

# Optimize machinery settings to achieve growth in 2.5% S.L. of cotton

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On the basis of precise information about the quality of yarn required by the end-user, the spinners select the quality of cotton most suitable for producing it. The properties of cotton fibres and lint influence the yarn quality and efficiency of spinning process significantly. The main fibre properties are length, fineness, strength and maturity. According to Max Preysch<sup>[1]</sup>, the yarn strength can be predicted on the basis of fibre characteristics as follows:

It is obvious from the relative effect of the fibre characteristics on yarn strength as given above that 2.5% S.L. and Uniformity Ratio make the highest contribution. Uniformity Ratio represents ratio between 50% S.L. and 2.5% S.L. both of which can be measured by using either a Fibrograph or HVI Spectrum.

If the 50% S.L. is 12m.m. it indicates that 50 % of the fibres of the beard extend into the draft zone a distance of 12m.m. Similarly, if 2.5 % S.L. is 28 m.m. it indicates that at least 2.5% of the fibres extend a distance of 28 m.m. into the draft zone.

As is well-known the settings between the functional parts of the machines are determined with reference to 2.5% S.L. Consequently, the machines in a Spinning Mill are primarily sensitive to the 2.5 % S.L. It is therefore recognized as the most important fibre property. In order to produce yarn conforming to the quality required by the end-user, the spinners ensure fulfillment of the following fundamental requirements:

- Preparation of homogeneous cotton mixing.
- Elimination of fibre damage or breakage by optimization of machinery speeds and settings.
- Adequate growth in 2.5% S.L.

## 1. Homogeneous Cotton Mixing

Spinners pay special attention to the preparation of consistent quality homogeneous cotton mixing for processing in the blow rooms in order to achieve adequate growth of 2.5% S.L. and produce good quality yarn. The quality of ginning of Pakistani cotton is generally unsatisfactory. Consequently; Pakistani spinners make special arrangements to overcome quality deficiencies of cotton bales some of which are:

No.	Fibre Characteristics	Contribution to yarn Strength (%)
1	2.5 % S.L. and Uniformity Ratio	39
2	Fineness in Microgram per inch (Micronaire)	18
3	Strength in pounds per sq. inch (P/tex)	20
4	Unexplained factors	23
Total		100

- A mixture of varieties and grades leading to large scale variations in 2.5% S.L., micronaire value, strength and maturity index.
- Trash content is generally higher than 7.0%
- Presence of polypropylene [PP] fibres, human hair, hairpin, pieces of broken combs etc. Presence of PP fibres is the biggest hurdle in the manufacture of value-added products.<sup>[2]</sup>

By developing and implementing bale management programme and making special arrangements for removal of contaminant especially PP fibre., the spinners generally succeed in preparation of a homogeneous cotton mixing conforming to the following standard:-

- The difference in the micronaire values from mix to mix is not more than 0.1.
- Within a mix the CV% 2.5 % of S.L. is less than 3.
- Within a mix the CV% of micronaire value is less than 10.
- Rd% of cotton lots selected for mixing is above 70 and yellowness + b below 10.

## 2. Spinning of yarn

Homogeneous cotton mixing is conditioned in the blow room for at least 24 hours before processing is started. In spinning mills equipped with Ring Spinning or Compact Spinning Systems the processes performed on cotton are blowing, carding, drawing, (2 passages), roving formation, spinning of yarn and winding for manufacture of carded yarns.

Processing Stage	Entry inches	Delivery inches	Growth inches	% Growth	Remarks
Blow Room Lap	1.00	1.005	0.005	0.50	2.5 % S.L. of cotton mixing is assumed at one inch
Card Sliver	1.005	1.02	0.015	1.50	
Pre-comber Draw Frame	1.02	1.06	0.04	3.92	
Lap Former	1.06	1.08	0.02	1.90	
Comber	1.08	1.10	0.02	1.85	
Breaker and Finisher Draw Frames	1.10	1.14	0.04	3.64	
Roving Frame	1.14	1.15	0.01	0.88	
Ring Frame	1.15	1.16	0.01	0.87	
Total			0.16	16 %	

For production of combed yarn, card sliver is also passed through a combing set comprising of per-comber draw frame, lap former and four or six combers. The processes of roving formation and winding of yarn on winding machines are eliminated in spinning mills equipped with Open-End Rotor Spinning Systems.

The Spinners Optimize machinery settings at all processing stages in order to achieve adequate growth in 2.5% S.L. and produce good quality yarn. Samples of the material being fed to the machines and that being delivered are tested in the Quality Control laboratory for 2.5% S.L. at each processing stage. If fibre damage or breakage is detected, the settings of the machines are suitably adjusted to eliminate it.

By trials, tests and adjustments of the settings between the rollers in the break draft and front draft zones and elimination of fibre damage at the drawing frame, Max Preysch<sup>[1]</sup> reported growth in 2.5% S.L. of fibres from 1.06 inch to 1.12 inch, i.e., 5.7%. By following a similar procedure for optimization of machinery settings, it is possible for spinning mills to achieve adequate growth in 2.5% S.L. of homogeneous cotton

mixing assumed to be one inch as tabulated in Table-2 on previous page.

Adequate growth in 2.5 % S.L. makes it possible for Spinners to economize in the purchase of cotton. The machinery settings or gauges as commonly called are given department-wise for a typical spinning mill in Appendix -1.

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### References

1. Max Preysch, "New Developments of Digital-Fibrographs and Their Applications in Cotton Spinning Mills," October, 1973,500, No. 216.
2. Abdul Razaq Teli, "Contamination V/S Value-addition," Letter to Editor, Pakistan Textile Journal, May, 2000. ♦

Appendix-1		
Department	Settings or Gauges	
<b>B/ Room</b>	Piano motion to Feed Roll	08mm
	Feed Roll to Krischner Beater	08mm
	Krischner Beater to Mote Knife	2.0mm to 21/2
	Krischner Beater to Grid Bar	12mm
<b>Card</b>	<b>Feed Plate to Takerin</b>	<b>12/1000 (inch)</b>
	Takerin to Cylinder	7/ 1000
	Cylinder to Topset	10/ 1000 to 12/1000
	Doffer to Cylinder	5/1000
	Doffer to Striping Roll	10/1000 to 12/1000
	Front Plate Top Plate	34/1000
	Front Bottom Plate	22/1000
	Cylinder Under Casing	F 22,M34, B 68/1000
	Back Plate	22/1000
	Takerin Under Casing	5mm
	Takerin to Mote knife	38/1000 (inch)
<b>Drawing</b>	Breaker Roller Gauge	F 5.0, M 6.0, B 7.0mm
	Finisher Roller Gauge	5.0, 6.0, 6.0 " "
<b>Simplex</b>	Roller Gauge	6.5, 20.5, 21.5 " "
	Roller Pressure	Green
<b>Ring</b>	Roller Gauge	F 44mm, B 48mm
	Roller Pressure	Green (Spacer Yellow)
<b>Auto Cone</b> (Settings of Automatic Electronic yarn Clearer for Short thick place, long thick place and thin place)	Count 14/s	+ 160/1.5cm, + 30/100 cm, - 30/70cm
	Count 20/s	+ 160/1.5cm, + 30/100 cm, - 30/70cm
	Count 23/s	+ 140/2.0cm, + 30/40 cm, -30/40cm
	Count 30/s	+ 120/2.5cm, + 30/40 cm, - 30/40cm