

Country Report

Bangladesh's Cotton Research and Development Status and Future Prospects

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Introduction

Textiles and textile-related products account for more than 12% of GDP and account for more than 81% of export earnings. The industry employs nearly 5 million people, with women accounting for 80% of the workforce. Cotton is an important cash crop in Bangladesh as well as the primary raw material for the textile industry. Bangabandhu Sheikh Mujibur Rahman, Bangladesh's Father of the Nation, established the Cotton Development Board in 1972 to promote cotton cultivation. CDB's primary activities include research, extension, seed production and distribution, ginning, and marketing. Bangladesh produces two types of cotton: American Upland Cotton (*Gossypium hirsutum*) and Hill Cotton (*Gossypium arboreum*). Plains cotton is grown in 36 districts, while hill cotton is grown in one.

Area and production

Table 1 shows the area under cotton cultivation over the last ten years. Between 2011-2012 and 2020-2021, the upland cotton area in Bangladesh increased from 20025 ha to 27180 ha. The hill cotton area was 15650 ha in the 2011-2012 cotton growing season and 17120 ha in the 2020-2021 cotton growing season, respectively. American cotton production was 43964 tons in the 2011-2012 cotton growing season and 76104 tons in the 2020-2021 cotton growing season. Hill cotton production was 3051 tons in the 2011-2012 cotton growing season and 4622 tons in the 2020-2021 cotton growing season (Table 2).

Table 1. The area of cotton over the last 10 years

Crop year	Area (ha)		
	Upland Cotton	Hill Cotton	Total
2011-2012	20025	15650	35675
2012-2013	24000	15756	39756
2013-2014	24855	16643	41498
2014-2015	26320	16380	42700
2015-2016	25990	16810	42800
2016-2017	25960	16890	42850
2017-2018	26300	16750	43050
2018-2019	27005	17180	44185
2019-2020	27250	17180	44430
2020-2021	27180	17120	44300

Table 2. The production of cotton over the last 10 years

Crop year	Production (000 Kg)		
	Upland Cotton	Hill Cotton	Total
2011-2012	43964	3051	47015
2012-2013	55200	3465	58665
2013-2014	62139	3662	65801

Crop year	Production (000 Kg)		
	Upland Cotton	Hill Cotton	Total
2014-2015	65800	3063	68863
2015-2016	66071	3670	69741
2016-2017	67496	3716	71212
2017-2018	71010	4188	75198
2018-2019	73723	4296	78019
2019-2020	76300	4638	80938
2020-2021	76104	4622	80726

Cotton Research and Development

CDB conducts research to develop hybrid and short-duration high-yielding cotton varieties with desirable fiber characteristics; to generate agronomic management technologies to increase productivity; integrated soil fertility management combining organic and inorganic fertilizer sources; development of bio-pesticides in controlling cotton insect pests; cotton disease management; identification of cotton seed health; and identification of the factors affecting cotton seed health. Furthermore, stress management research has been prioritized in order to expand cotton cultivation in hill, char, saline, and drought areas by combining traditional knowledge and skills with advanced biotechnology tools while maintaining fiber quality traits.

Cotton research is conducted at research farms/centers in five disciplines (breeding, agronomy, entomology, pathology, and soil science). Upland cotton research is carried out at the research farms/centers of Mahiganj (Rangpur), Sreepur (Gazipur), Sadarpur (Dinajpur), and Jagadishpur (Jessore). Hill cotton research is carried out at the Hill Cotton Research Center in Balaghata, Bandarban, as well as three sub-centers (Raicha, Bandarban; Kawkhali, Rangamati & Matiranga, Khagrachari). The CDB has produced 76 technologies to date.

Seed Production

Since its inception in 1972, one of CDB's core activities has been the production of high-quality cottonseed. CDB keeps 601 cotton genotypes in its germplasm center in Mahigonj, Rangpur. The Cotton Breeders of CDB are constantly working to develop high-yielding varieties with desirable traits. CDB is used in the production of breeder seed and foundation seed. The Cotton Development Board's main activities for providing quality cottonseed to farmers are variety maintenance and improvement, seed production, and seed processing.

CDB has released eighteen high-yielding American upland cotton (*Gossypium hirsutum*) varieties, three hill cotton (*Gossypium arboreum*) varieties, one hybrid cotton, and one mutant cotton variety to date. Table 1 lists the key characteristics of the released varieties and hybrids. CDB is currently evaluating 12 Turkish cotton varieties. Furthermore, the multi-location trial for the introduction of the Bt cotton hybrid has been completed at four CDB cotton research centers.

The Cotton Development Board's main activity is seed production and distribution. In Bangladesh, CDB is the sole producer of cotton Breeder and Foundation seeds in its research centers. Table 2 shows the available areas for these research centers. However, contact farmers produce truthfully labeled cottonseed under the supervision of CDB field officers. In two research centers and three seed multiplication farms, CDB produces breeder seed and foundation seed. Contract farmers produce truthfully labeled seeds or certified standard seeds in isolated seed production blocks. The seed cotton grown by the contact farmers is purchased at a higher price.

Potential areas for cotton cultivation

The Cotton Development Board has taken the necessary steps to expand cotton-growing areas. According to a cotton suitability study conducted by the Bangladesh Agricultural Research Council, 2.5 Lac hectares of land are highly suitable for cotton cultivation during the Kharif 2 season (Fig. 4). However, instead of replacing food crops grown on fertile land, CDB plans to expand cotton cultivation in low-productivity areas such as drought-prone areas, saline areas, coastal areas, and hill tracts.

Drought-prone areas are mostly found in Bangladesh's northwestern and northern regions, covering an area of 5.46 million ha. The northwestern Barind tract is particularly prone to drought. Drought severity is increasing in these areas as a result of the effects of climate change. Cotton genotype tolerance to drought has received increased attention in CDB crop improvement programs. Cotton germplasm with high genetic variability in desirable traits has enormous potential for use in conventional and/or molecular breeding approaches.

The coastal region covers nearly 29,000 square kilometers, or about 20% of the country, and contains more than 30% of the country's cultivable lands. Salinity affects approximately 53% of coastal areas. The agricultural land use in these areas is very poor, far below the country's average cropping intensity. Although cotton is regarded as a pioneer crop in the reclamation of saline soils, excessive soil salinity has a negative impact on its growth and development, as well as yield and fiber quality. CDB first attempted to develop salt-tolerant cotton varieties through direct selection from existing cotton varieties and germplasm.

Chittagong Hill Tracts (CHT) is a large hill area in Bangladesh's southeastern region. The Chittagong Hill Tracts cover an area of approximately 13,184 square kilometers. In this region, shifting agriculture (jhum) is still the dominant cultivation system. Cotton is grown as a Jhum component crop. CDB conducted several adaptive trials on the hill slope, resulting in rice-cotton intercropping technology as an alternative option that provides more yield and income to hill farmers.

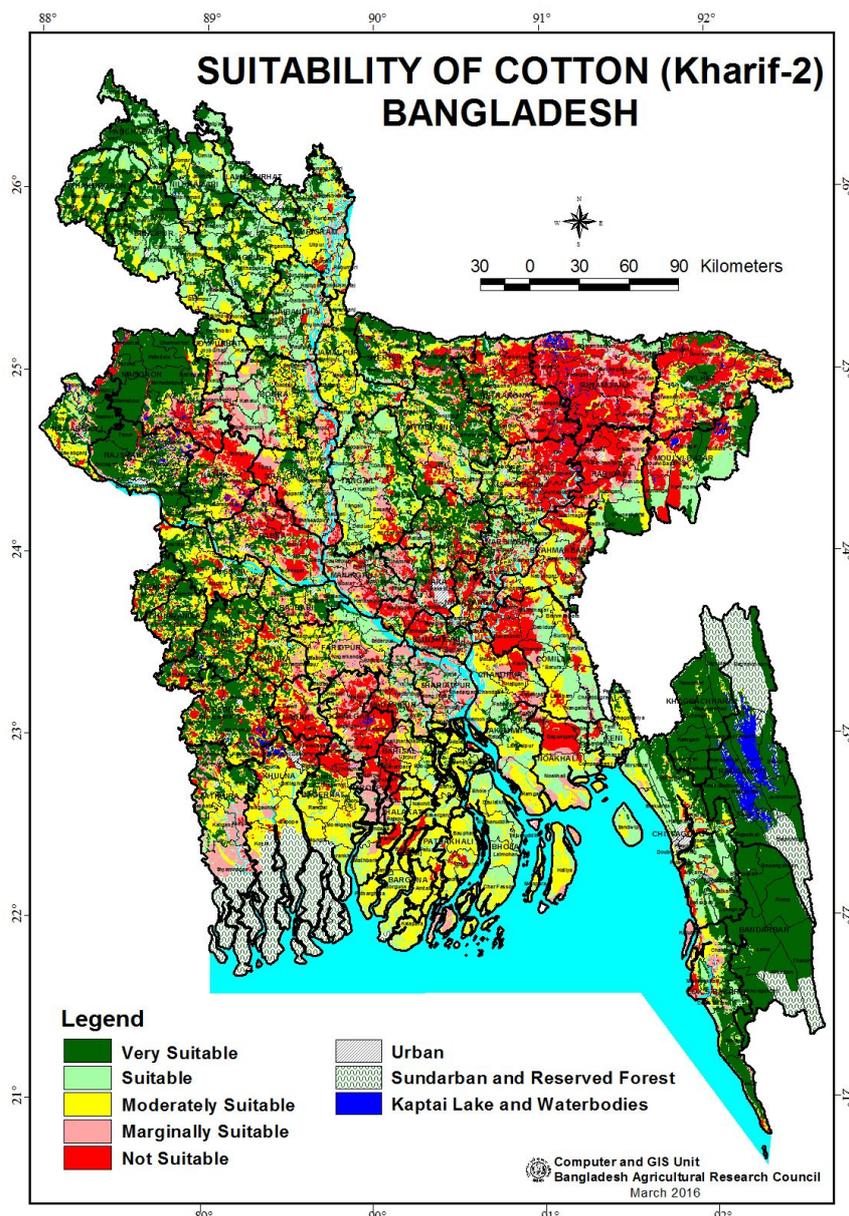


Figure 1. Suitability of cotton in Kharif 2 season

CDB has undertaken an intensive program to produce quality seed by combining advanced biotechnology tools with traditional knowledge, as well as begun collaborative work with international development partners, in order to successfully expand cotton cultivation in low productive areas.

Cottonseed processing

Seed cotton contains both seed and fiber when harvested. Ginning machines separate cottonseed and fiber at CDB's five cotton research centers. Furthermore, CDB operates eleven ginning centers across the country. Cottonseed is processed and stored in ginning centers after ginning for distribution to farmers during the following crop season. The unit and sub-unit offices are in charge of distributing seeds to farmers.

Cotton fiber quality

CDB has made the necessary efforts to improve cotton fiber quality in accordance with the needs of spinning mills, and spinning mills are assisting us in improving our fiber quality. Cotton cultivar, climate, crop and harvest management, including sowing time, row spacing, plant population, insect management, weed management, fertilizer management, irrigation, growth inhibitor, harvesting, and

storage, all have an impact on cotton fiber quality. Through production research, CDB has optimized all of the management factors affecting fiber quality. CDB has been encouraging our cotton farmers to harvest after proper bursting (fully matured) and to dry their seed cotton in sunlight to retain moisture as per the spinning mill's recommendation. Currently, the fiber quality of Bangladeshi cotton is comparable to or better than that of imported cotton from India and African countries..

Marketing and Ginning of Seed Cotton:

Cotton is a cash crop that is traded internationally, so its marketing system is relatively complex. Cotton marketing and processing begin at the farm gate after cotton harvesting and progress through various stages of processing. Private ginners provide ginning services for seed cotton harvested by cotton growers. Ginning is the separation of seed and fiber. Around 20 private ginners procure seed cotton from cotton growers in the main cotton growing areas. These are the middle-stage processing centers for farmers' seed cotton, and they play an important role in cotton production and marketing. Fiber is sent to spinning mills after ginning, and seed is used for oil extraction by the expeller. The crude oil is then transported to an oil refinery factory to be refined into edible oil. The oil cake is used to feed animals or fish. CDB's field-level extension workers assist farmers with seed cotton marketing. Every year, the price is set based on the price of the international market so that farmers can get the best possible price. The domestic cotton value chain has advanced significantly (Figure-1).

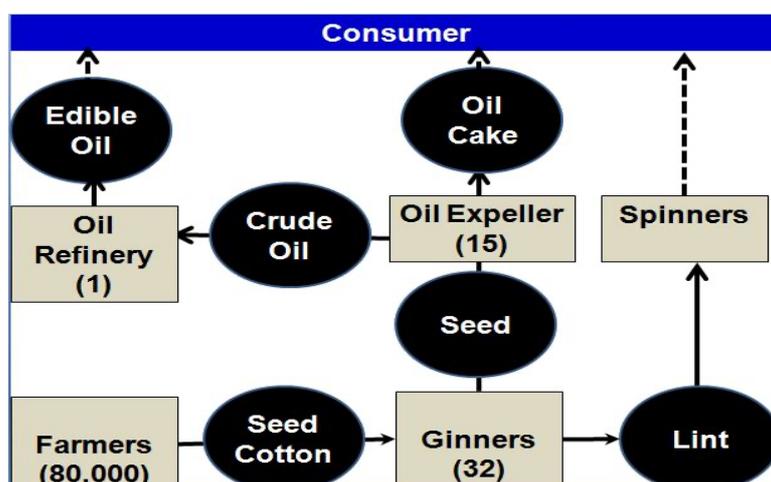


Figure 2. Cotton value chain in Bangladesh

Public-private partnership in cotton research and development

The Public-Private Partnership in cotton research and development has grown in recent years. CDB encourages private seed companies to import exotic seed and conduct research to identify production technologies for the imported seed. The Supreme Seed Company Ltd.'s marketing of hybrid cottonseed has been a major success in this regard. Cotton Connect, in collaboration with the CDB, is working with 15000 cotton farmers in Bangladesh to establish a sustainable cotton supply chain from farm to store in the 2020-2021 cotton growing season, with support from Primark, a global retailer.

Introduction of Bt Cotton

Cotton Development Board has taken the initiative to introduce Bt cotton. Bt cotton Contained Greenhouse Trial, d Bt cotton Contained Field Trial, and multi-location trial were completed successfully with the two Bt hybrids obtained from JK Agri-Genetics Ltd, India, JKCH 1947 Bt and JKCH 1050 Bt. Cotton bollworm resistance was found in these two hybrids. During the cotton growing season of 2021-2022, a multi-location trial was completed at the CDB's four research centers. Bt cotton is expected to be available in the coming season.

International Linkage

Bangladesh joined the International Cotton Advisory Committee thanks to the Bangladesh Cotton Association's strong advocacy. Currently, CDB is an active participant in the ICAC's various policy meetings and research conferences. The CDB has been working with Turkey's Cotton Research Institute to improve cotton varieties and build the capacity of researchers/officers with financial support from the Islamic Development Bank.

Conclusion

Cotton benefits our society in a variety of ways. Cotton helps rural farmers' food security in a variety of ways. Cottonseed is manually sown in-furrow with 90 30 cm spacing. Farmers in Bangladesh use intercropping with vegetables, chili, and mungbean during the early stages of cotton growth. Furthermore, farmers are becoming more interested in relay cropping of turmeric, ginger, banana, chili, wheat, and sugarcane. These practices improve farmers' food purchasing capacity by increasing their income.

Agriculture is the most common source of rural employment. In Bangladesh, 400-450 people are needed per hectare from seed sowing to harvesting and drying. It generates employment opportunities, particularly for rural women, because dryland cotton farming is preferable to wetland rice farming. In Bangladesh, biomass fuel is the primary source of energy for rural households. Cotton is a woody plant, and farmers use the stalks as fuelwood. Per hectare of land, an average of 4.8 tons of stalks are produced.

Cotton by-products such as seed oil, oil cake, and fuelwood, in addition to fiber, the main raw material for the textile sector in Bangladesh, contribute to the national economy through value addition. Seed cotton is a harvested boll that contains 40% lint and 60% seed. Cottonseed contains both the hull and the kernel. Fiber and linters are produced by the hull. The kernel contains oil, protein, carbohydrates, and other nutrients like vitamins and minerals, as well as lecithin and sterols.

Cottonseed oil is made from the cottonseed kernel. Cotton seeds are currently used by the 18 crude oil crushing industries to make crude oil (25%) and oil cake (75%). In Bangladesh, one oil refinery industry refines crude oil to produce edible oil. Generally, oil cake is used as organic fertilizer, fish feed, or livestock feed. Cottonseed oil is a type of edible oil that is widely used in cooking. Cotton oil cake helps livestock and fish production, which helps farmers' food security indirectly.

Bangladesh is a hotspot for climate change, with a high frequency of natural disasters such as floods and droughts. Climate change is putting additional strain on the rural peoples of Bangladesh's low-productivity areas, where traditionally grown crops are no longer profitable. Cotton cultivation has been identified as a viable option for mitigating the negative effects of climate change. Furthermore, increasing domestic cotton production will benefit the economy by reducing raw cotton import dependency.

Given the national importance of cotton as well as its value addition, CDB's vision 2041 is to expand cotton cultivation over two lac hectares of land. To accomplish this goal, CDB seeks active collaboration with national and international cotton research and development institutes.