

Revisiting the Culture of Cotton in the Past: Historical Cultivation Practices, Farmers Decision Making, Intensification of Production

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Abstract: *The cultivation of cotton and production of cotton textiles have been a well-entrenched culture and it has supported the economy of the Indian subcontinent since historic times. The subcontinent attained excellence in textile production relying on high-quality and decentralized cotton production, elegant workmanship, efficient and locally-evolved tools, and intergenerational knowledge of dyeing, stitching, and printing. The glory began to fade with the introduction of exotic species and the saga of decline continued thereafter. Here, I revisited the historic cotton cultivation that fed the production of diverse cotton textiles catering to local and global consumers. It revealed a broad range of local varieties grown almost throughout the country in a range of agro-ecosystems. The different quality of cotton supplied the raw material to manufacture very simple, coarse to elegant and extravagant textiles of myriad kinds. A review of historic texts also showed that farmers have exercised various practices like multi-cropping, crop rotations, and cultivating extensively or intensively contingent on available capital and resources, over the centuries. These demonstrate their ability to adopt measures to mitigate risk and underscore the primacy of farmers in decision-making. The cultivation of cotton began to change responding to various socio-economic factors and intensification of production, especially in the twentieth century, was one of the drivers underlying such change. In summarising, I show the apparent contrast between some critical dimensions of the past and present cultivation practice and shed light on a part of the agricultural history of cotton and its change.*

Keywords: *Indian Cotton, Cotton Textile, Gossypium Arboreum, Risk Abatement, Multi-Cropping, Crop Rotation, Decision-Making, Traditional Agro-Ecological Knowledge*

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Introduction

The cultivation of cotton and production of cotton textiles have been a well-entrenched culture in the Indian subcontinent since historic times (Parthasarathy 2001, Riello and Parthasarathy 2011).

Domestication of two species (*Gossypium arboreum* and *G. herbaceum*) and naturalization perhaps took place in the prehistoric period (Gulati and Turner 1929; Hutchinson 1954; Wendel et al. 1989). The archeological remains from Harappa and Mohenjo-Daro revealed fine cotton textile from *G. Arboreum* (Gulati and Turner 1929). The long process of range expansion of two species followed a rich cultural history of cotton farming that complemented the country-wide manufacture of cotton textiles. It had survived the agricultural economy for centuries and millennia and provided a means of subsistence to the great number of peasants (Parthasarathi 2009). In this course, India became a giant in cotton textile production and maintained its dominance in the global trade of cotton textiles. Many types of cotton clothes are produced from Indian cotton which demonstrated enormous diversity in color, staple length, texture, yield, and tolerance to environmental stress (Chandra 1998). The cotton cloth from the Indian subcontinent has reached distant lands and won the choice of wide-ranging consumers, regional or global alike. It attained excellence in textile production relying not only on high-quality and decentralized cotton cultivation but also capitalizing on a number of intrinsic factors like elegant workmanship spread well over the sub-continent, efficient and locally-evolved tools, intergenerational knowledge of dyeing, stitching and printing (Taylor 1851; Parthasarathy 2001; Parthasarathi, P., 2009). The gradual establishment of local and global trade networks depending on local entrepreneurs and middlemen has also operated in tandem with the thriving sustenance of the cotton economy (Hossain 1988; Riello and Roy 2009; Riello 2013; Menon and Uzramma 2017).

However, the introduction of American cotton varieties in the late eighteenth century has sown the seeds of the decline of the Indian cotton industry and the crisis continued to this day. In search of longer-staple length to feed machine ginning, two new-world varieties (*G. hirsutum* L. and later *G. barbadense* L.) were introduced and gradually expanded on the Indian soil (Pearse 1913-14). Over the years, the production of indigenous cotton shrunk and small-scale handlooms disappeared greatly. It was also exacerbated by the implementation of the discriminatory policies by the ruling British administration (Menon and Uzramma 2017; Prasad 1999). Concomitant with this was the burgeoning competition with machine-made and cheaper materials from Lancashire (Chatterjee 1987). As a result, the cotton textiles produced from Britain flooded the Indian market at the cost of native handloom textiles which were prohibited through various unfair policies like over-taxation (Menon and Uzramma 2017). The acreage of diploid cotton was further reduced during the post-independence era and was substituted by tetraploid New World cotton (Kulkarni et al. 2009). The development was also instigated by the adoption of new technology-derived hybrid cotton and the Bt cotton in 1970-71 and in 2002, respectively (Gutierrez 2018; Basu and Paroda 1995; Kranthi 2012). The Bt cotton has arguably multiplied the production but with severe collateral damage (Stone 2011; Glover 2010). The costs of cultivation in terms of seeds, agrochemicals, and other agricultural inputs multiplied several times, so multiplied recurrent pest attacks. In sum, Indian cotton may seem highly remunerative at a quick glance, but bore the brunt of being a highly input-intensive production system and pushing farmers into the spirals of uncertainty, debt, and finally leading to mass suicide (Glover 2010; Gutierrez et al. 2015; Gutierrez 2018).

With much research that has been performed on cotton describing its biotechnological intervention, politics and policies, environmental and socio-economic impacts, agrarian systems, and its influence on economic history, a review of the past culture of cotton cultivation has been thoroughly ignored (but see Parthasarathy 2001; Riello and Roy, 2009; Riello and Parthasarathy 2011). Yet, it is imperative in the recent agrarian crisis when an alternative narrative and application of agro-ecological principles has been steadfastly emerging as a sustainable solution to today's crisis. Therefore, my intention, in this article, is to reconstruct the historic cultivation by incorporating anecdotes to elucidate the illustrious

heritage of cotton culture in India. Most of which have been well-forgotten amid the productivist scenario, that changed the course of cotton cultivation into a highly resource-intensive external finance-dependent, a risk-prone system that has been reaching its limits in recent times (Kranthi and Stone 2020). In doing so, I attempt to weave the discussion around certain aspects, from the diversity of landraces, historic cropping patterns, seed conservation, farmers' decision making, and how these cultural practices helped them to insulate from impending risk. Lastly, I outline the trajectory of intensification of production to demonstrate the rise in yield from the historic period which has been a prime driver of change in cotton cultivation. In summarising, my implicit objective is to show the apparent contrast between some critical dimensions of the past and present cultivation practice and to shed light on the agricultural history of cotton.

Attributes of Historical Cotton Cultivation

In this section, dwelling on the historical texts, I mostly delineate the culture of cotton cultivation in the past in terms of the geography and local varieties, cropping patterns and rotation, seed conservation - the key attributes of historical cotton cultivation.

Diversity of Agro-ecology, Fibre and Textiles

A rich culture of cotton was not only embedded in the vibrant history of textiles but it largely exploited the agricultural tradition that varied greatly in the geographic regions of cultivation, their agro-ecological conditions, and also in terms of biological produce, i.e, cotton fiber (Pearse 1913-14; Mackenna and Wadia 1920). Despite numerous vernacular and trade names of local variants, the landraces belonging to two biological species, *Gossypium arboreum*, and *G. herbaceum* were historically cultivated while tetraploid *G. hirsutum*, *G. barbadense* were introduced later part in the eighteenth century. In addition to the two indigenous species, there were several local varieties, e.g., *bairaiti* or *biretti*, *bhoga*, *coconadas*, *hansi*, *photee*, *karannangany*, etc, which were presumably various landraces or ecotypes of *G. arboreum* or *G. herbaceum* originated and evolved through farmers' selection and adaption in respective agro-ecological conditions (Pearse 1913-14; Mackenna and Wadia 1920; Schmidt 1912; Taylor 1851) (table - 1). It has been documented that, between the twelve and eighteenth centuries, cotton had been grown in almost every part of the Indian subcontinent, from the north-western provinces, i.e., from Multan, Punjab, Sindh to central India, from the black soil-rich Deccan plateau to the Bengal basin extending to the north-eastern hilly tracts (**Figure -1; Table - 1**). Historically, cotton has been cultivated in widely differing agro-ecological conditions, fertile plain land, river basins, drought-prone arid regions, shifting cultivation fields, highlands and plateaus, etc (Pearse 1913-14; Taylor 1851; Ray, in press). Quite evidently, the divergent environmental and edaphic conditions posed selective pressure that probably manifested in the wider variability of cotton. As a result, cotton fiber displayed remarkable diversity in color, texture, staple length, yield, and the capacity to withstand environmental stress (Chandra 1998). The report of the Indian cotton committee (1919) also chronicled the nitty-gritty of the cotton-growing culture of the Madras Presidency and adjoining regions, the United Provinces, North Eastern Circle, Western Circles, Eastern Circle and Central circles. It was also illustrative of the diverse types of cotton and their cultivating regions (p.119-120, p.57).

The variability of textile was partly attributable to the wide array of cotton landraces. The quality of textile also varied from very coarse to premium types and is suited to a diverse range of consumers, local or regional to global. Certain premium varieties were appreciated all throughout India and also exported abroad. *Dacca Muslin*, the finest quality Bengal cotton, produced from specific landrace,

Table 1: The Diversity in Local Varieties or Landraces, the Regions of Cultivation and Characters in the Historic Period (Around 1600-1900)

Name of the variety/ landrace	Geographic regions of cultivation	Characteristics
<i>Assam Comillas.</i>	Khasi, Garrow Hills	Similar to <i>Bengala</i> but rougher. Generally very white in color.
<i>Bani (Hinganghat Barsi or Gaorani)</i>	Central Provinces, northern parts of Nizam's dominions, Chanda districts of Central Provinces	Silky, fine cotton, long-staple.
<i>Bihar and Orissa</i>	Saran, Santhal Pargana and Ranchi districts of Bihar and Orissa	X
<i>Broach</i>	Northern part of Broach district from Hansot to Amod	Very white, good staple, silky
<i>Broach Goghari and Kanvi</i>	Part of Amod and whole of Jambusar talukas	X
<i>Buri</i>	Northeast Hyderabad, Chhotanagpur, Central and United Provinces	<i>Buri</i> were favored for their long-staples.
<i>Berar or Central Provinces</i>	Berar and Western part of Central Provinces	Fairly long-staple
<i>Cawnpore American</i>	Cawnpore (Kanpur)	X
<i>Comillas</i>	Eastern Bengal and Assam	X
<i>Cambodia</i>	Coimbatore, Trichinopoly, Madura districts, Small areas of Dharwar districts of Bombay, Chhattisgarh division of Central Provinces and Hyderabad	X
<i>Coconadas</i>	Guntur, parts of Nellore, Kistna and Godavari Districts of Madras and south-east Hyderabad	Very variable in staples; white, at times khaki, silky, strong
<i>Goghari</i>	Around Broach district	Coarser fibre
<i>Jathia</i>	Bihar and Orissa	X
<i>Karunganni</i>	Tinnevelly, Madura, Ramnad	X
<i>Khandesh</i>	East and west Khandesh, Ahmednagar, Sholapur, Nasik, North Bijapur and Hyderabad	X
<i>Khandesh - Roseum</i>	Khandesh	X
<i>Kumpta - Dharwar</i>	From Satara district southwards down to and including the northern districts of Mysore.	Dull yellowish, silky
<i>Malawi or Malwa</i>	Malwa plateau in Central India	X
<i>Mathia or Mathio</i>	Kathiawar and Ahmedabad	High ginning out-turn and matures early
<i>Lalio</i>	north Gujarat	X
<i>Navsari</i>	Bilimora, Navasari	X
<i>Northerns</i>	Kurnool and part of Cuddapah (Nandyal)	A very leafy cotton, Sometimes bright white to creamy white in color and soft. Its staple is fairly strong.
<i>North-west Frontier Province</i>	Peshawar valley	X
<i>Punjab</i>	Punjab, northwest of the line from Ambala to Hisar	The Punjab type produces two very nice indigenous cottons, <i>Hansi</i> and <i>Multan</i> ; very white, at places dull white or silky at other
<i>Punjab Americans</i>	Punjab canal colonies in the districts Lyallpur, Montgomery, Jhang, Shahpur, Multan, and Gujranwala	X
<i>Rajputana</i>	Rajputana	Short staple, medium rough and may reach a grade of super choice, white with yellow stain
<i>Rozi or Jaria</i>	Kaira and north of Baroda	Perennial cotton
<i>Roseum</i>	Berar and adjoining tracts	X
<i>Saw Ginned Dharwar</i>	Southern part of Dharwar district and northern districts of Mysore	X
<i>Sind</i>	Sindh	Very white in color, at places dull white or silky at other
<i>Surat (Surti)</i>	Surat and southern part of Broach district	Very white, good staple, silky
<i>South-east Punjab</i>	South of the line from Hisar to Ambala	Rougher, white, bulky, bright, and clean with the highest quality, from good to extra superfine
<i>Tinnevellys</i>	Madura and Ramnad	Very white or creamy at times
<i>Uppam</i>	Coimbatore, Trichinopoly, parts of south Arcot	Replaced by Cambodia and <i>Karunganni</i>
<i>Nadam</i>		Perennial
<i>Bourbon</i>		Perennial
<i>United Province (Bengal cotton /Bengala)</i>	United Province	High ginning percentage, short-staple
<i>White-flowered Aligarh</i>	Aligarh and surrounding tracts	Longest staple
<i>Wagad</i>	North Gujarat, Kathiawar, and Cutch	The cotton is of fair quality, coarser than <i>Lalia</i>
<i>Westerns</i>	Anantpur, Bellary Districts, Part of Bijapur district, and south-west Hyderabad	White, sometimes yellowish dull silky. It is slightly cream in color and soft

Source: Report of the Indian Cotton Committee (1919); Speilman HW (1950); Pearse (1913-14); Schimidt (1911-1912)

photee, was probably a *G. herbaceum* variant (Roxburgh, 1874). It was cultivated aplenty around the river banks of *Brahmaputra* and *Meghna* river, in and around districts of Dacca and Mymensingh; whereas the other inferior variety, ‘*bairaiti*’ or ‘*biretti*’, was also very popular and grown in the eastern part (Royle 1851; Taylor 1851). The quality of *Muslin* was quite diverse, ‘ordinary’, ‘fine’, ‘superfine’, ‘fine superfine’, available in many forms and styles like plain, striped, chequered, figured and colored, and catered generously to a suite of consumers. *Mulmus khas* (for the private use of kings), *Jhuna* (net-like fine muslin for native dancers or singers, wealthy Indians), *Abrawan*, *Circar Ali* (for the Nawabs of the province), *Khasa* (of fine close texture), *Shubnam* (superfine like evening dew), *Tunzeb* (ornament of the body), *Nyansook* (thick muslin), *Buddun Khas* (fine muslin), *Surbund* (worn as turban), *Surbutee* (twisted, coiled, and worn as turban), *Kumees* (used to make *koorta*), *Dooreea* (striped muslin), *Charkanu* (chequered muslin), *Jamdanee* (muslin with intricate and complex designs) to name a few (Taylor 1851, p.43-48). There were myths and mist sprouted around the finesse of *Muslin* that spurred the imagination of artists and travellers alike. Thus, it is quite understandable from various historical texts that the glory of *Dacca Muslin* had remained at its peak for several centuries and allured consumers of the subcontinent and abroad. Apart from fine muslins, many textiles also stood apart for their distinguishing colors, prints, or motifs and were not less in their grace. For a quite long period, Gujarat was generally famous for its fine printed clothes or materials, and the cotton textile was carried by European ships to distant places and traded widely. These cargoes also included a variety of embroidered textiles. Similarly, cotton clothes from South India were also quite famous and were manufactured in many parts. Apart from Gujarat, the Coromandel Coast was famous for its finest painted clothes which were created with precise drawings and durable colors and manufactured in the neighborhood of Masulipatam and Pulicat. The other kinds of clothes in South India varied from the coarse type that was meant for a great majority of poor to very fine muslins of *Arni* that was even comparable to the famous produce of Dacca (Parthasarathi, 2001). Similarly, *Tinnevelly cotton*, a mixture of *Uppam* and *Karannganny*, from northern Tinnevelly and south of Madura is appreciated across vast geography (Indian cotton committee 1919, p.118). And the cotton for non-premium types of textile for the commoners was grown regionally, for instance around Punjab (perhaps from *Hansi* or *Multan* cotton) and elsewhere across the subcontinent (Schmidt 1912, p.63). On the other hand, cotton produced in the shifting cultivation fields in the highlands of central, eastern, or north-eastern parts, e.g., Garo cotton, was perhaps meant for local use mostly, surplus might have sold when the trade network became alive. Given the fact that the ethnic tribal groups living amidst these regions and practicing shifting cultivation also demonstrated a rich tradition of weaving, the question remains whether hill cotton provided these people with a supply of raw material?

Examining the diversity of cotton and derived textiles it seems that India boasted a vibrantly rich culture of cotton from the early periods and it perhaps diversified over time suiting to local agro-ecology, indigenously-evolved tools and technology, artisanal skills and complex trade networks. Perhaps it all began with the versatile cotton that was regionally produced almost throughout the subcontinent. The widely differing quality of cotton supplied the raw material to manufacture very simple, coarse to elegant and extravagant textiles of myriad kinds satisfying consumers’ choices and surviving the economy for millennia.

Historical Cropping Pattern

Cropping pattern of any region is largely contingent on the prevailing agro-ecological condition, primarily contingent on soil, and water availability among others. Cultivation of cotton in historical times was essentially different in multiple aspects from the modern days. The following points

underscore the major points of departure in the cultural practice, in terms of cropping pattern, crop rotation, seed conservation, etc.

Multiple Cropping

Unlike mono-cropping nowadays, the cultivation of cotton has never been done alone in the past but always included another crop(s) (**Table 2**). The choice of the second or third crop varied with geography and even from district to district, e.g., two rows of *jowar* planted between every six to ten rows of cotton or peanuts are intercropped with cotton in the Deccan (Spielman 1950). On the other hand, an old report elucidated cotton agriculture in Rungpore (now in Bangladesh) and recorded its co-cultivation with indigo, chillies, and ginger (The Committee of Papers, 1845, p.95).

The other dry crops such as pulses are also planted with wet crops like rice in south India. For example, extensive cultivation of cotton in many parts of south India, from Ganjam, Vizagapatnam to the Baramahal, South Arcot, Trichinopoly, and Dindigul further to Coimbatore, Tinnevely, Ramnad, and the Godavari where cotton was usually mixed with various cereals or pulses for several reasons like grains took less time than cotton to mature and to give a harvest that offered cultivator some income prior to the ripening of cotton pods. It allowed reaping the benefit in addition to cotton, i.e., increased output from the same piece of land thus giving a higher income (Parthasarathy, 2001). Moreover, the inter-cropping reduced uncertainties in rainfall whether untimely or over rainfall. So, farmers were able to avert high risk by raising two crops on the same land with different water requirements. Similar observation can be sought from the Godavari, where it had been a practice to sow white cotton with black paddy and dhal (pulse); paddy being water-thirsty species, failed when rainfall was scanty, and that weather allowed the cotton and dhal to flourish since both can sustain water scarcity. Conversely, the situation reversed and saved paddy instead of the dhal and cotton had the rains been abundant. Similarly, cotton is intercropped with pulses and oilseeds around Coimbatore. Therefore, by mixed cropping, the farmer increased his chance to harvest a moderate crop of each or a good crop of either one or the other. All these, together, rendered the system resilient to external shocks arising out of weather conditions.

Furthermore, gleaning from the texts, we also find other tactics employed by cotton farmers to mitigate the risk of losing crops. In the Tamil countryside, a variety of cotton called *nadam* had been cultivated. It was a perennial plant and less dependent on rains than grain crops. Being a shrub, *nadam* cotton was able to withstand droughts that typically had destroyed cereals. Moreover, in poor rainfall, the cotton yield was curtailed but was never a total failure like grains. And, the *nadam* cotton plant survived for three to five years; so, it was expected to recover after a poor monsoon and produce a moderate yield after the next good subsequent rain. Thus, *nadam* cotton provided peasants an extra cover of security at the time of failure of other grain crops (Parthasarathy 2001). The diversity of crops in intercropping is also illustrated in the Coimbatore district manual (Nicholson 1887, p215-241), it says cotton in red soil was mixed with *kambu* (*Penicillaria spicata*), *pulimanji* (*Hibiscus cannabinus*) with castor and bean in furrows; sometimes it was sown with *cholam* (*Sorghum vulgare*) or gingelly (*Sesamum indicum*). So, when *kambu* was reaped cotton was left to grow, so farmers had the harvest of one crop before cotton matured. Besides, there existed a variety of crops co-cultivated with cotton, e.g., coriander, castor, various millets, *thenei* (*Panicum sp*), *varagu* (*Panicum miliaceum*), *samei* (*Panicum miliare*). We note a variety of drought-tolerant millets were co-cropped with cotton that mostly allowed earlier harvest than cotton thus mitigating the risk of losing both the crops (table - 2). On the other hand, reports of the Indian cotton committee (1919) had also vividly described the diversity of inter-cropping. Cotton co-cultivated with major cereals such as rice either in the same

row or in alternate rows or with millets (*Pennisetum typhoideum*, *Sorghum vulgare*, *Setaria italica*) or with legumes (*Phaseolus mungo*, *Dolichos biflorus*) Also, coriander and other condiments, sesamum, linseed, green chilly, are also often grown with cotton (p121-122). In the middle of the twentieth century, when monocropping and intensification of cotton cultivation had not reached their peak, the nature of multi-cropping was highly diverse. It employed a wide range of crops from cereals, pulses, oilseeds, or fiber crops in equally variable combinations. Aiyer (1955) recorded the multi-cropping practice with cotton; it revealed around fifty combinations of crops, of which eighteen contained cereals, twenty-six contained pulses, and thirty-one included other crops. Given *desi* cotton was mostly grown as a rainfed crop, various millets fared well when co-cropped with cotton, and foxtail millet was the most important of all (Aiyer 1955). From the above discussion, the culture of intercropping seems to be prevailing in every cotton-growing zones of the Indian subcontinent, only the cropping package differed, perhaps hinging on the local choice of produce.

Rotation

The insurance from crop failure was not only met with intercropping but also pushed peasants to adopt crop rotations (table 3). Although not practiced throughout the cultivation range it also allowed peasants to restore fertility for the next season and attain a higher yield in certain cases.

Cotton in many places (e.g., Central Provinces and Berar) rotated with *juar* or *jowar* (*Sorghum vulgare*). Similar observations were also documented in Punjab where the usual crops rotated with cotton were *toria* (*Brassica campestris*), sugarcane, maize, gram, and less often wheat. It seemed that cotton was seldom rotated with cotton (Reports of Indian cotton committee, 1919). A similar observation was also reiterated by Pearse (1913-14) on his third visit to India. He noted a year-wise sequence of rotation of principal crops: 1st year, wheat; 2nd year, wheat; 3rd year, toria (oil seeds); 4th year, cotton, but it also included gram, millet, and sugar cane. In Punjab, he also elucidated the details of inter-cropping in various provinces. Quite often when Bengal gram was rotated with cotton, it resulted in a better yield (Table - 3: Arno S Pearse 1913-14). Apart from rotation, there are other means to restore soil quality, i.e., to keep a fallow period between two successive cotton growing seasons. It was believed that if the earth was left fallow one season, well cleared of weeds and roots, and so to imbibe the sufficient rains for a season, a good yield of the finest cotton in the next year is expected (Anon 1836, p8).

Seed Conservation

Saving of seeds, their distribution and exchange, and sowing the same in the next season tends to keep the seed network viable, which is a key to farmers' control over seeds and infuse resilience to the farming systems (Pautasso et al. 2013). Yet, modern varieties, in most cases, do not allow seed saving. The volatile performance of company-bought seeds, a lot of plurality in the seed market clouding the situation, high prices, etc all add to the woes of farmers nowadays. In contrast, seed saving was an integral component of cotton farming culture in the past. Involved in the elaborate process of multiple-time plowing, manuring, seed treatment, weeding, and sowing of seeds, and irrigating farmers were engaged in the various phases of landscape management. Also, farmers had a detailed process of harvest and seed conservation to raise crops in the next generation since seeds were the lifeline of cotton cultivation and any break in the recurring cycle could put their subsistence at stake. One such account wrote about the seed storage procedure followed by farmers in Bengal '...The seeds are kept with their wool on them during the rainy season; in order to preserve them from damp, they are put into earthen jars, smeared inside with ghee or oil - the vessel, with its mouth closed up, being

Table 2: Region-wise intercroops for cotton

Regions	Inter-crops
Deccan	Two rows of <i>jowar</i> planted between every six to ten rows of cotton or peanuts
Southern India, e.g., Ganjam, Vizagapatnam to the Baramahal, South Arcot, Trichinopoly and Dindigul further spreading to Coimbatore, Tinnevely, Ramnad and Godavari	Pulses along with wet crops like rice
Godavari	White cotton with black paddy and <i>dhal</i>
Coimbatore district	Cotton in red soil is mixed with <i>Kambu</i> (<i>Penicillaria spicata</i>), <i>pulimanji</i> (<i>Hibiscus cannabinus</i>) with castor and bean in furrows; sometimes it is sown with <i>chulam</i> or gingelly A variety of crops co-cultivated with cotton, e.g., coriander, castor, various millets, <i>thenei</i> (<i>Panicum sp</i>), <i>varagu</i> (<i>Panicum miliaceum</i>), <i>samei</i> (<i>Panicum miliare</i>)
Karnataka	Castor, <i>Rabi jowar</i> , <i>til</i> , linseed, <i>bhendi</i> , horse-gram, chili
Rungpore, now in Bangaldesh	Indigo, and also with chilies and ginger
United Provinces	<i>Cajanus indicus</i> (pigeon pea or <i>Cajanus cajan</i>)

Source: Arno S Pearse (1913-14) Indian Cotton Secretary, on his Third Visit to India, October, 1913—February, 1914

Table 3: Region-wise rotation-crops for cotton

Regions	Rotation-crops				
	1st	2nd	3rd	4th	Additional crops
Punjab	Wheat on 1st year	Wheat on 2nd year	Toria (oil seeds) on third year	Cotton on fourth year	Also gram, millet, and sugar cane
North-Western	Cotton (April - September/ October)	Wheat (November to May)	Jowar (millet) July - October	Fallow for six months	X
United Province	Wheat six months	Cotton eight months	Barley and Peas (mixed) four months	Maize, wheat six months	X
Western India (Bombay-Kumpta-Dharwar)	Cotton	Wheat	Jowar	X	X

Source: Pearse (1913-14); Report of the Indian Cotton Committee (1919) P16; Spielman HW (1950); Schimidt (1911-1912)

generally hung from the roof of the ryot's hut, over the spot where the fire is kindled. They are sown, in November, ' (Taylor 1851, p12).

There were other practices that facilitated seed conservation by farmers. Prior to the mechanical and centralized ginning (removal of seeds from lint) facility, hand-ginning was operative at a local scale. The hand-ginning was mostly run by households all across the cotton-growing region and enabled the manual separation of seeds from lint. The advantage of non-mechanical hand-ginning was the seeds were also returned to the cultivator along with the lint, it entailed the collection of seeds post-ginning and allowed sowing in the next season. Local hand-ginning may not be as fast as a machine but this cycle sustained the local seed network and nurtured farmers' seed selection and indigenous

diversity. Machine-ginning though produced larger output damaged the seeds in the course. So, its introduction caused a shortage of seeds for planting (Menon and Uzramma 2017). In addition, by mixing all the different kinds of cotton brought to the facility and mass-scale ginning the centralized system of mechanical ginning has not distinguished the inherent diversity of cotton that was possible through decentralized local hand-ginning. So in essence, it acted as a catalyst to abolish seed network and diversity, and also indirectly promoted the varieties producing more lint but not the other distinct and culturally important traits of the indigenous cotton. The attributes of historical cotton cultivation revealed the diversity of landraces, various cultural practices pertaining to multiple cropping and rotation, and conservation of seeds. These are intricately related to the key role of farmers in decision making, and how these helped them to insulate from the risk of crop failure (next section). It also outlines the apparent contrast between the past and present cultivation practice and sheds light on the nuances of the agricultural history of cotton.

Traditional Knowledge and Farming Decisions: Intensive Vs Extensive Cultivation In The Past

Gleaning from history, the key role of farmers building on the accumulation and application of knowledge, skills, and consequent decision making can not be ignored. They go through a continuous process of learning and applying to sustain agriculture in dynamic agro-ecological conditions. Historical notes, in this regard, assert another layer of support for this notion. It exhibited a diverse culture of cotton production counting on a range of locally grown landraces depending on the regional edaphic and agro-climatic conditions. The cotton can be used to produce a versatile range of textiles capitalizing on the quality of cotton, dyeing and printing, and artisanal skills, and the finished product, cotton clothes, used to feed the national and international market. Farmers used to minimize risk and insulate themselves from crop failure by exercising crop rotation, multi-cropping, and deciding on intensive or extensive types of farming. Adoption of various measures of risk abatement probably infused resilience to the system of cultivation. On the same note, a revisit of historical phases of cotton cultivation clearly presented an apparent contrast with today's intensification of production that may have unleashed a spurt in yield, but simultaneously devalued their decision-making potential and made them confront a severe risk.

Here, I would offer a specific example of the decision-making process in adopting the extensive or intensive mode of cultivation dependent on resources, labor, etc. In order to execute farming activities and thereby sustain themselves by reducing risks, the cultivation of cotton was largely contingent on capital, labor, and local agro-climatic conditions. Largely in unison with this, Parthasarathy (2001) has narrated how the farmers of South India exercised two very different modes of cultivation of cotton, intensive or extensive depending on available capital and labor. The output was essentially different in these two forms, yields from intensive cultivation were at least twice or even more than those from extensive cultivation which required far fewer inputs than intensive cultivation in terms of both capital and labor. Intensive cultivation was performed on the rich and loamy black soils of South India while extensive cultivation was done on thinner and lighter red soils. Thus, soil seemingly played a critical role in the distribution of extensive and intensive cultivation. The soil around Dindigul, South Arcot, Trichinopoly, and the Baramahal was red and cultivation was extensive. Whereas much of the intensive cultivation in South India was found in Tinnevely, Madurai, Coimbatore, and the southern Deccan plateau. It was perhaps the availability of capital, another major determinant, that could draw the supply of labor required in cultivation. While extensive cultivation incurred a little expenditure that made it especially attractive to peasants who can act preemptively. So, they needed no ready

supply of cash, used seeds saved from the previous generation of crops, and labor investment was made possible by the cultivating household. Besides, they could also reduce the risks posed by the climatic uncertainties through intercropping or crop rotation that insulated them from huge losses. For instance, cotton was generally co-cultivated with grain crops with divergent water requirements that gave farmers an earlier harvest and thus an additional income. It also insured them from the uncertainties stemming from erratic rainfall. Around the Godavari, white cotton was grown with black paddy and dhal (pulse).

On the other hand, intensive-type was contingent on the heavy supplies of capital. Funds were needed for clearing and plowing the heavy black soils; in some cases, several rounds of plowing and other related landscape management were necessary which were not possible without significant hired labor investment. Therefore, intensive cultivation could only be possible for wealthy cultivators who either possessed capital or had access to capital. In addition, it also meant hiring and paying laborers since the labor supplied by a peasant household was not sufficient given the heavy demands of cultivation on black soils. Finally, intensive cultivation not asked for more in terms of investment, so also entailed greater risks than extensive. Thus, cultivators had to possess sufficient resources to survive crop failures and tide over unfavorable conditions (Parthasarathy 2001, p50-53 and Appendix 2.1).

The Trajectory of Cotton Cultivation: Intensification of Production

Historians argues that the competitive position of Indian textile was rooted in higher productivity of Indian agriculture, higher cropping intensity, double or triple crops of mostly cereals per year that kept the food grain price lower than Europe (Fisher 2018; Parthasarathy, 2001). However, a rise in productivity may not apply to cotton that perhaps remained stable for centuries prior to the twentieth when it underwent rapid change in the last century. The first spell of change in cotton cultivation in the subcontinent was brought about by the introduction of exotic species and subsequent discriminatory policies, whereas the next phase can be judged in light of the intensification of the production framework. Specifically, cotton cultivation in India has undergone an unprecedented change in the last 100 years or so. The seed of change probably began to germinate in the early twentieth century as stated by Arno S Pearse (1913-14). He had noted a decline in mixed cultivation owing to anticipation of more profit from the same piece of land (p113). It indicated a gradual shift towards intensive cultivation of cotton as a cash crop driven by market demands. It perhaps happened in response to the huge surge in demand for raw cotton in British and/or domestic looms and caused a temporary shortage of cereal grains in many parts of the country. The rate of change was even faster in the last 50-60 years with the introduction of newer technologies like hybrid seeds in 1970-71 or Bt cotton in 2002. In tandem, indiscriminate application of agrochemicals like heavy fertilizers, pesticides as well as irrigation has transformed the system into a highly productive one though unbolted the propensity of risk. Consequently, the yield has almost quintupled during the transition from the late nineteenth to the early twentieth century (**Figure 2**).

It is quite apparent that the intensified yield or productivity of cotton would occupy the center stage of discussion that revolves around the history of cotton agriculture and its change as it has affected the socio-economy of the subcontinent so much. Therefore, to gain insight into cotton yield and its rise in the historic time period, we may refer to the analyses by Roy (2012) who has offered a fair elaboration sieving from various sources. From his discussion, it seemed that there has been a lot of conjecture regarding the absolute value of yield. A view, widely supported by the nineteenth-century

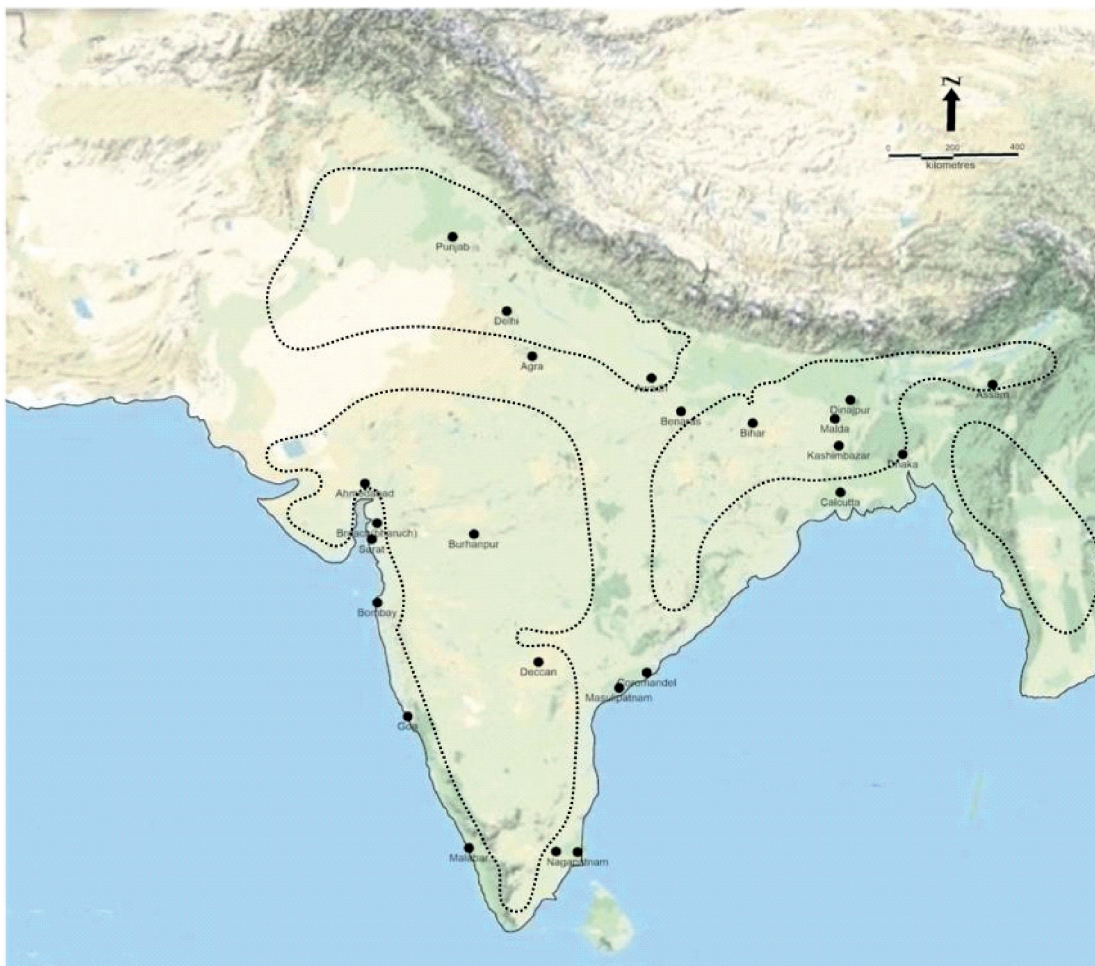


Figure 1: Schematic diagram of major cotton cultivating regions (enclosed in dotted border) and manufacturing units (closed black circles) across the Indian subcontinent (approximately 1600-1800)

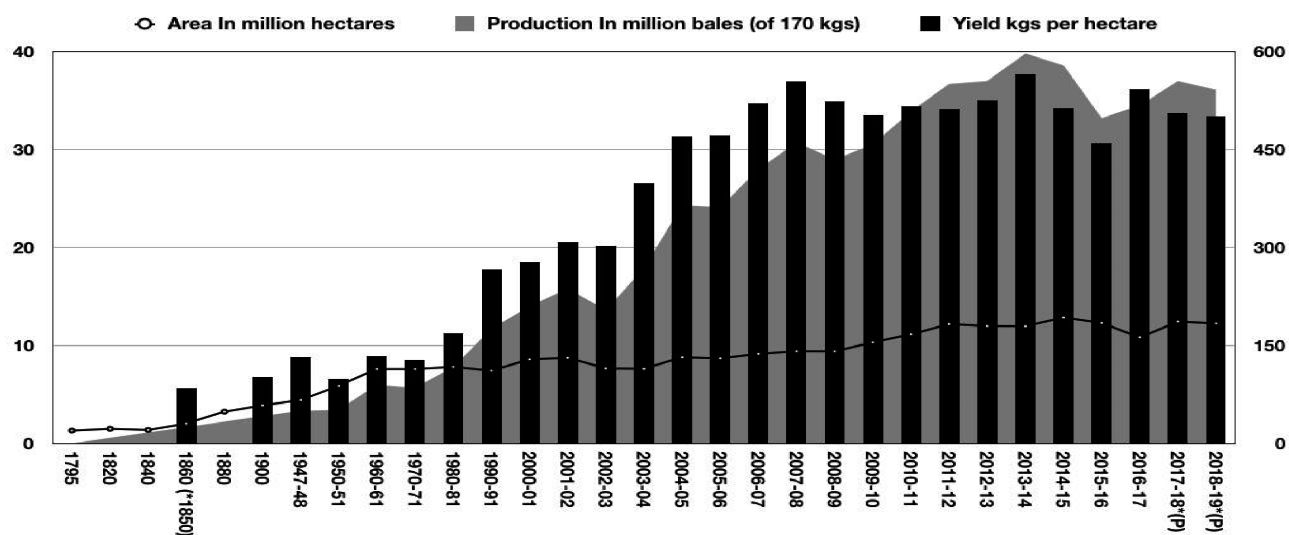


Figure 2: Trends in cotton production statistics, acreage (million hectares), production (million bales), and yield (kilogram/hectare) from the late eighteenth century.

cotton planters in India, was that the yield of Indian cotton in the past varied greatly by location owing to differences in soil and other agro-climatic conditions and less influenced by cultivation practices. The indigenous landraces did not usually fail to give a poor yet stable yield. The higher yield came from the American, Mexican, and Mauritian types but they were less adapted to extreme heat and rain and susceptible to pest attack. So, the higher yield came at a cost, their unpredictability and proneness to risks, as unanimously agreed by many commentators (Parthasarathy, 2001). Regarding yield, there was high regional variation, e.g., a district survey of Bundelkhand revealed yield that varied widely between 50 lb/acre and 150 lb/acre. Another report said about an average of 75 lb/acre in Bombay Presidency in 1850, whereas the Parliamentary committee on Indian cotton determined the average yield of Punjab and United Province to be 91 lb/acre and 103 lb/acre in 1840. The Royal Commission on Agriculture, accounting for variation across places and years, presented a reliable average estimate for a period (1914-27) with a modal number of 90 lbs/acre of cleaned cotton. So, converting these numbers from lb/acre to kg/hectare, we obtain a fairly reasonable estimate of cotton yield that ranged from 75 - 105 lb/acre or 84.06 - 115.45 kg/hectare.

Comparing this range to the estimates of the last seventy years starting from 1947-48 (132 kg/hectare) portrays a gradual increment of yield in the early forties to eighties-nineties but a rapid increase from 2001-02 (308 kg/hectare) that continued more or less undiminished till 2005-2006 (472 kg/hectare). Afterward, yield almost stagnated and went on more or less the same till 2016-17 (542 kg/hectare). There has also been a simultaneous rise in acreage under cotton cultivation, along with the total yield of cotton. The area under cotton cultivation increased manifold, from 1.31 million hectares in 1795 to 3.88 million hectares in 1900; then 4.4 (in 1947-48) to almost 12.23 million hectares in 2018-19. This enormous expansion of the cotton field especially in the last 100 - 120 years is also significant in terms of total production, which multiplied from 3.34 (in 1947-48) to 36 (in 2018-2019) million bales (of 170 kgs each). In summary, the production, acreage, and productivity of cotton have demonstrated an unparalleled rise in the last century. The four-fold rise in cotton productivity probably underlies many agrarian changes that happened in the subcontinent; the seminal change in cultivation systems of cotton is one of them.

Conclusion

The illustrious culture of cotton lived with grace in India enmeshed in the complex interaction of its sprawling cultivation, post-cultivation processing and production, textiles, and trade network. Its rootedness in Indian geography resonated in the wide diversity of local landraces which had been cultivated almost throughout India adapting to local agro-climatic conditions, rainfall, irrigation, and external input of labor and capital. The diversity of landraces is also reflected in the quality and quantity of clothes produced from them. Reckoning the past also exposed a host of activities by farmers, i.e., multi-cropping, rotation, seed conservation, preference for extensive cultivation over intensive cultivation, relatively little dependence on external inputs that translates to abatement of risk owing to crop failure. It also emphasizes the conscious decision-making process by farmers that is critical to any kind of agricultural activity. That might have rendered their cultivation resilient to various external stresses. As opposed to it, Indian cotton has become highly contingent on external inputs, be it costly seeds, agrochemicals, or irrigation, and turned into an intensively cultivated monocropped cash crop. Said so, this reconnaissance study uncovered these little-known and unacknowledged aspects of cotton cultivation, the facts are relevant to uncover the apparent contrast with the present system and in the discourses of the current crisis of cotton in India.

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