Effect of Twist on Yarn Properties

#Mr.K.R.Patil, #Mr.Kulabhaskar Sing, *Prof.P.P.Kolte, *Prof.A.M.Daberao,
#Raymond Ind. Pvt. Ltd. Jalgaon.
* CTF, SVKMs, NMIMS, MPSTME, Shirpur.
Email:- kiranpk.rp.kp@gmail.com, prafullkolte@gmail.com.

Abstract

Yarn testing plays a crucial role in gauging product quality, assuring regulatory compliance and assessing the performance of textile materials. It provides information about the physical or structural properties and the performance properties of the yarn. Today more and more countries have a stake in the treatment and testing of yarn. The number of tests required for textile yarn has grown. As a result the testing of yarn is increasingly varied, in this introductory chapter describes the importance, scope, current status and future trends in yarn testing. The TPI (Twist per Inch) were affected by various yarn properties. It was found that an increase in TPI in many cases causes of yarn properties affect.

Key words: *Twist, TPI, Yarn Properties, Yarn performance.*

I. Introduction

Though even under ideal circumstances, certain losses in yarn quality in ring frames are inevitable; some remedial measures can improve the yarn quality of ring frames. Ring spinning has been in existence since its introduction by an American, John Thorpe in 1828 and then Jenks developed the traveler that rotated on the ring [1]. These two steps opened the door to the current ring spinning technology that is the standard of yarn manufacture. Other spinning technologies have been developed that are higher in productivity, but are lacking in many aspects of the yarns desirable characteristics. Ring spun yarn has retained its position as the system that produces the strongest, finest, softest and most lustrous yarn and fabric. To spin high quality yarn at high spindle speeds the fiber and its preparation have to be controlled to high standards. The ring frame cannot spin superior yarn from inferior material or roving. The ring spinning will continue to be the most widely used form of spinning machine in the near future [2-3]. Drafting arrangement is the most important part of the machine. It influences mainly evenness and strength. The Drafting system is fundamentally important; it basically determines the uniformity of the yarn [4]. The draft at Spinning is higher than any other draft applied throughout the process and it handles the fiber mass when it is at its finest [5-6]. This necessitates the process control the fibers being processed to suppress the formation of drafting waves. In Roller drafting the fibers are accelerated as they pass from the control of the first pair of roller running at a higher surface speed. The Short Fibers are released from the first roller and “Float” until they are accelerated by the second rollers or accelerated by longer adjustment fibers already being drawn at the higher speed. The Control of the short fibers is the primary challenger of the high performance drafting system as and has been greatly improved by the development of the “Double Apron” drafting system for the main draft zone The Two aprons restrain the short fibers until they are close to the nip of the delivery rolls [7].

II. Importance of yarn breakages in weaving process

In the weaving industry it is always emphasized to increase production and maintain quality of woven fabric so the mill can meet the demands of both national and international quality familiar consumers and markets. Also Competitiveness is the main feature of the textile industry in future. The main issue is able to compete at international levels. It is clear from many international exhibitions that the competition will be very brutal in the coming years [8-9]. Now a days, many mills are able to produce similar quality of the woven fabric. Therefore the main issue is the cost of grey cloth per meter. In order to lower the production costs per meter of woven fabric the yarn breakages are essential to be reduced at every stage of manufacturing the woven fabric. In weaving industry one of the most frequent facing problems is breakages of both warp and weft yarns which not only reduce the production rate and also deteriorate the quality of the produced fabric. These breakages on the preparatory processes and also on loom produce lots of problems and become labor intensive. Lesser the number of yarn breakages lesser will be the defects [10]. So by reducing these breakages of both warp and weft yarns not only increase the productivity of the processes involved to the production of fabrics including warping, sizing etc. maintain quality of the woven fabric can be increased but also reduces wastages of yarn, and energy ultimately the cost per meter of the prepared fabric reduces. It is generally observed and the analysis of the loom stoppage revealed that one breakage per loom per 100,000 picks loses considerably efficiency and at every loom stop there is a chance for a defect to come. So it is very important to note that the end breakage rate cone winding, weft winding, warping, sizing and finally onto the loom has to be controlled as minimum as possible. In order to control end breakage rate different quality control measures are taken in each process. Analysis of the requirements of the weaving mill show that no more than one stop per 100,000 m of weft yarn should occur. As soon as two or more stops per 100,000 m of yarn are available in the high production weaving mill, costs will increase as a result

of a reduction in efficiency. There are many factors which influence the yarn breakages on loom [11-12]. They are as follows:

- Quality of yarn
- Preparation of warp beam & weft package
- Condition of loom (mechanical, electrical, electronic)
- Atmospheric condition of weave room

III. Material and Methods

Work methods

The work methods are very critical for getting the required quality of yarn. One can get a good result in spite of fairly poor raw material or old machine provided appropriate work methods are followed.

- Old system
- Inadequate training and lack of knowledge

Material

- Department:- New Spinning
- Machine:- Textool,WS60
- Machine No.:- 21, Sampling machine
- Marking:- P99277
- Shade No.:- SJ5001
- Blend:- 381, Polyester 2.5 Denier 65%, Wool 22.5 Micron 35%
- Count:- 60 Nm
- Twist:- 17 TPI, 18 TPI, 19 TPI.
- No. Spindle Working:- 4
- Machine Speed:- 6500 rpm

Raw material introduction

There is a direct relationship between certain quality characteristics of the fiber and those of the yarn. 70% to 80% of basic yarn quality is decided by the raw material. The fiber properties like the staple length, uniformity in staple length, short fiber contents, fineness, strength, elongation, maturity, etc., play a role. If the micronaire is coarse, the number of fibers in the yarn cross section will be less. This always results in lower strength and lower elongation. But it is easy to process coarse micronaire fibers in combing. Nepping tendency is less for coarse micronaire fibers. On the contrary, spinnability (in both roving frame and ring frame) is not good with coarser micronaire fibers. U% is affected by micronaire. Coarser the micronaire, higher shall be the U%. Coarser the fiber, higher the end breakage rate in spinning. Uster thin places (30%) in the yarn vary depending upon the fiber micronaire. Lower the micronaire lower the thin places and vice versa. Raw materials if not suitable for the product being produced cannot give the quality parameters as needed. We need to understand the quality objectives of the product and decide the raw materials. The factors like feel of the fabric, hairiness in the surface of fabric, strength of the yarn and the fabric and dye ability are governed by the raw material properties. Just by spending more money on superior fine cotton/wool cannot give the quality required by the customer, but shall increase the cost of manufacture leading to a loss to the company. Raw material should be suitable for the machine being worked. The machines are normally designed for a range of raw materials, and we need certain modifications while working. The type of opening machines differ from woolen to worsted, and also with in the wool itself from fine to superfine wool. Coarser wire points are used for carding polyester, whereas for wool we have different wire configuration. The nose plates are different for wool and polyester. Similarly there are number of changes in the machine configuration to suit different raw materials. If we are not clear about the same, in spite of having latest machinery and good raw materials, we might produce bad quality yarns. Variations, mix-ups, contaminations and damages in raw materials are also responsible for poor quality yarns. The selection of raw materials for the product and the machines play a vital role in getting the required quality. Apart from the selection of raw materials, the ways in which they are handled and used also play an important role [12].

Definitions

Nep: A Nep is a small cluster of entangled or knotted fibers forming a compact ball which is not likely to be disentangled by drafting. Neps are found in most card slivers regardless of the fiber type. Paradoxically Neps usually are first formed during the carding process [13].

Slub: An unusually thick in the yarn [14].

Imperfection Index (IPI): Mean of thick places at 50%, thin places at -50 % and neps at 200 % is the IPI. For example if thick places are 384, thin are 23 and neps are 700 then, total IPI is 1107 [15].

Uniformity %: U % means how much fibers are uniform or even in a yarn [13].

Twist wheel used different Twist per Inches [TPI]

Table No. 1 Twist wheel used different TPI

TPI	Twist Wheel
17	36T
18	34T
19	32T

IV. Results and Discussion

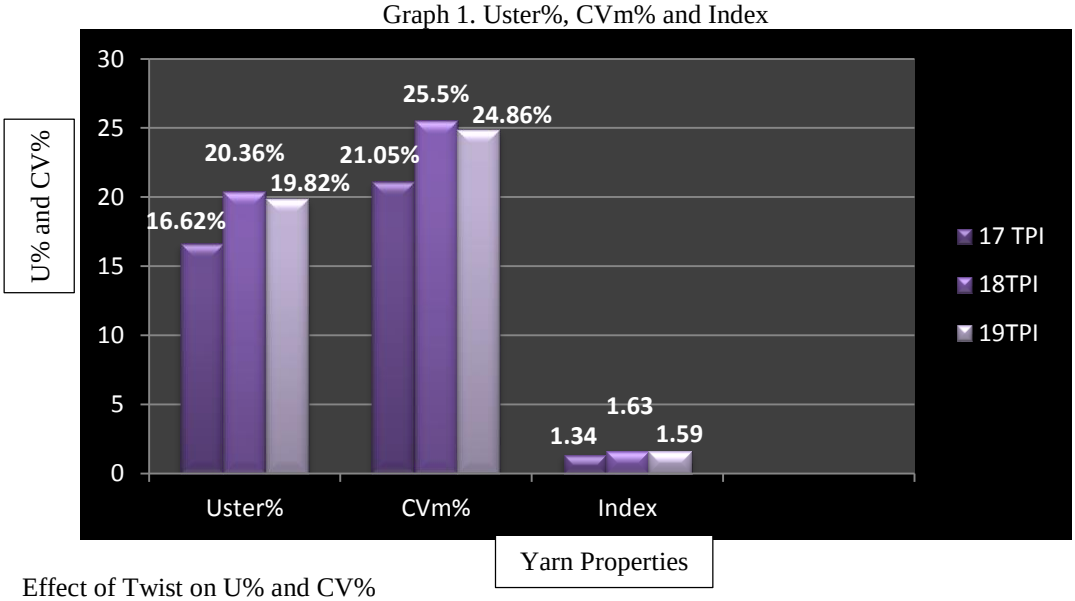
Yarn Quality results

The results obtained in the present study on various properties of ring spun yarn on the basis of different combinations of yarn TPI and shore changes yarn property shown in Table.

Table 2 Test (Uster%, CVm%, Index)

TPI	Uster %	CVm %	Index
17	16.62	21.05	1.34
18	20.36	25.5	1.63
19	19.82	24.86	1.59

Graph 1. Uster%, CVm% and Index



- Effect of Twist on U% and CV%

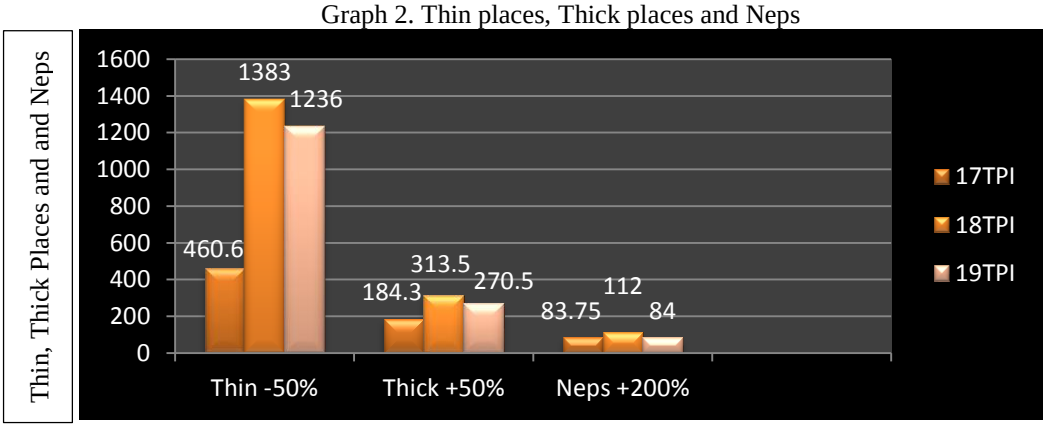
  As TPI value increases 17 TPI to 19 TPI U% and CV% increases. 17 TPI shows better result for U% and CV%.

Test (Thin place, Thick place and Neps)

Table No. 3 Test (Thin place, Thick place and Neps)

TPI	Thin -50% /km	Thick +50% /km	Neps +200% /km
17	460.6	184.3	83.75
18	1383	313.5	112
19	1236	270.5	84

Graph 2. Thin places, Thick places and Neps



Yarn Properties

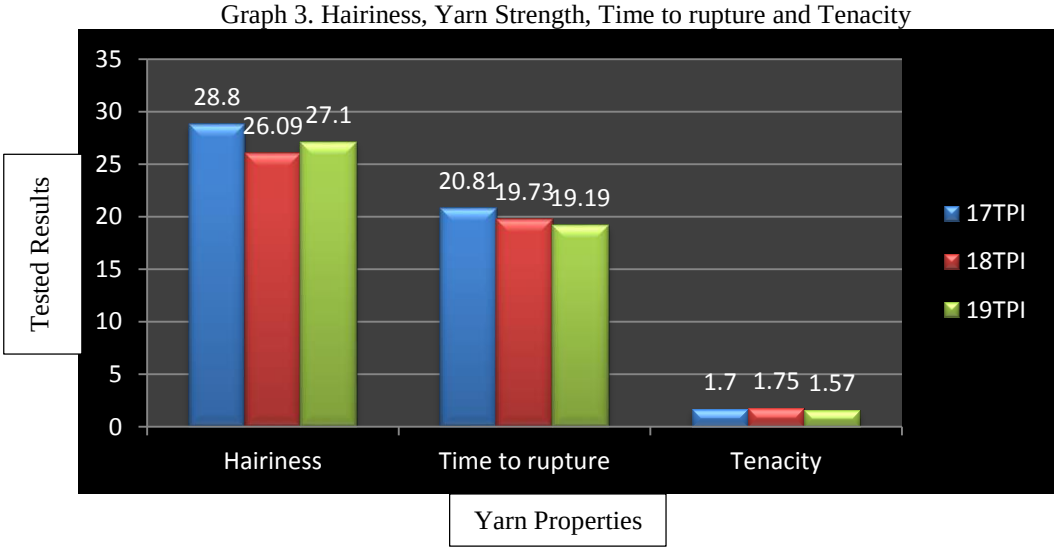
- Effect of Twist on Thick place, Thin place and Neps
  As TPI value increases, Thin place, Thick place and Neps gets increased and TPI value decreases Thin place, Thick place and Neps gets decrease. Referring to the table, 17 TPI with Shore the minimum Thin place, Thick place and Neps.

Hairiness and Strength test

Table No. 4 Hairiness and Strength test

TPI	Hairiness/M	Time to rupture sec.	Tenacity	Strength	Elongation%
17	28.8	20.81	1.70g/den	254.38g	29.34
18	26.09	19.73	1.75g/den	263.16g	27.02
19	27.1	19.19	1.57g/den	235.04g	27.8

Graph 3. Hairiness, Yarn Strength, Time to rupture and Tenacity



- Effect of twist on Tenacity and Strength
  Tenacity and Strength shows as we increases twist from 17 TPI to 19 TPI then Tenacity and Strength decreases. 17 TPI shows better results for Tenacity and Strength.

Conclusion

The weaving performance is depending on the yarn quality. The yarn must have less thick and thin places having less hairiness. The even twist and more parallel yarn help to get better efficiency. It is better to invest a little more in better raw material and benefit by lesser loom stoppages, better loom efficiency and reduced fabric damages. Tests should be taken on the Yarns with 17 TPI, 18 TPI and 19 TPI then 17 TPI Yarn is better than 18 TPI and 19 TPI as per results. As TPI increases then U%, CV%, Thin place, Thick place, Neps are increases and Tenacity, Strength get decreases. As TPI decreases certain limit then U%, CV%, Thin place, Thick place, Neps are decreases and Tenacity, Strength get increases.

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