



AGRI-HISTORY OF COTTON IN INDIA

AN OVERVIEW

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Abstract

*The antiquity of cotton in the Indian subcontinent has been traced to the 4th millennium BC. The fabrics dated approximately 3000 BC, recovered from the Mohenjo-daro excavations in Sind (Pakistan), were identified to have originated from cotton plants, closely related to the *Gossypium arboreum* species. The lint-bearing species of the genus *Gossypium*, the true cottons, are four, out of which the diploid ($2n = 26$) species *G. arboreum* and *G. herbaceum* are indigenous in Asia and Africa.*

*The history of introduction into India of the new world cottons (tetraploid species of *G. hirsutum* and *G. barbadense* with $2n = 52$) dates back to the 18th century AD. By the last decade of the 20th century. India had gained a pride of place in the global cotton statistics with the largest cropped area of 8.9 million in 1996-97, growing the most diverse cultivars in terms of botanical species and composition, producing the widest range of cotton fiber quality suitable for spinning 6's to 120's counts yarn, and supporting the largest agro-based national industry of the country.*

The article presents an overview of the ancient origins of the indigenous cottons of India, the recorded history of the crop from the early introductions to their rapid spread of cultivation in response to export and domestic needs during the pre-independence period (1900-47). And the spectacular advances in quantitative and qualitative composition, to support the requirements of the national textile industry after independence (1947-97).

Introduction

Animal skins and hides, and barks of some tree species were probably the earliest materials used by pre-historic human beings to cover their bodies.

The earliest known woven fabrics were those used as shrouds for the Egyptian mummies. These shrouds are considered to be made around 5500 BC although some authorities claim these were older (12000-10000 BC) and made of linen.

It has to be recognized that cellulosic fibers in general and cotton (*Gossypium* spp.) in particular are easily degraded by microorganisms and are not normally found in a preserved condition in archaeological excavations. Nevertheless, there is enough scientific evidence to trace that cotton has been used in India for over 5000 years.

Antiquity of cotton in India

In the past, ideas and details of events were passed on through generations orally rather than in writing. It is therefore difficult to pinpoint when the use of cotton began in India.

Reference in ancient texts

Although there is a reference to threads in looms in the Rigveda ascribed to have been variously compiled between 4000 BC and 1200 BC, there is no specific mention of cotton in this ancient sacred text. However, in the Vedangas, i.e., in *Sutra* literature ascribed to have been written around 1000 BC in the principal *Apasthamba Grihya Sutra*, *Manthara Patha*, *Ekagni Khanda*, *Prasna* 11, *Adh 2 Riks* 3 and 4, a reference to cotton reads as follows, when translated from Sanskrit.

“O cloth! The Goddess Revati prepared a sliver by beating you out of seeds. The Goddess Krithika spun you into yarn. The Goddess Dhee did the weaving. The Goddess Gna cut and took you out of the loom. The above goddesses and thousands more made up the ends at both sides of the cloth. The Goddesses gave the cloth to the Sun (Savitr) God and even as he put it on, its greatness became explicit. So, too, is the cloth.”

It may be noted that the stages of ginning of seed cotton, spinning the lint and weaving the yarn are covered in the religious text, thus suggesting the implicit use of cotton in India by 1000 BC (Sundaram, 1974). In the days of Herodotus, the father of history, who wrote around 445 BC, it was evident that Indians wore cotton clothes. He wrote that “they possess a kind of plant which instead of fruit, produces wool of a finer and better quality than that of sheep; of this the Indians make their clothes”. In Manu Smriti, ascribed to have been written around the second century BC (Ramanatha Ayyar and Parameswara Aithal, 1964) verse 44, chapter 2, reads as follows when translated from Sanskrit.

“The sacred thread of Brahman shall be of cotton, of right-twisted three ply; of a Kshatriya (shall be) of hemp and of a Vaisya (shall be) of wool”.

The other sacred texts such as Ramayana, Mahabharata, and the Puranas also contain references to cotton materials, apart from the Tamil Sangam (Academy) literature dated prior to third century AD (Ramanatha Ayyar, 1962). The use of cotton seed as food during famine, untwisted lint as wick for lamps, and the evolution of the lint as material for spinning and its use as textiles have been mentioned in the ancient Dravidian literature.

Use of cotton in ancient India

The speculations about the earliest use of fibres from cotton in the Indian subcontinent were set at rest with the discovery of cotton materials in the excavations at Mohenjodaro in the Indus Valley carried out during the 1920's (Gulati and Turner, 1929). The archaeological evidence showed that the cotton samples retrieved from Mohenjodaro would have been made around 3000 BC. In these excavations, well-preserved fabrics of cotton were discovered in silver vessels. The fragment of fabric was carefully examined at the Cotton Technological Research Laboratory, Bombay (now Central Institute for

Research on Cotton Technology, Mumbai). The photograph of the fabric and microphotograph of the fiber from the excavated sample are reproduced (Fig. 1), as recopied and enlarged from Bulletin No. 17 Technological series, October 1928 published by the Indian Central Cotton Committee, Technological Laboratory.

After critical examination of the fiber's properties of length, weight per unit length, fiber strength, convolutions per inch, ribbon width, and fiber rigidity, Gulati and Turner (1929) concluded that on the whole, this early cotton has been produced from cotton plants closely related to the present day *G. arboreum* types. According to Hutchinson and Stephens (1947), the progenitors of the early cottons of the Indus Valley must have been introduced from southern Arabia or northeastern Africa.

Botanical status of true cottons

The lint-bearing species of the genus *Gossypium*, the true cottons are four, out of which the diploid ($2n = 26$) species of *G. arboreum* L. and *G. herbaceum* L. are indigenous to Asia and Africa and are popularly referred to as *desi* cottons in India. The new world cottons, i.e., the tetraploid ($2n = 52$) species of *G. hirsutum* L. and *G. barbadense* L. were initially introduced into India during the 17th and 18th centuries AD. It has been shown that the new world cottons are natural amphidiploids containing the A genome from a taxon of the Asiatic diploid group and a D genome from a taxon of the American diploid group. The new world cottons are popularly known as American (*G. hirsutum*) and Egyptian (*G. barbadense*) cottons.

Origin of the indigenous cottons

Santhanam and Hutchinson (1974) summarized the origins of indigenous cottons as follows:

The cotton textiles of the Harappan civilization (2300-1750 BC) were produced by sophisticated textile craftsmanship. Thus at the earliest agricultural levels yet discovered, true cottons were already present in the Indian subcontinent. Wild and weedy types have been found to be associated with primitive cultivated types in both the old world species of *G. herbaceum* and *G. arboreum*.

Species of *G. herbaceum* have been found from the coastal strip northwest of Karachi (Pakistan), through northern Baluchistan to south Yemen, Ethiopia, and Sudan and even in West Africa south of the Sahara. Species of *G. arboreum*, have been recorded by Watt (1907) in Kathiawar, Gujarat, Khandesh, and the Deccan in India. It seems likely that it was in Gujarat (India) or Sind (Pakistan) that *G. arboreum* cottons were first brought into cultivation (Hutchinson, 1971).

It may further be surmised that the differentiation of the three perennial races of *G. arboreum*, namely *burmanicum* of northeastern India, *indicum* of western India and the Penninsula, and *sudanense* of northern Africa, ante-dated domestication and that each contributed separately to the cultivated cottons in Asia and Africa.

Evidence on the origin of the new world cottons is not presented in this paper which is primarily concerned with Asian agri-history of cotton. It is sufficient of state however that *G. barbadense* and *G. hirsutum* existed as distinct species in the wild in central America and their cultivated derivatives were separately domesticated.

Cotton goods and its trade in India

Pre-Christian era

Consequent to the invasion of India by Alexander the Great (327-323 BC), Greek merchants commenced the import of cotton cloth from India. The Roman general Mark Antony (83-30 BC) is also reported to have given his men the comparative comfort of cotton clothes from India.

During the reign of Chandragupta Maurya (321-297 BC) the manufacture of cotton goods was reported to have reached a state of excellence. Kautilya in his Artha-sastra written during the second century BC has referred to the fine cotton goods of Vanga (present Bangladesh).



Early centuries

In the 1st century AD, the Arabs and Greeks are reported to have transported raw cotton and cotton goods from Patiala, Ariaka, Barygaza (probably Bharuch in Gujarat), and Masalia (Masulipatnam in Andhra Pradesh) as well as *Gangitiki* muslin from Bengal.

Subhas Chandra Bose (1938) wrote about the early history of Indian cotton industry thus:

“Sulaiman, the Arab traveler who visited India in the ninth century AD, writes of cotton fabrics made in the Kingdom of Rahmi (which has been identified with East Bengal, now Bangladesh) are so fine and delicate that a dress made of it may pass through a signet ring. In Marco Polo’s days (1294-95 AD) there were flourishing cotton industries in Bengal and other parts of India.”

“As stated by Prof. J. N. Sarkar, very fine cotton goods were produced at Agra, at Sironj in Malwa, at Broach (now Bharuch). Baroda, and Navasari in Gujarat.”

“The best, however, were the Dacca (now Dhaka in Bangladesh) muslins which received such poetic names as *Ab-i-rawan* or running water (because if placed in a stream, it could scarcely be seen), *Belf-hawa* or woven air (because if thrown in the air, it would float like a cloud) and *Shab-nam* or evening dew (because if spread on the grass, it would be mistaken for evening dew).”

“The English first exported Dacca muslins around the year 1666 AD and by 1675 AD the fashion of wearing these fabrics became pretty general in England.”

The question has often been asked from which cottons, the famous Dacca muslins were spun.



The type of cotton used in the manufacture of the famous Dacca muslins was investigated in 1935 from fabric samples obtained from the Shirley Institute, Manchester, England (Gulati, 1947). The results showed that although the mean fiber length of the cotton was estimated to be 0.70-0.94 inch (1.8-2.4 cm), the yarn was one of the finest ever heard of at 345-356 counts. After analyzing the various facts, Dr Gulati opined that the cotton used in the manufacture of Dacca muslins was indigenous and not imported.

Gulati (1947) refers to the hand-spinning skills of Andhra khadi-work-women, who have demonstrated capability for spinning 70-100 counts yarn from cotton samples [with staple length of 0.60 inch (1.5 cm)], which will yield only 12's counts yarn in machine spinning.

These types of fabrics reported with great admiration are now relics of a bygone era and the traditional act of spinning and weaving which flourished in those days were lost with the advent of machines.

Mughal period

After the consolidation of the Mughal Empire by Akbar (1542-1605 AD) there was a revival of arts and industries and very fine cotton fabrics were produced in various parts of the country and exported, according to several historians.

Tavernier reported in 1666 AD that some clothes are so fine that they are woven from the thread of such delicacy that a single pound of cotton was spun into a thread 250 miles (463 km) long (Gandhi, 1937).

The production and export of cotton goods have been reported from Khandesh, Surat, Bharuch, Ahmedabad, Banaras, Coromandal Coast, and Bengal. By far the most famous textile center was Dacca, famous for its fine muslins woven there.

British East India Company

The East India company, with the Royal Charter presented to the Mughal Emperor Jahangir in 1615 AD by Sir Thomas Roe, started establishing trading posts and factories to produce cotton goods. The first factory was established at Surat and the second at Madras in 1639 AD. Direct trading of cotton goods to Britain began in the 1640s through the port of Calicut thus earning the name of “Calico”. The English first exported Dacca muslins about the year 1666 AD. In due course, the new clothes began to appear as a threat to the then existing British woolen industry. The East India Company came under severe attack for encouraging production of cotton fabrics in India and bringing them to England. An Act of Parliament was passed in 1721 AD prohibiting the wear of the printed Calicoes. The dawn of the Industrial Revolution in England in the 18th century, with the invention of spinning and weaving machines under the modern factory system, strengthened the Lancashire textile industry. The perspective of the East India Company changed.

Although a small quantity of cotton was being imported into England for making candle wicks since the 13th century AD, the demand for raw cotton increased enormously with the establishment of the Lancashire textile industry, with its new manufacturing capacity.

By 1793, the Court of Directors of East India Company in London revised their policy to (i) increase import of raw materials; and (ii) increase the export of British manufactured goods. The imports of raw cotton into Britain was placed at £56 million in 1801 and India was the principal source of supply of this raw material. By 1850, India accounted for almost one-sixth of the total textile exports from England and also became the largest consumer of British textiles. India was thus reduced from the position of a supplier of manufactured cotton goods to that of a supplier of raw cotton, for the British textile mills.

Agri-history of cotton production development

Until the middle of the 18th century, only indigenous *arboreum* and *herbaceum* varieties of cotton were grown in different regions of the country. Due to the human skills and dexterity of the local artisans, very fine yarns were produced by them, from even the short staple and coarse cottons grown in India.

In 1788, the Governor General (at Calcutta) was requested by London to encourage growth and improvement of Indian cottons to meet the requirement of the Lancashire textile industry. The figures for exact area under indigenous cottons and production in

India during this period are not available, although it is reported that the local production had stabilized by 1900 AD.

Origin and spread of new world cottons in India

In the late 18th and 19th century, the fortunes of Indian cotton seem to have been linked with the adequacy or otherwise of cotton exports to England from America. In an attempt to develop an alternative source of supply (apart from America), the East India Company initiated trials with exotic cottons (new world cotton varieties) introduced into India. Sethi (1960) had summarized their early history thus:

The first attempt was made in 1790 AD to grow Bourbon (*G. hirsutum* race *punctatum*) variety introduced from Malta and Mauritius in the Bombay and Madras Provinces. The initial trials proved unsatisfactory. In 1840 AD, trials with exotic American cotton were carried out in Gujarat, the Deccan, and the Konkan. New Orleans seed (*G. hirsutum* race *larifolium*) was grown in 1842 AD in Hubli taluk of Karnataka and by 1861-62 was grown on 72313 ha.

Deepak Kumar's (1997) article reproduced in Asian Agri-History Vol. 1, No. 2 reports on the efforts to promote cotton, among other cash crops in the 19th century. The work on American cotton with upland Georgian and New Orleans varieties in Dharwar (now Dharwad) and Gadag during the first decade of the 20th century, established the Dharwar American Cotton Crop.

The efforts in the Madras province commenced with Bourbon variety in 1790 and subsequent trials with New Orleans and Sea Island (*G. barbadense*) in Coimbatore were unsuccessful. After the reorganization of the Madras Department of Agriculture in 1905, American, Peruvian, Egyptian, and Sea Island varieties were experimented with, but without success.



The most significant development for the future success and spread of American cotton in India was the introduction of a cotton variety originally found suitable in Indo-China

into the Madras Presidency. This variety was known as Cambodia in 1904-5. It proved very successful under irrigated conditions and the cultivars selected from Cambodia have formed the basis for several new varieties and hybrid cottons which were extensively cultivated in later years.

Efforts were also made to introduce exotic cotton varieties in other parts of the country. In 1846 AD, a few maunds (1 maund = 82.3 lb = 37.3 kg) of seeds were supplied from Bombay (now Mumbai) for trials at Shikarpur in Sind, while in 1852 AD more trials were undertaken with Egyptian, Sea Island, and New Orleans cottons, without much success.

The first attempts at growing American cotton varieties in the Punjab were made in 1853 AD but were not successful. Subsequently, seeds obtained from Dharwar were distributed in 1876-77 in parts of the Province. In 1902, a variety named Punjab Narma was found growing in several areas; it presumably descended from earlier introductions of American cotton. The cotton improvement work, initially started in 1902, was shifted to Lyallpur (in Pakistan) in 1903 and variety 4F, a rough-leafed upland type selected to the insect pest jassids. In 1917, out of 111697 ha under American Cotton in the undivided Punjab Province, about 72846 ha were covered by variety 4F.

Experiments on growing American cotton in the United Provinces (Uttar Pradesh) commenced in 1826, and an acclimatized variety of mixed origin known as Cawnpore-American was established by 1909, after initial failures to grow it in Allahabad.

Early cotton development work by agricultural departments

The different problems concerning the cultivation of cotton, as of other crops in India, were systematically studied with the establishment of Agricultural Departments in various Provinces of India in 1904. The Departments of Agriculture in Bombay, Central Provinces, Berar (Punjab), United Provinces, and Madras were pioneers in taking up research work on cotton and the selection of improved strains with better yield and lint quality from existing mixtures.

Hilson and Ramanatha Ayyar were the earliest workers in Coimbatore. Variety Co 1 from Cambodia (*G. hirsutum*), N14 (*G. arboreum*) in Northern cotton trait, H1 (*G. herbaceum*) in the western tract, and several other strains were developed by them. Ramanatha Ayyar released an even better variety Co 2 in Cambodia cottons in 1929 (Ramanatha Ayyar, 1961).

Milne in the Punjab was responsible for selection of 4F cotton among the acclimatized Punjab Americans. Subsequently Labh Singh isolated the early-maturing selection named as LSS. In central Provinces, Youngman and Mahta selected V. 262 and V. 434 (*G. arboreum*) and in United Provinces, Leake and Ram Prasad were responsible for developing C. 520 (*G. arboreum*). Subsequently Bryce Burt isolated Cawnpore American No. 9 (*G. hirsutum*) in the United Provinces.

For the Surti Tract (Gujarat), Fletcher was responsible for the isolation of the famous 1027 ALF (*G. herbaceum*) variety. Kottur contributed to the evolution of variety

Jayawant (*G. herbaceum*) for the Kumpta in the erstwhile Bombay Province, M L Patel to BD8 and Wagad 8 (*G. herbaceum*) for Bharuch and Viramgam tracts (Gujarat), and Prayag to Banilla and Jarila (*G. arboreum*) for Central Provinces and Berar.

Setting up of the Indian Cotton Committee

Prior to the outbreak of World War I in 1914, the total world production of cotton was about 25.5 million bales of lint (392 lb/bale) while the share of USA was 15 million bales and that of India was 4-5 million bales, almost entirely *desi* cotton with a short staple length (below $\frac{3}{4}$ inch).

With increased local consumption of US cotton by the US textile industry (nearly 60% of the production) during 1915-18 and the consequent decreased availability for the Lancashire industry, the British Empire looked to India for increasing the production and improving the fiber quality. India was then the largest cotton-producing country in the Empire and the second largest in the world.

The Governor General in Council therefore set up in 1917 “the Indian Cotton Committee” under the Chairmanship of J MacKenna, Agricultural Advisor to the Government of India and six other members, to investigate the possibilities of extending the growth of long-stapled cottons in India, after examining the work which had been done in the various provinces in India on the establishment of long-stapled cottons. The cotton exports to UK from India for five years ending 1917-18 were 215 thousand bales.

The MacKenna Committee observed that the only parts of India from which assistance of real value to Lancashire could be expected were tracts in which cotton of one inch or slightly more in staple length could be grown in larger quantities (MacKenna *et al.*, 1919). The tracts which answered this description were stated to be parts of the Madras Province growing Cambodia (*G. hirsutum*) and *Karunganni* (*G. arboreum*) cottons and the Punjab where American cotton was making rapid headway. Sind (Pakistan) was also considered a potential area for growing Egyptian and American cottons, if perennial irrigation was provided by the construction of the Sukkur barrage.

MacKenna *et al.* (1919) summarized the area and estimated production of cotton by trade classification, botanical variety, and staple length group for various tracts in the Indian Provinces, including Burma (now Myanmar). This worked out to a total area of about 9.3 million ha out of which 95% comprised indigenous *arboreum* and *herbaceum* varieties. The production was estimated around 3.3 million bales.

The major recommendation of the MacKenna Committee was that a Central Cotton Committee should be set up at Bombay on a permanent basis. This was set up in 1921 as a Technical Advisory Body to the Government. In 1923, legislation was enacted to levy a cess of cotton consumed by the textile mills or exported from the country. Thus the Indian Central Cotton Committee became a statutory body with disposable funds for promoting agricultural and technological research in cotton.

In 1924, the Indian Central Cotton Committee set up under its aegis the cotton Technological Research Laboratory [now known as Central Institute for Research on

Cotton Technology (CIRCOT)] at Bombay (now Mumbai) with Dr A J Turner as its first Director who joined on 1 January 1924.

Cotton improvement and spread under the aegis of Indian Central Cotton Committee

From 1924 to 1937, the Indian Central Cotton Committee provided the entire expenditure for various ‘schemes’ operated by the Departments of Agriculture of the Provincial Governments for improvement of cotton cultivation, including breeding and varietal improvement, seed multiplication, agronomy, control of pests and diseases, and physiology. The pattern of funding assistance was subsequently modified with the Provincial Governments also sharing the expenditure after 1938 until 1966, when the Indian Central Cotton Committee was wound up and the functions transferred to the Indian Council of Agricultural Research (ICAR), New Delhi.

Before the break of the second World war in 1939, the country recorded a total cotton area of 8.1 million ha with a production of 5.9 million bales in 1938-39, as compared to 4-5 million bales reported for the year 1914. During the second World War period 1939-45, food production received greater attention and the total cotton production in India was brought down to 4.2 million bales in 1945-46 (Sethi, 1960). There was a further setback to cotton area and production development in India when the subcontinent was partitioned in 1947 with the transfer of large areas of irrigated cotton fields to Pakistan (Table 1). In the year after partition, cotton production in India touched a record low of 2.6 million bales, as against an annual mill consumption of about 3.9 million bales by the textile industry in India.

Description	India	Pakistan	Total
Area (lakh ha)	43	28	71
Production (lakh bales)	26	16	42

Evolution and spread of cotton during post-independence period (1947-97)

Historically the cotton crop in India changed according to the prevailing agricultural, economic, and political forces. At the first conference of Cotton Research Workers organized by the Indian Central Cotton Committee at Bombay in 1937, Ramanatha Ayyar working at Coimbatore, put forth the view that cotton breeding and varietal improvement should be concentrated on American (*G. hirsutum*) type cottons for increasing the yield and fiber quality of the Indian cotton crop. This policy perspective received further impetus after the partition of the country in 1947, which cut off from India the greater part of the Indian upland cotton (*G. hirsutum*) crop of the Punjab (transferred to Pakistan).

Accelerating cotton production with better fiber quality

During the first few years after Independence, more than one million bales of superior quality of cotton had to be imported each year to meet the needs of the Indian textile

industry. Due to concerted efforts made by the State Governments under the aegis of Research and Development Schemes sponsored by the Indian Central Cotton Committee, the area under cotton steadily increased to about 7.8 million ha and the production increased to about 5.6 million bales by 1966-67 (Table 2). The qualitative composition of the Indian cotton crop also underwent a progressive changes with nearly 20% falling under long staple category.

Time frame	Area (million ha)	Production (million bales)
1918-19, Composite India and Burma	9.3	4.7
Pre-World War II, 1938-39	8.1	5.9
Post-partition of subcontinent, 1947-48	4.3	2.3
Start of the All Indian Coordinated Research Project 1966-67	7.8	5.6
Final Year of VIII Plan Period 1996-97	8.9	16.8

Source: Reports of the Indian Central Cotton Committee; the East India Cotton Association; and Project Coordinator (Cotton), All India Coordinated Research Project.

This was largely made possible due to the development of Indian *hirsutum* varieties with better fiber quality and replacement of indigenous *arboreum* and *herbaceum* cultivars by the newly evolved American varieties, which gave higher yields under protection from insect pests, made possible with a new range of insecticides.

The Madras Cambodia varieties (MCU series), Laxmi (Gadag 1 x Cambodia 2 derivative) in Dharwar American cotton, interspecific Indo-American varieties Deviraj and Devitej in Gujarat and Maharashtra, Madhya Pradesh American varieties bred at Indore, and the Punjab American Cottons P216F and 320-F effectively contributed to the significant change in quantitative and qualitative composition of the Indian cotton crop (Sikka and Joshi, 1960).

National cotton development activities during 1967-97

With the abolition of the Indian Central Cotton Committee in 1966 and reorganization of ICAR which incorporated all Crop Sciences research in its mandate, the All Indian Coordinated Cotton Improvement Project (AICCIP) was launched in 1967 knitting together the state agricultural university centers of cotton research. The infrastructure for cotton research was further strengthened with the establishment of the Central Institute for Cotton Research (CICR) at Nagpur in 1976. In due course several other centers and subcenters became operational (Fig. 2).

The field research program has always had a happy marriage with CIRCOT. The basic support and direction for cotton extension in the field to the State Departments of Agriculture was provided by the Directorate of Cotton Development, based on National Plans for production increase and qualitative requirements of the textile industry. In recent years, agencies such as the Cotton Corporation of India, the Indian Cotton Mills'

Federation and Development Wings of the Textile Industry's Association have also been contributing to the cotton research and development (R&D) program.

Significant milestones were established in cotton R&D with the evolution of new cultivars such as MCU-5 (*G. hirsutum*); the first ever hybrid cottons to be commercially grown anywhere in the world such as Hybrid 4 (intra- *hirsutum*) and DCH-32 (interspecific *hirsutum* x *barbadense*); and the extra-long-staple cultivar Suvin (*G. barbadense*), the most adaptable cultivar LRA 5166 (*G. hirsutum*), and the high-yielding medium-staple hybrid (intra- *hirsutum*) NHH-44.

The private sector seed companies also made a significant contribution to development of several hybrid cottons supported by an effective hybrid seed production and extension support system. A significant landmark in the history of cotton development in India is the extension of the first generation hybrid cottons on a commercial scale heralded with the release of intra-*hirsutum* Hybrid 4 by Dr C T Patel in 1970. A number of hybrids, both intraspecific and interspecific (*hirsutum* 5 *barbadense*) have since been released and popularized in commercial cultivation (Basu and Paroda, 1995).

About 20 major popular hybrid cottons occupied nearly 40% of the total cotton area of 8.3 million ha during 1995-96 and contributed to 60% of the total production of 16.3 million bales of cotton, a phenomenal increase over 5.6 million bales only, recorded at the commencement of the AICCIP in 1966-67. The most widely cultivated improved cultivars number about thirty (Venugopal, 1977). The history of progress in Indian cotton extension and production is summarized in Table2.

Impact on crop production development

With over 1500 textile mill units, about 4 million hand looms, 1.7 million power looms and thousands of garment, hosiery, and processing units, the textile industry in India has grown to be the single largest agro-based industry in the last decade of the 20th century. The industry is predominantly cotton based, with the fiber consumption ratio being, nearly 70% cotton and 30% non-cotton.

During 1996-97, India produced 16.8 million bales of cotton thus setting the highest ever record for indigenous availability or raw cotton for the national textile industry, which consumes on an average 14.4 million bales of cotton each year (average of 1995-97) in fiber quality groups suitable for 6's to 120's counts of yarn.

The significant agricultural transformation, which led to the above growth of the cotton crop from 4.7 million bales recorded from the entire Indian subcontinent including Myanmar in 1918-19, due to the progressive replacement of *G. arboreum* and *G. herbaceum* cultivars which occupied 95% of the cotton in that year, by the spread of improved *G. hirsutum* cultivars and hybrid cottons which extended to cover about 67% of the area in 1996-97 and the concurrent improvement in agro-techniques and crop protection management.

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