RESEARCH ARTICLE

Indian Cotton and the Needs of Spinning Industry

R. GURUPRASAD and S. K. CHATTOPADHYAY

Central Institute for Research on Cotton technology, Matunga, Mumbai 400019, India

Received 23 Aug 2013, Accepted 11 November 2013, Published on the web: 8 March 2014

Abstract

India is one of the biggest producer and consumer of cotton in the world. About 90% of cotton growing area of the country is now occupied with *Bt* cotton. Cotton farmers grow more of long staple variety and hence there is shortage in availability of short staple cotton. About 60% of cotton produced is consumed by the Indian spinning industry. The spinning mills also import significant quantity of long staple and extra-long staple varieties. New high speed spinning systems like vortex spinning demand fibres of highest quality for trouble free processing. Co-ordinated and sustained efforts are required from breeders, extension scientists and textile technologists to bring a positive change in Indian cotton and spinning scenario.

Keywords: Cotton, spinning industry

[**Citation**: R.Guruprasad and S.K.Chattopadhyay. 2013. Indian Cotton and the Needs of Spinning Industry. *Cotton Res. J*. 5(2) 215-221]

Introduction

India is one of the biggest producer and consumer of cotton in the world. With the introduction of *Bt* cotton and better crop management practices, the average cotton yield has increased from 300 kg/hectare to 550 kg/hectare [1]. About 90% of cotton growing area is now occupied with *Bt* cotton. *Bt* cottons show higher micronaire and lower level of trash than their non-*Bt* counterparts [2]. Cotton farmers grow more of long staple variety and hence there is shortage in availability of short staple and extra long staple cottons [3]. Most of the imports are Extra Long Staple (ELS) and cotton from the U.S., Egypt, and West Africa [4]. The quality of fibre produced is also of major concern. Indian cotton lacks the tenacity and colour of imported cotton varieties. The short fibre content is also high.

The minimum support price set by the government was often found inadequate by the farmers as their cost of cultivation has gone high due to increase in input costs. Adding to this are the problems of irregular rainfall, volatility in market and poor supply chain. Cotton farmers expect cotton to be exported as much as possible, whereas the spinning mills expect sufficient availability of cotton in the domestic market to meet cotton yarn demands and to keep yarn prices stable.

About 60% of domestic cotton is consumed by the Indian spinning industry [5]. The new spinning systems like air-vortex system has stringent fibre requirements for trouble free processing and higher yarn quality. In this article, present cotton scenario, fibre quality issues and fibre quality requirements of modern spinning systems are discussed.

Cotton production & consumption

Cotton occupies eminent place among cash crops. India has made rapid strides in the production of cotton from 2.79 million bales of 170 kg each in 1947-48 to 17 million bales in 1998-99. The production of cotton stood at 35.3 million bales in 2011-12 (Figure 1). India is not only self sufficient in its total requirement of different quality cotton for its flourishing textile industry but also have exportable surplus of cotton. The country had exported 14.17 million bales of cotton in the 2011-12.

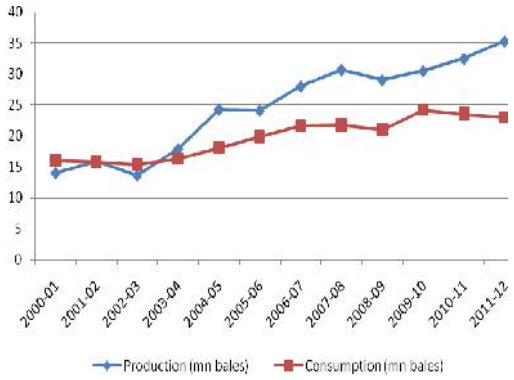

Figure 1. Cotton Production and Consumption over the years (Source: Cotton Corporation of India)

India has the largest cotton cultivated area that constitutes around 30% of the global cotton area. Area under cotton cultivation is 12.1 million hectares in the year 2011-12 and has reduced to 11.6 million hectares in 2012-13 [1]. It is expected that the growing area will stagnate in years to come due to competition from food crops. Cotton yield in India improved remarkably to around 554 kg/ha in 2007-08 from 278 kg/ha during 2000-01. However, cotton productivity is still lower in India when compared with the world average yield of 774 kg/ha. The yield of cotton stood at 493 kg/ha in the year 2011-12. Hence the biggest challenge is to produce more and more cotton from the available land to meet the requirements of ever growing population.

India's total textile and apparel industry size is estimated at $89 billion in 2011 and is projected to grow at a Cumulative Annual Growth Rate (CAGR) of 9.5 percent to reach $223 billion by 2021. Cotton has around 59% share in the raw material consumption basket of the Indian textile industry. Cotton is known for its versatility, performance and natural comfort. It's used to make all kinds of clothes and home textiles as well as for industrial purposes like tarpaulins, tents, hotel sheets and army uniforms. Cotton is a food and fibre crop. Cotton seed is fed to cattle and crushed to make oil. This cottonseed oil is used for cooking and in products like soap, margarine, emulsifiers, cosmetics, pharmaceuticals, rubber and plastics. Linters are the very short fibres that remain on the cottonseed after ginning. They are used to produce goods such as bandages, swabs, bank notes and cotton buds. In the years to come, the robust increase in domestic consumption is likely to drive down the surplus in cotton. Therefore, it is essential that there is greater focus on enhancing production of cotton significantly to cater to the expected increase in domestic demand [5].

Cotton Quality

India is the world's second largest exporter of cotton, but quality problems with Indian cotton are evident in surveys of international textile mills and the discount Indian cotton receives on world markets [6]. Indian cottons generally lack the tenacity of imported cottons and also have higher short fibre content. Imported cottons are uncontaminated, and the trash and microdust levels are extremely low. Studies also show that bale-to-bale and lot-to-lot variability in fibre quality are minimal in imported cottons. Some of the major fibre characteristics of Indian and Egyptian cotton are compared in Table 1. It can be seen that the tenacity of Giza cottons are very high. It is very essential to develop new varieties with high strength, as new spinning processes exploit fibre strength less well than older processes. The need for developing high strength varieties also exist with the technical textile segment. The use of cotton in filtration, sportswear, protective wear, automotives, medical, health & hygiene sector is on the decline and cotton is being replaced by polyester and polypropylene fibres to a major extent. With the development of new high strength varieties, cotton textiles can compete with the polyester textiles in various technical textile market segments.

Table 1 Comparison of Indian and Egyptian cotton varieties

Category	Fibre	Length (mm)	Fineness (Mic)	Strength (g/tex)
Long staple	Bunny	30-32	3.4-4.4	21-22
	Giza 86	32.5	4.3	44
Extra long staple	Suvin	36-37.5	2.7-3.4	27-34
	Giza 88	35.7	3.7	48

Indian spinning sector

Indian spinning industry is one of the biggest in the world with around 50 million spindles. Installed capacity of rotors in the country is around 8 lakh. India has the second highest spindleage after China and contributes to about 25% share in world trade of cotton yarn. Cotton continues to be the predominant fibre consumed by the textile industry. Cotton textiles contribute to over 60% of Indian textile exports. India is biggest yarn exporter in world and mainly exports to China, Korea Republic, Bangladesh, Egypt, Taiwan, Hong Kong, Turkey, Japan, Israel, European Union and Mauritius. India produces yarn of wide range of counts, which varies from 2^s to 120^s Ne and mainly dominated by cotton yarn. Other than 100% cotton yarn, cotton is spun with other fibres to produce blended yarns. Some of the major blended yarns exported from this country are polyester/cotton, cotton/viscose and acrylic/cotton. Sector-wise production of 100% cotton, cotton blended and Non-cotton yarns are given in Figures 2 and 3 respectively [7].

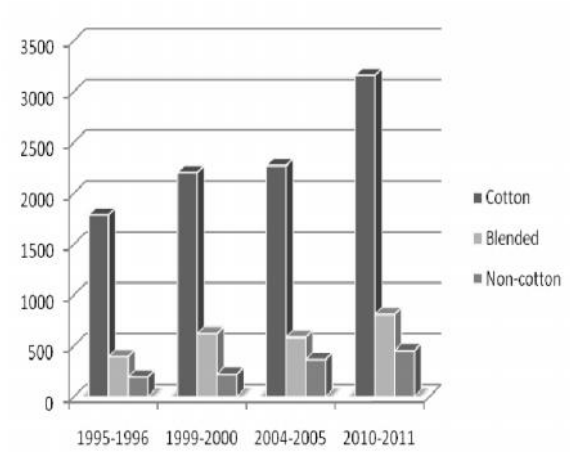

Figure 2 Sector-wise Production of spun yarns [Qty. in mn kg]
(Source: SIMA Review, 2013)

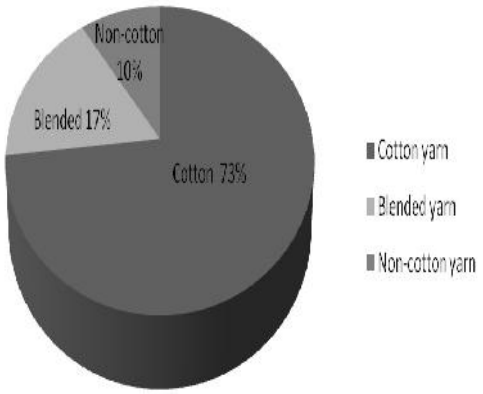

Figure 3. Sector-wise production of yarns in the year 2012
(Source: SIMA Review, 2013)

The profitability of a spinning unit is primarily driven by raw material costs (which account for 50 -70 per cent of total yarn manufacturing costs). The increase in cotton prices over the past two years has depressed the margins of spinners. Spinners are unable to pass on hike in input costs owing to the fragmented nature of the industry, characterised by excess capacities and significantly lower demand.

Effect of fibre properties on processing and yarn quality

Fibre characteristics have direct influence on mechanical processing and on yarn quality [8]. It is not possible to produce a good quality yarn with a poor quality fibre. Table 2 summarises different cotton fibre properties and the ill effects of using poor quality fibre on processing and yarn quality. From Table 2, it can be seen that every fibre property has major influence on yarn quality.

Table 2 Importance of fibre quality on processing and yarn quality

Sl. No	Shortfall in Property	Effect on processing & Yarn quality
1	Length	Unevenness, Tenacity loss, hairiness in yarn
2	Length uniformity	Thick and thin places, unevenness in yarn
3	Short fibre property	Increased process waste, unevenness, weak yarns
4	Fibre maturity	Immature fibres are weak, prone to nep formation and results in poor dyeing
5	Fibre fineness	Low mic fibre leads to nep generation, roller lapping
6	Fibre strength	Weak yarns, poor processability, end breaks
7	Trash	Loss of good fibres, end breaks in spinning
8	Stickiness, seed coat fragments	Reduced process efficiency, lower yarn quality

Fibre quality needs of Different spinning systems

Currently the major spinning systems used to produce spun yarns are ring, rotor, and air-jet/vortex spinning. Ring spinning is still the most dominant spinning system followed by rotor and air-jet/vortex. Almost 60% of the spun yarns produced are by ring spinning route. Table 3 shows the current production speeds and yarn count range possible with these spinning systems.

Table 3 Production speeds of different spinning systems

S.No.	Spinning system	Production speed	Yarn count range (Ne)
1	Ring	25 m/min	Coarse, medium and fine counts (2^s – 200^s)
2	Rotor	200 m/min	Coarse and medium counts (up to 40^s)
3	Air-jet	300 m/min	Medium and finer counts (30^s – 80^s)
4	Air-vortex	350-400 m/min	Medium and finer counts (30^s – 80^s)

Vortex spinning technology is one of the most promising new inventions in the spinning market. Air-vortex technology is a refinement of air-jet spinning. It has been demonstrated that the machine is capable of spinning 100% carded cotton fibers at very high speeds of about 400 m/min [9]. This system requires fibres of good length, low trash, good strength and better uniformity. With the recent developments in the machinery sector, the spinning speeds have improved and rising speeds in turn demand fibres of certain quality for trouble free processing and production of quality yarn. In general, the attributes of cotton that are required for modern spinning machineries are [3];

- Highly clean, contaminant-free cotton fibres
- Stronger and mature fibres for a given length
- Low variability in fibre attributes from bale to bale
- Lower short fibre content
- Higher fibre elongation
- Lower fibre neps and seed coat fragments
- Lower organic trash and microdust
- Higher amenability to cleaning

The spinning systems have different priorities as far as the fibre quality is concerned. Some of the major spinning systems and their fibre quality requirements in the order of importance are given in Table 1 [10].

Table 4 Fiber quality priorities for different spinning systems

Rank	Ring	Rotor	Air-jet/Vortex
1	Length	Strength	Length
2	Strength	Fineness	Cleanliness
3	Fineness	Length	Fineness
4	-	Cleanliness	Strength

It is essential that the spinner purchases cotton which is most suitable to process on their spinning machines to achieve the quality standards desired. Most spinning mills operate continuously, which means the fibre properties of the cotton used must be uniform throughout the year.

Conclusion

With the rise in spinning speeds, the fibre quality parameters assume much more significance than ever before. The cotton fibre properties have to be more consistent in order to produce a yarn of international standards. There is a need to develop high strength cotton varieties to tap the opportunities available in technical textile market. The need for improving the fibre quality has to be realised by the breeders and the farmers should be educated about basic fibre quality parameters. Co-ordinated and sustained efforts are hence required from breeders, extension scientists and textile technologists to bring a positive change in Indian cotton and spinning scenario. The government of India should continue to support this sector by introducing suitable policy measures to streamline and to strengthen the supply chain for the benefit of cotton farmers, spinners and related stake holders.

References

1. http://www.cotcorp.gov.in, accessed on 20/07/2013
2. SITRA Norms for spinning mills (2010), The South India Textile Research Association, Coimbatore.

3. Sreenivasan, S & Venkatakrishnan, S. (2007). Cotton fibre quality research needs: The Indian perspective, Model training course on cultivation of long staple cotton, Dec 15-22, Central Institute for Cotton Research Regional station, Coimbatore.
4. https://www.icac.org/econ_stats/country_facts/e_india.pdf
5. http://texmin.nic.in, accessed on 15/07/2013
6. http://www.iimb.ernet.in/research/sites/default/files/ERR_Cotton%20Quality%20in%20India%20WP%20314.pdf
7. Sima Review (2013), The Southern India Mills' Association, Coimbatore.
8. Klein, W. (2004), The Technology of short-staple spinning, The Textile Institute, UK
9. http://www.muratec.net, accessed on 14/07/2013
10. Duessen, H., Rotor Spinning Technology (1993), Schlafhorst Inc., N.C., USA.