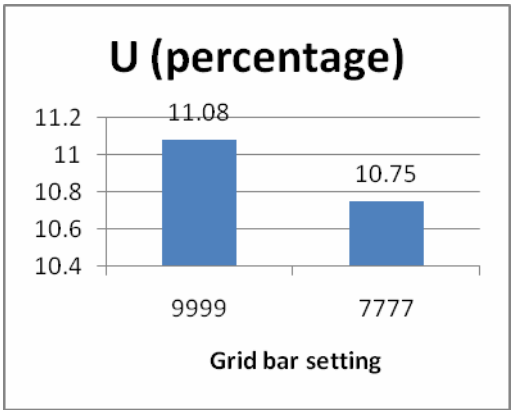


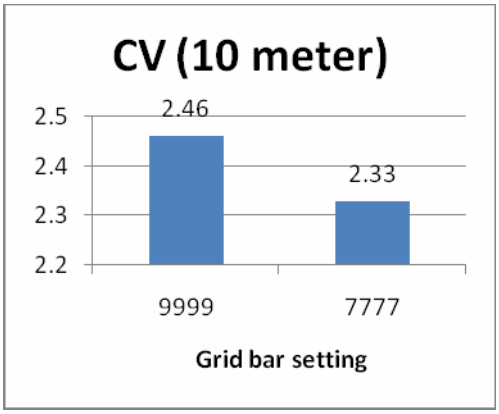


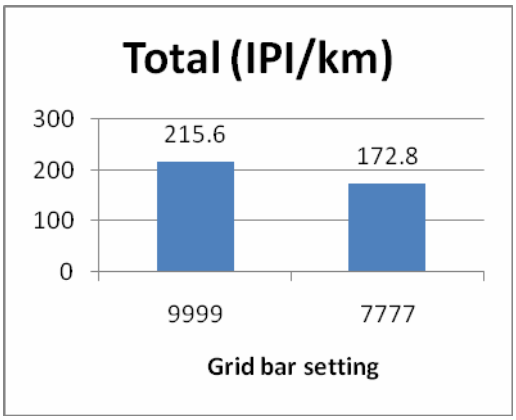


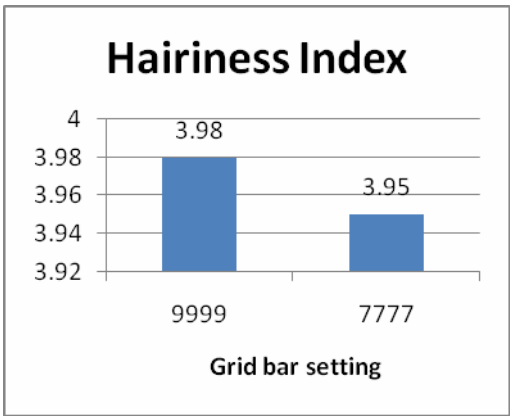


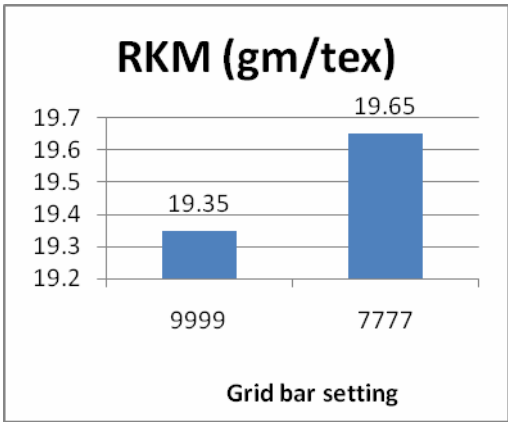
3.1 Results of Cops

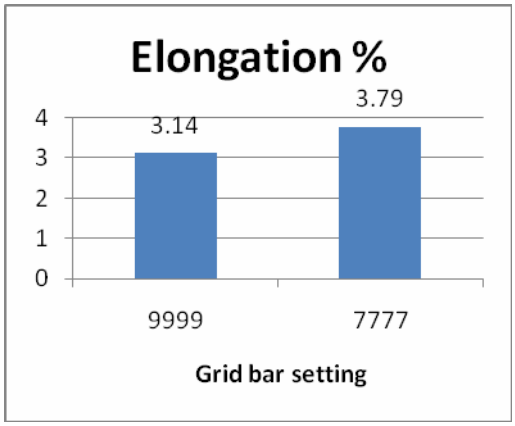






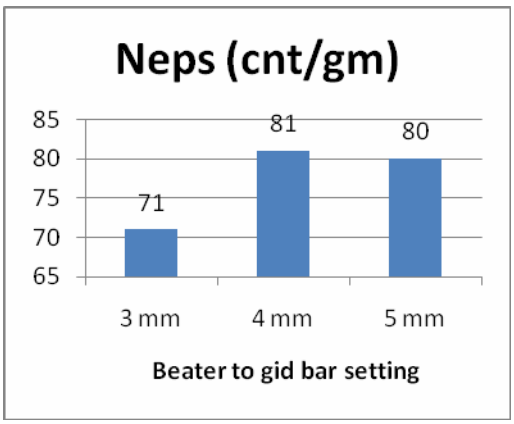


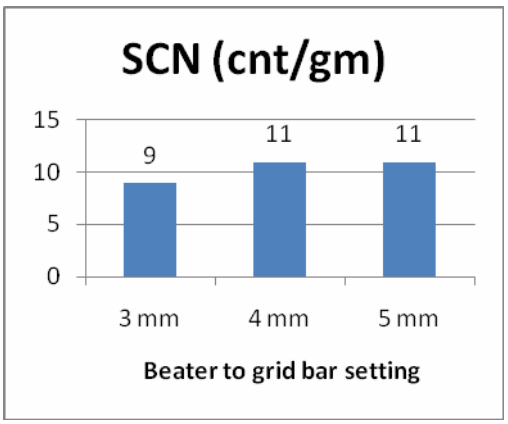


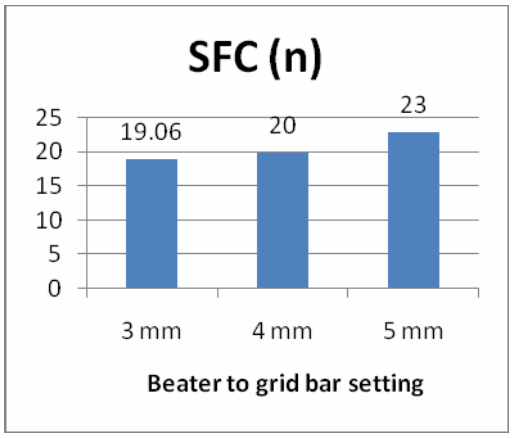


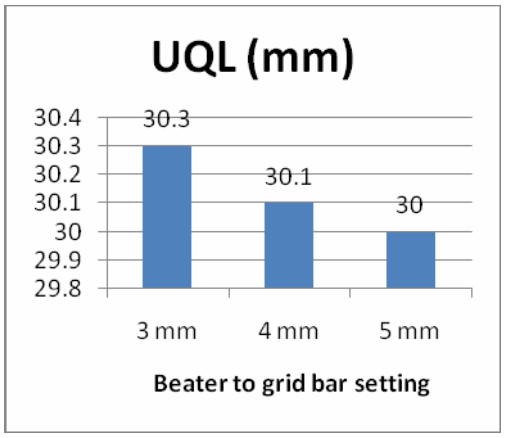
2) In the **Flexi clean machine** there are three trials taken such as **Beater to Grid Bar setting in mm**, after changing the setting check the **Card Sliver Quality & Forward up to the Yarn stage** for checking the Quality whether it is Optimum or not & Finally Implement that setting which are getting the **Optimum Quality.**

Graphical Representation of all Results from Card sliver to the Yarn stage.

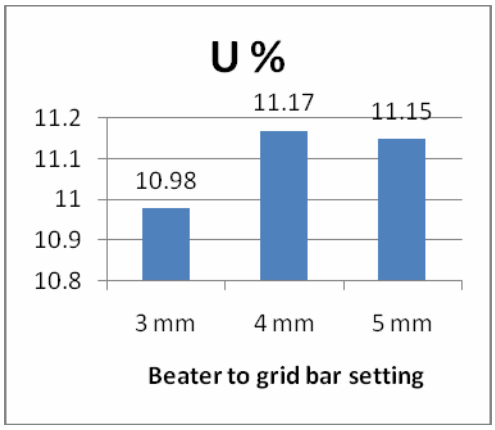


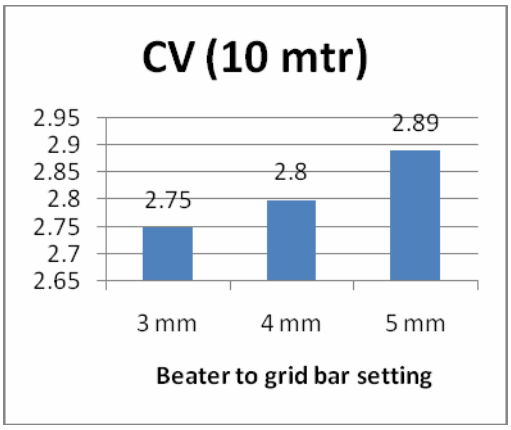


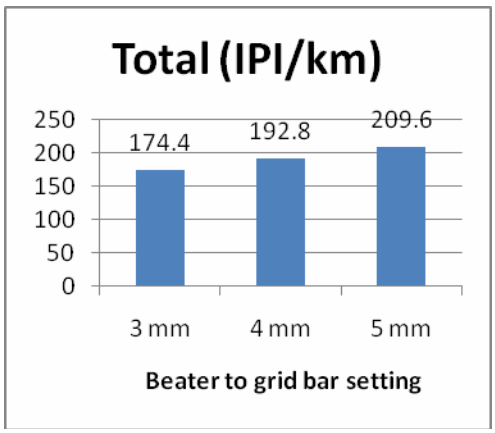


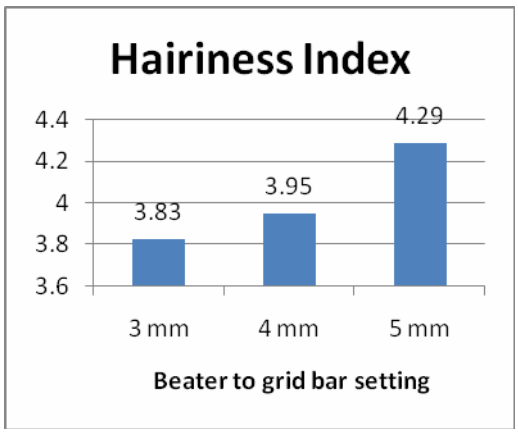


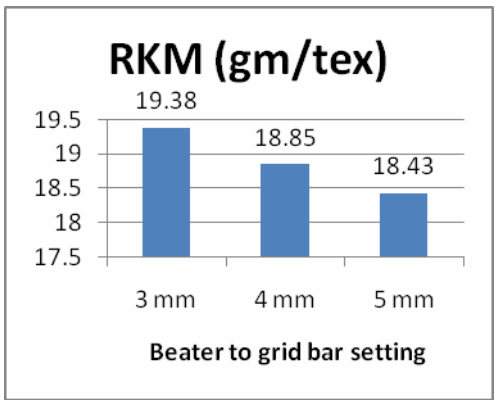
3.2 Result at cop stage

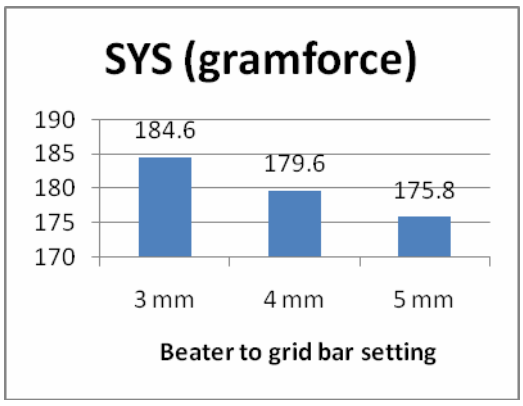




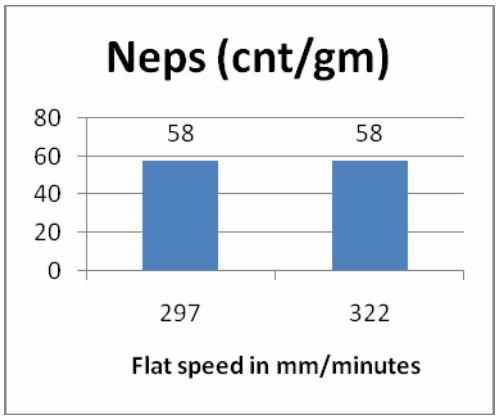


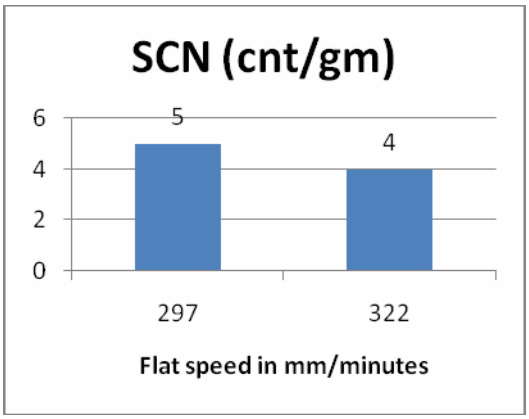


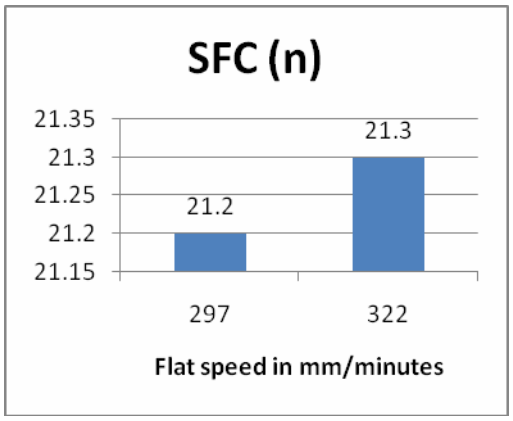


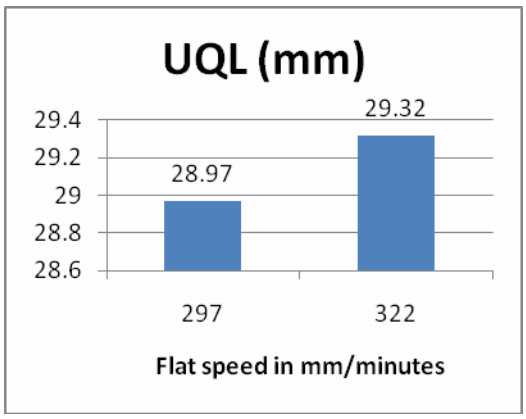


3) Graphical Representation of third trial by changing the **Flat speed in carding** and checking the sliver quality.









4. Conclusion

1) We conclude from first trial that, In this project there are three trials are taken from that Two better results are forward to the yarn stage therefore in Varioclean 500 rpm (Beater speed) & 7777 (grid bar settings) achieve the better results, due to that settings simultaneously I am getting less amount of wastes with excellent improvement in the quality, so that at the same time this settings are Implementing by the spinning manager.

Improvement Percentage

a) Varioclean:-25.77% (At Fiber stage)

At cop stage: - a) U%:- 2.97% b) 10 mtr CV:-5.28% c) Total IPI: - 19.85%

d) Hairiness:-0.75% e) RKM:-1.55% f) Elongation:-3.79% g) SYS: - 1.54%

2) The second trial in Flexiclean, shows that from three trials one trial having optimum results therefore we conclude that wider the gauge Quality become Inferior & narrow the gauge Quality

become optimum. Due to the wider setting the cotton will not be fully open therefore its directly affect on Yarn Quality & Due to Narrow setting the cotton will be fully open i.e. reduces the tuft size of the cotton that facilitates better Quality of the Yarn. Therefore in this way 3mm setting have implemented in Flexi clean.

Improvement Percentage

a) Flexi clean: Neps (11.25%), SCN (18.18%), IFC (17.76%) (At Fiber stage)

At cop stage: - a) U%:- 1.52% b) 10 mtr CV:-4.84% c) Total IPI/km: - 16.79%

d) Hairiness:-10.72% e) RKM:-5.15% f) Elongation:-2.56% g) SYS: - 1.54%

3) In third trials there are no any major changes in terms of quality in bothe the flat speeds in carding threfore we conclude that some minor effect on quqlity due to the change of flat speed.

References

1. Mr. W. Klein, A practical guide to opening carding, volume-2, The Textile Association Manchester, 1994.
2. Mr. Vivek plawat, Spinning tablet blow room, I, The Textile Association Manchester, 1994.
3. Ms. Dipali plawat, spinning tablet carding, 2, The Textile Association Manchester, 1994.
4. Mr. Shailendra Kumar Shrivastav, Spinning handbook of quality control, Mahajan Ahmadabad, 1991.
5. A.R. Khare. Elements of carding and drawing, Sai book centre Mumbai, 2007
6. www.google.com (searching the generation of neps and fibre rupture).
7. http://www.wikipedia.com/
8. Glibert R. Merrill, Cotton Carding, Glibert R. Merrill, 1955.
9. Process Control in spinning, A.R. Garde, T.A. Subramanian Third Edition: 1987.
10. Textile Express, 1-15 May 2005 (Daily News).
11. LMW Manual of Blow room and Carding

Image Courtesy: http://2.imimg.com