

Impact of Bt Cotton on Production and Utility in India

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CD Mayee

South Asia Biotech Centre

Cotton Pink Bollworm:

<https://www.sabc.asia/outreach.html>

India Africa Agriculture Engagement:

<https://www.sabc.asia/india-africa-agriculture-engagement.html>

WWW.SABC.ASIA

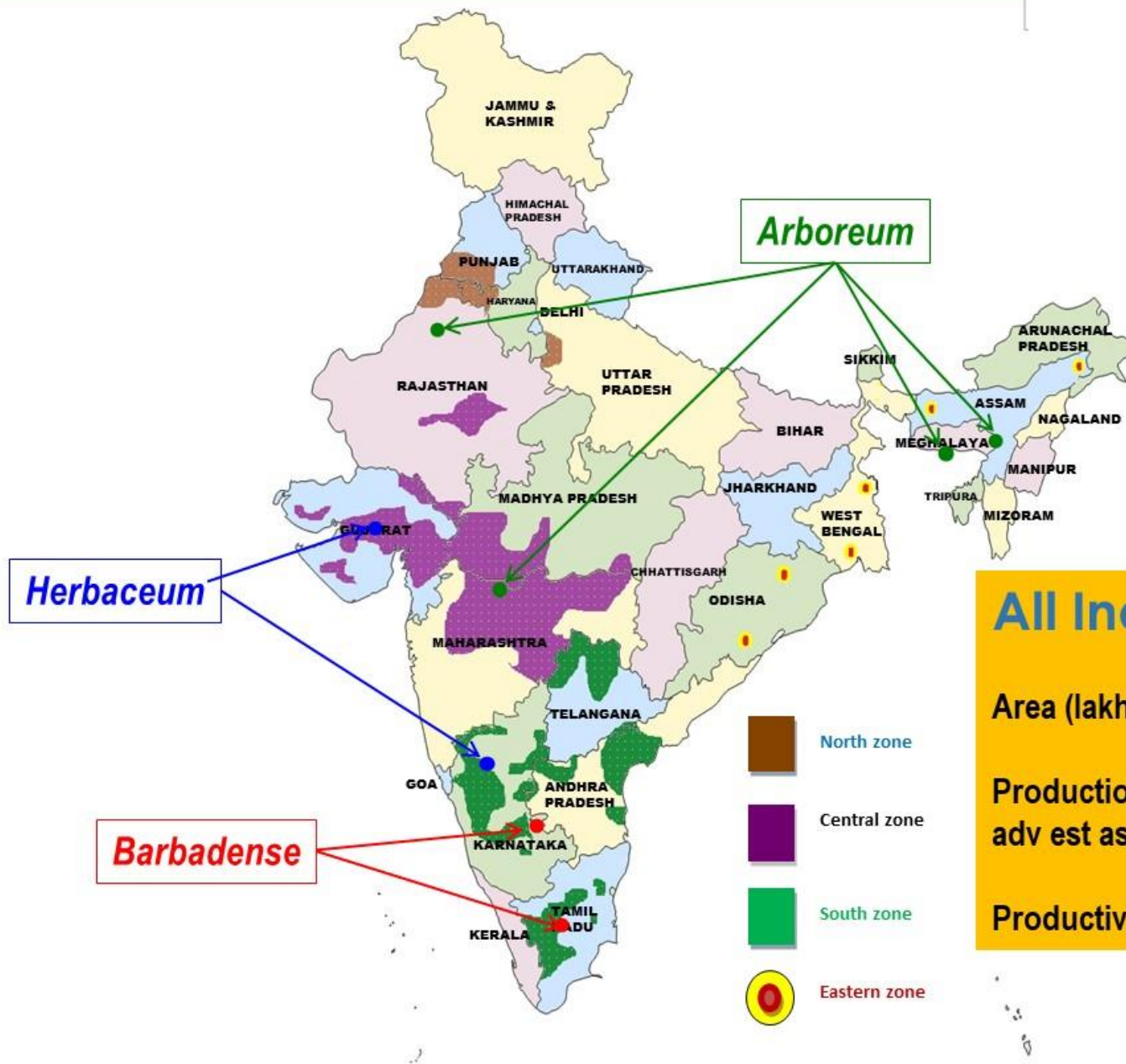
Importance of Cotton

- India - four species of cotton
- Cotton - 9 to 12 million hectares
- India - inter-specific diploid hybrids & intra-specific tetraploid hybrids
- Average cotton holding <1.5 ha; 7-7.5 million smallholder cotton farmers
- Diverse cropping practices including hand dibbling to drip-based-precision-planting to technology-intensive-inter-cropping system
- A robust cotton value chain providing employment to roughly 50 million people

Source: Central Institute of Cotton Research (CICR)

www.cicr.res.in

Cotton Map of India



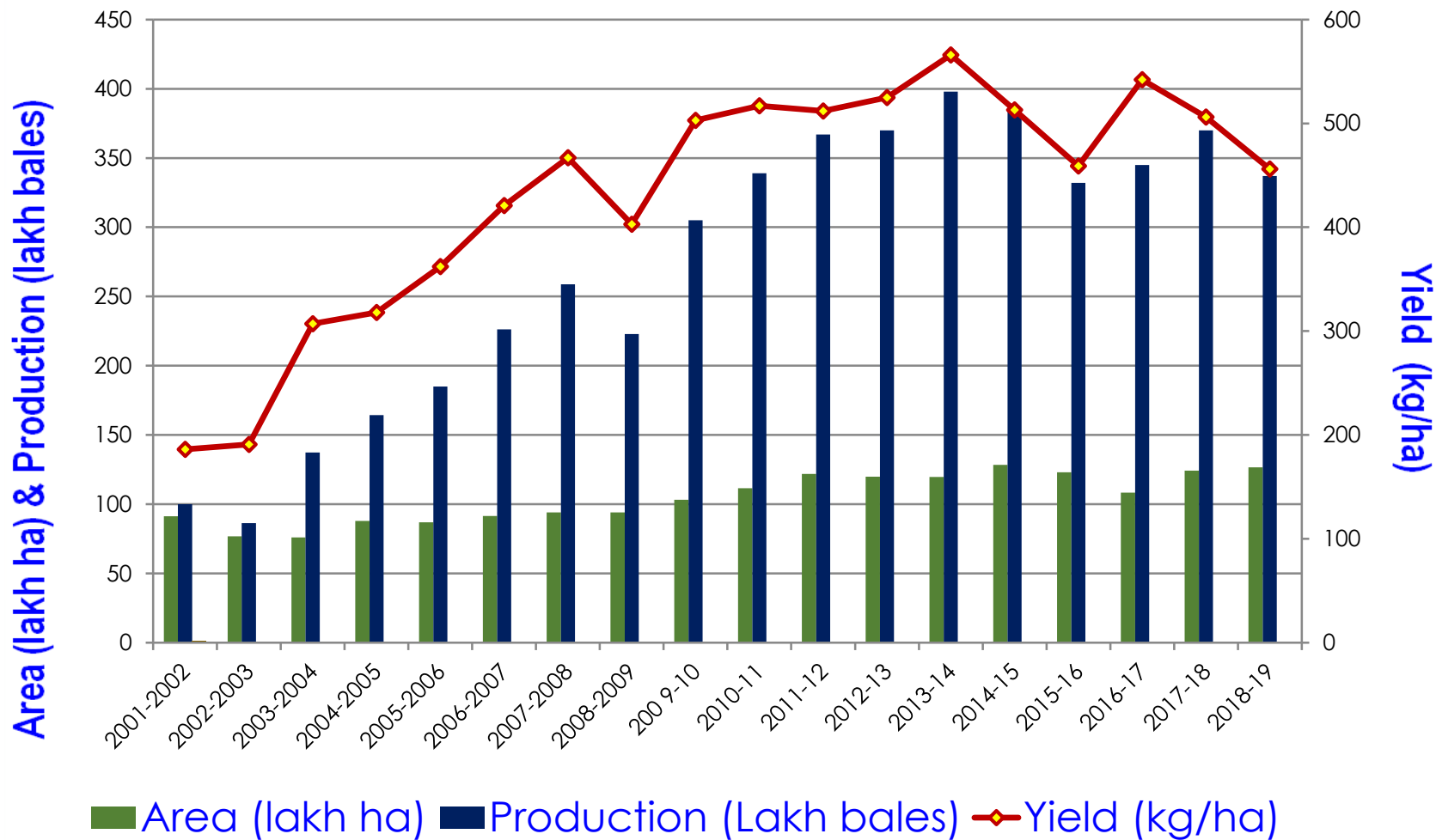
All India-2019-20

Area (lakh ha)=125.84

Production (lakh bales): 360 (3rd adv est as on 15-5-2020)

Productivity (kg lint/ha): 486 kg/ha

Growth in area, production and productivity of cotton in India



All India Cotton Sowing Report

 INDIAN COMMODITIES 23-09-2020

States	(Area in Lakh Hectare)			Changes	
	2020-21	2019-20	Changes(+/-)	in %	
Punjab	5.010	4.020	0.990		24.63%
Haryana	7.370	7.010	0.360		5.14%
Rajasthan	6.979	6.445	0.534		8.29%
North Zone	19.359	17.475	1.884		10.78%
Gujarat	22.792	26.668	-3.875		-14.53%
Maharashtra	42.341	43.837	-1.496		-3.41%
Madhya Pradesh	6.440	6.090	0.350		5.75%
Central Zone	71.573	76.595	-5.022		-6.56%
Telangana	24.219	18.595	5.624		30.25%
Andhra Pradesh	5.760	6.330	-0.570		-9.00%
Karnataka	6.789	5.754	1.035		17.99%
Tamil Nadu	0.347	0.501	-0.154		-30.74%
South Zone	37.115	31.180	5.935		19.03%
Orissa	1.712	1.696	0.016		0.94%
Others	0.222	0.271	-0.049		-18.08%
All India	129.981	127.217	2.764		2.17%

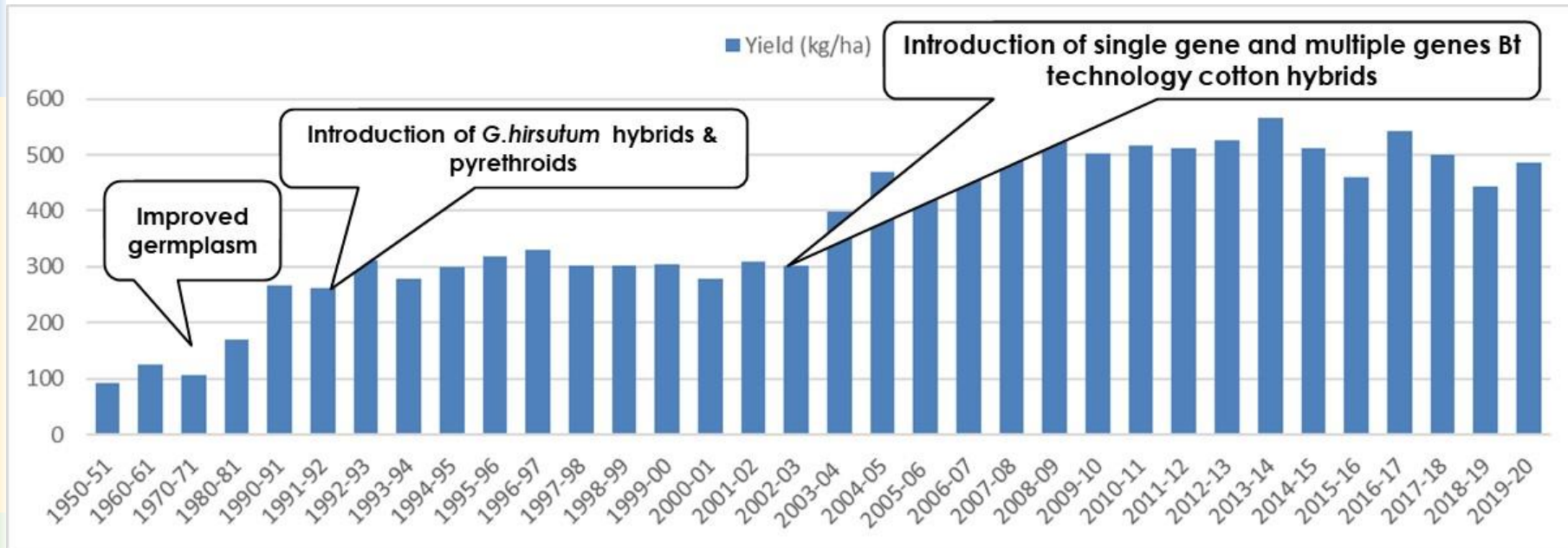
Compound Annual Growth Rate (%) in area, production and productivity of cotton in India



Period	Area	Production	Productivity
1950 to 1960	1.91**	4.22**	2.30*
1961 to 1970	-0.58	-0.27	-0.30
1971 to 1980	0.50	1.10	1.50
1981 to 1990	-0.97	3.32*	4.31***
1991 to 2000	2.21**	4.63**	2.31*
2001 to 2010	3.43***	9.63***	5.97***
2010 to 2019	1.28**	0.36	-0.96**

* , ** and *** significant at 10%, 5% and 1% respectively

Phases of Yield Acceleration in Indian Cotton

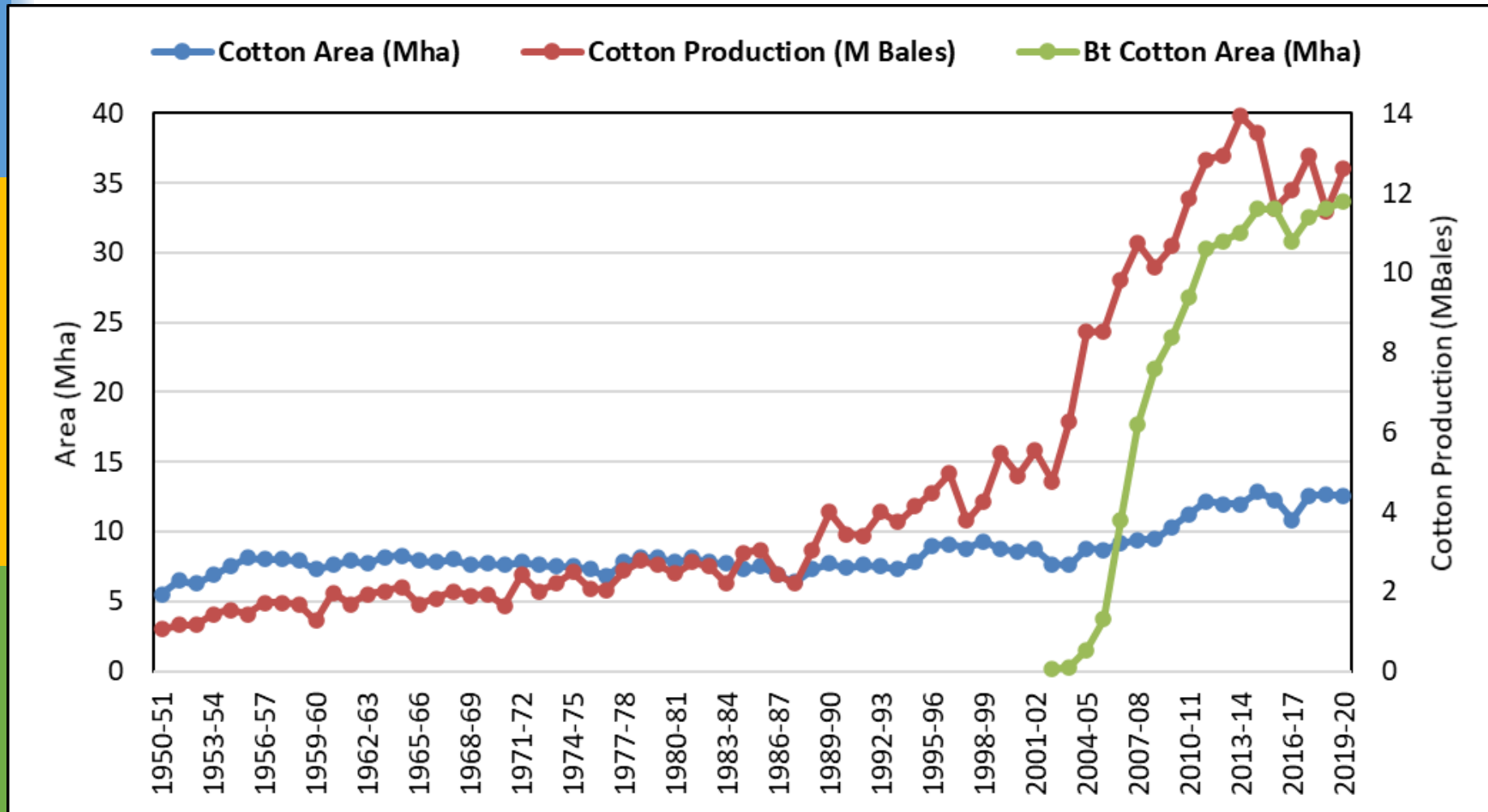


Source: Analyzed by South Asia Biotechnology Centre, 2020

Why Biotech Cotton?

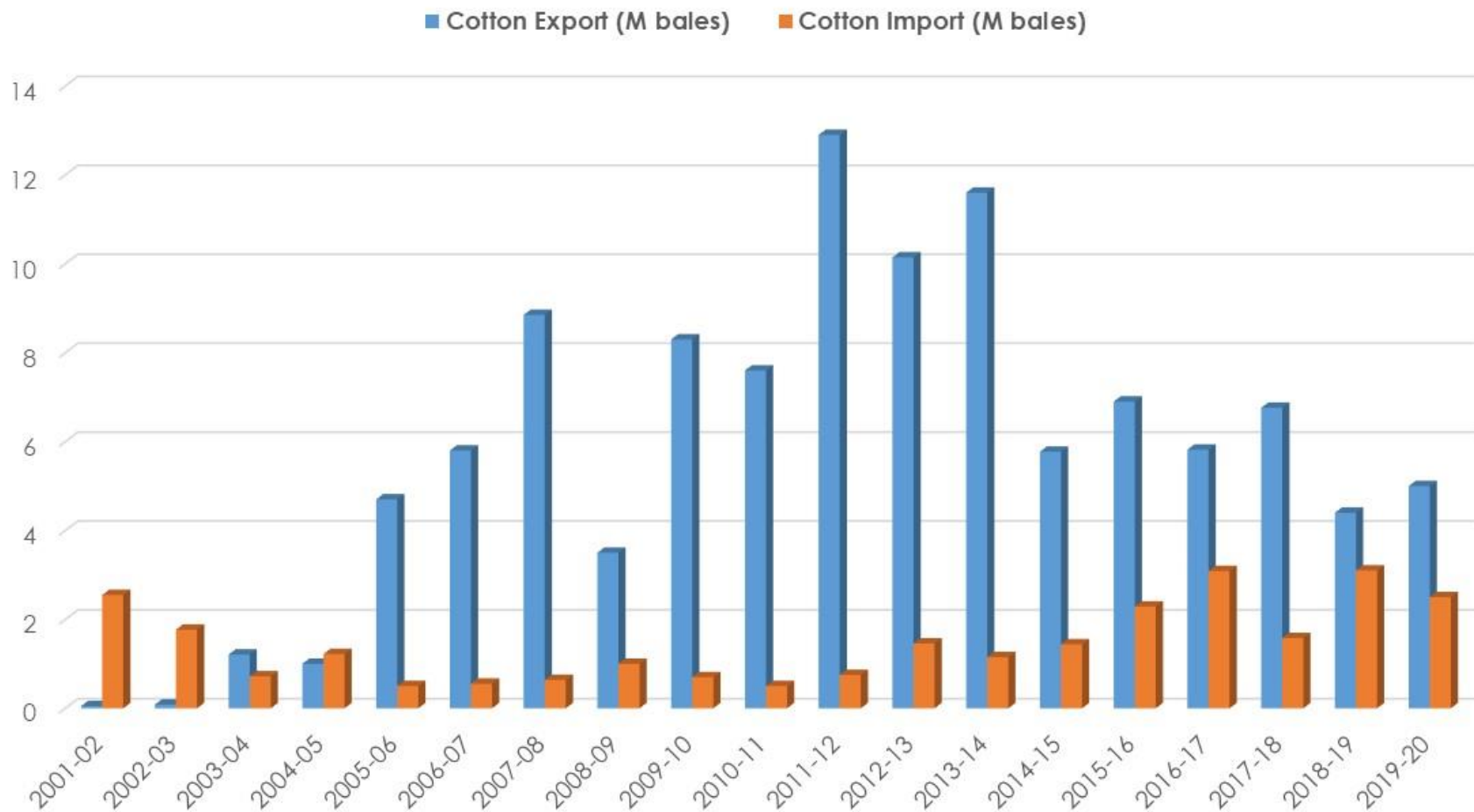
- Bollworm developed resistance to pyrethroids
- Cotton became highly susceptible to Lepidopteran pests
- *Frequent occurrence of the outbreak of Helicoverpa armigera* resulting in crop losses up to 80%
- Cotton consumed 46% of total insecticides valued at US\$504 million in 2001
- Farmers suffered losses- annual yield as low as 300 kg/ha, and often <154 kg/ha in rain-fed areas
- Indiscriminate usages of chemical insecticides
- Increasing import of raw cotton to meet textile need

Adoption of Biotech Cotton, 2002-2019



Source: Analyzed by South Asia Biotechnology Centre, 2020

Cotton Transformation Export and Import of Cotton in India, 2002 to 2020



Source: Analyzed by South Asia Biotechnology Centre, 2020

India's cotton exports *Exports (lakh bales)*



Source: CAI

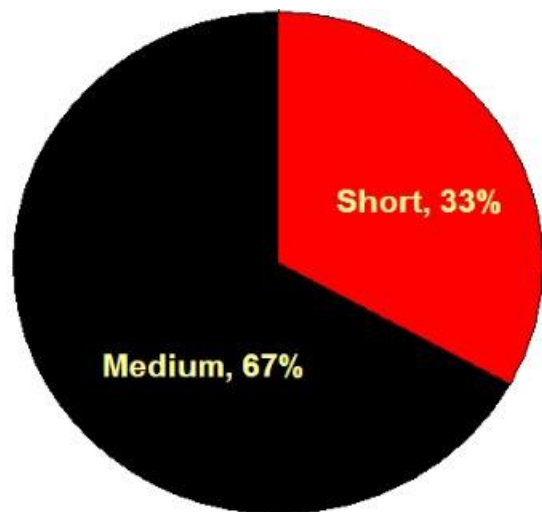


Indian Cotton cheapest in the world

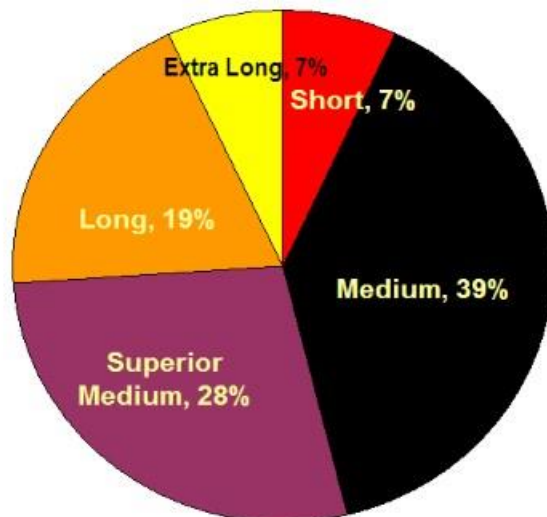
Country	Quoted cotton price in cents (per pound)	Quoted cotton price converted into ₹* (Per candy of 356 kg)	Difference from ICE rate of 65.4 cents (As on Sep 23, 2020)
Australia	83.4	48,084.57	18.0
US	75.4	44,335.20	10.0
West Africa	73.4	43,159.20	8.0
Brazil	70.4	38,808.00	5.0
India	66.0	36,456.00	0.6

Source: Trade data *Exchange rate: \$=73.54

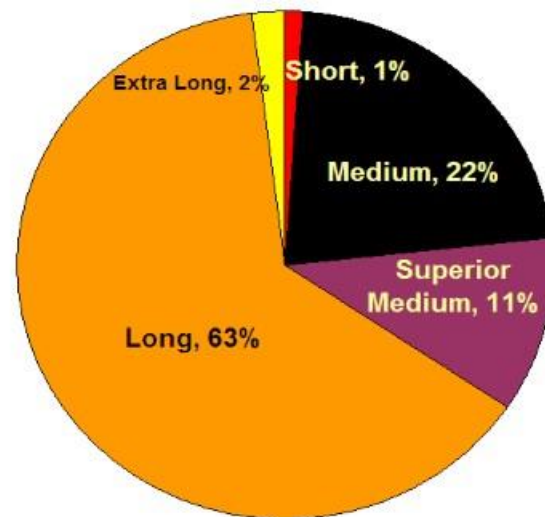
Changes in Staple length of Indian Cotton



1947

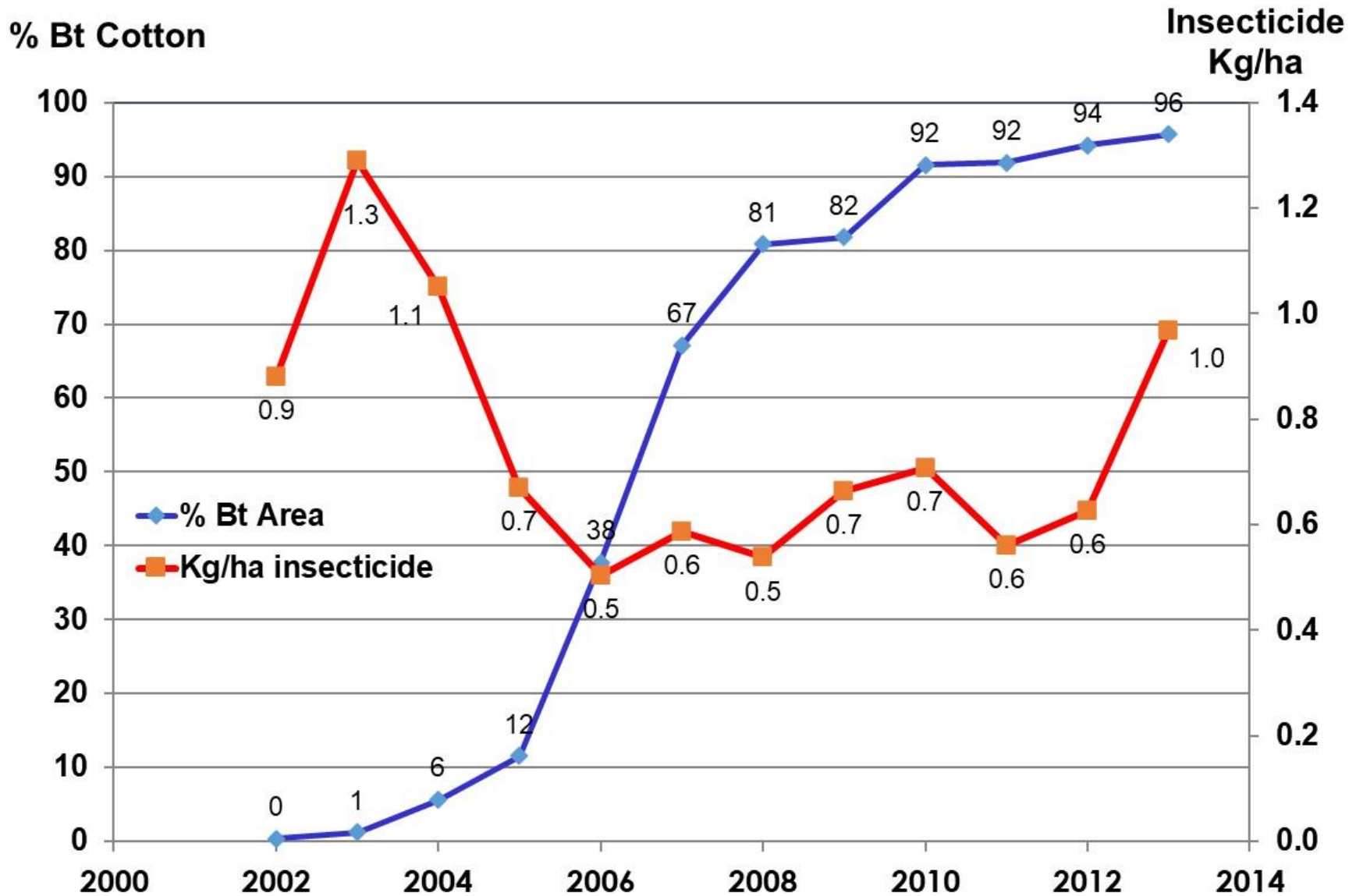


1991



2007

Insecticide use (Kg/ha) on Cotton



Environmental impacts .

- Bt cotton in general delivered significant environmental benefits by reducing the insecticide usage by 50% and doubling the level of ladybirds, lacewings and spiders.
- Bt-cotton contributed to high Sap-sucking pest in cotton and overall usage of insecticides for sucking pests increased.

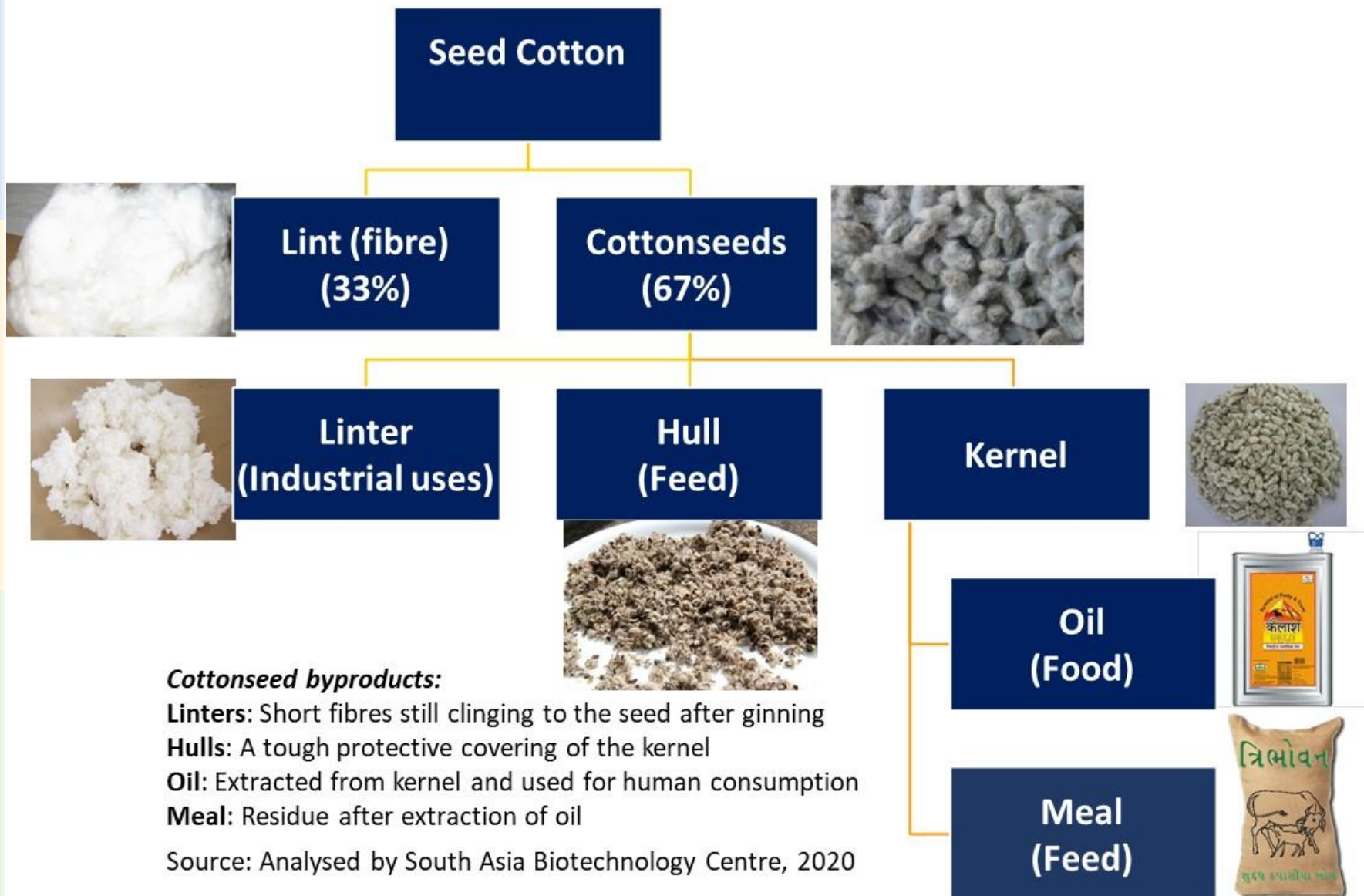


Socio Economic Benefits 2002-2018

- **Macro level Impact: Tripling cotton production**
- **Micro level Impact: Bt cotton replaced the Chemical-based crop protection method**
- **Insecticides sprays reduced by half, NO spray required to control bollworm complex**
- **A very high level of repeat adoption for 19 consecutive years**

Brookes and Barfoot provisionally estimated that India enhanced farm income from Bt cotton by US\$24.3 billion in the 13-year period 2002 to 2018

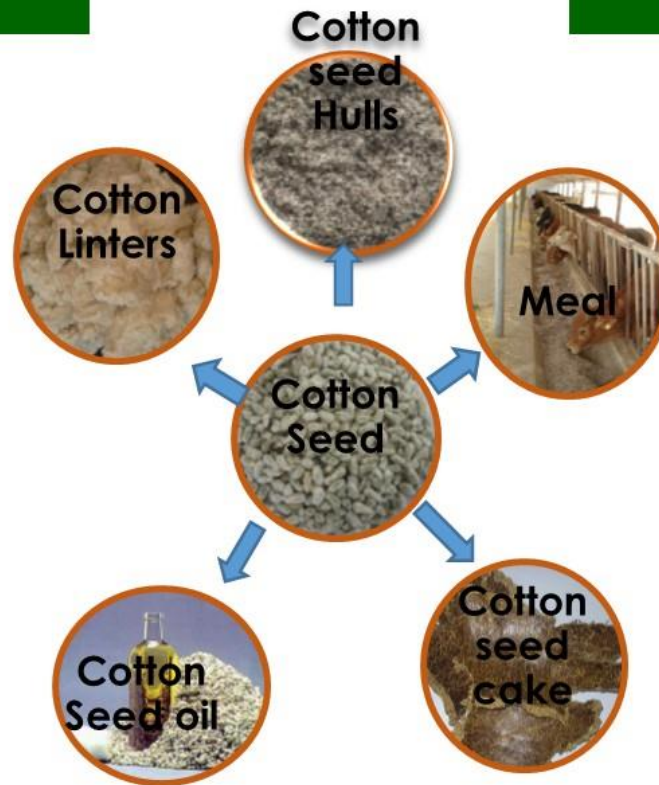
Cotton: A Multipurpose Crop



Value-addition to Cotton Plant By-produce

By-produce of Cotton

- **Cotton Seed**
125 lakh tonnes per annum
- Cotton Plant Stalks**
30 million tonnes per annum



By-products of Cotton seed

- Cotton Linters**
5 lakh tonnes/annum
- Cotton seed Hulls**
34 lakh tonnes/annum
- Cotton Seed oil**
15 lakh tonnes/annum
- Meal**
4.4 million tonnes/annum

Value addition to Cotton Stalk

- Particle Boards.
- Pulps & papers
- Corrogaed boxes
- Briquette s as fuel
- Bio-enriched compost
- Growing Mushrooms.



Particle Boards from Cotton Stalks



Pulps & papers



Corrogaed boxes



Briquettes as fuel

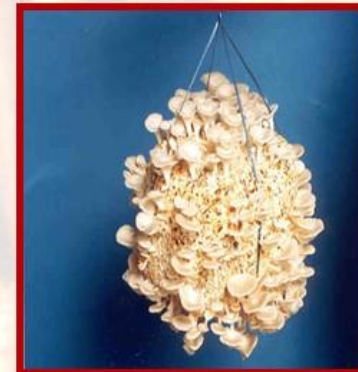


Bio-enriched compost from cotton stalks

A- Cotton stalks

B- Compost from cotton stalks

stalks

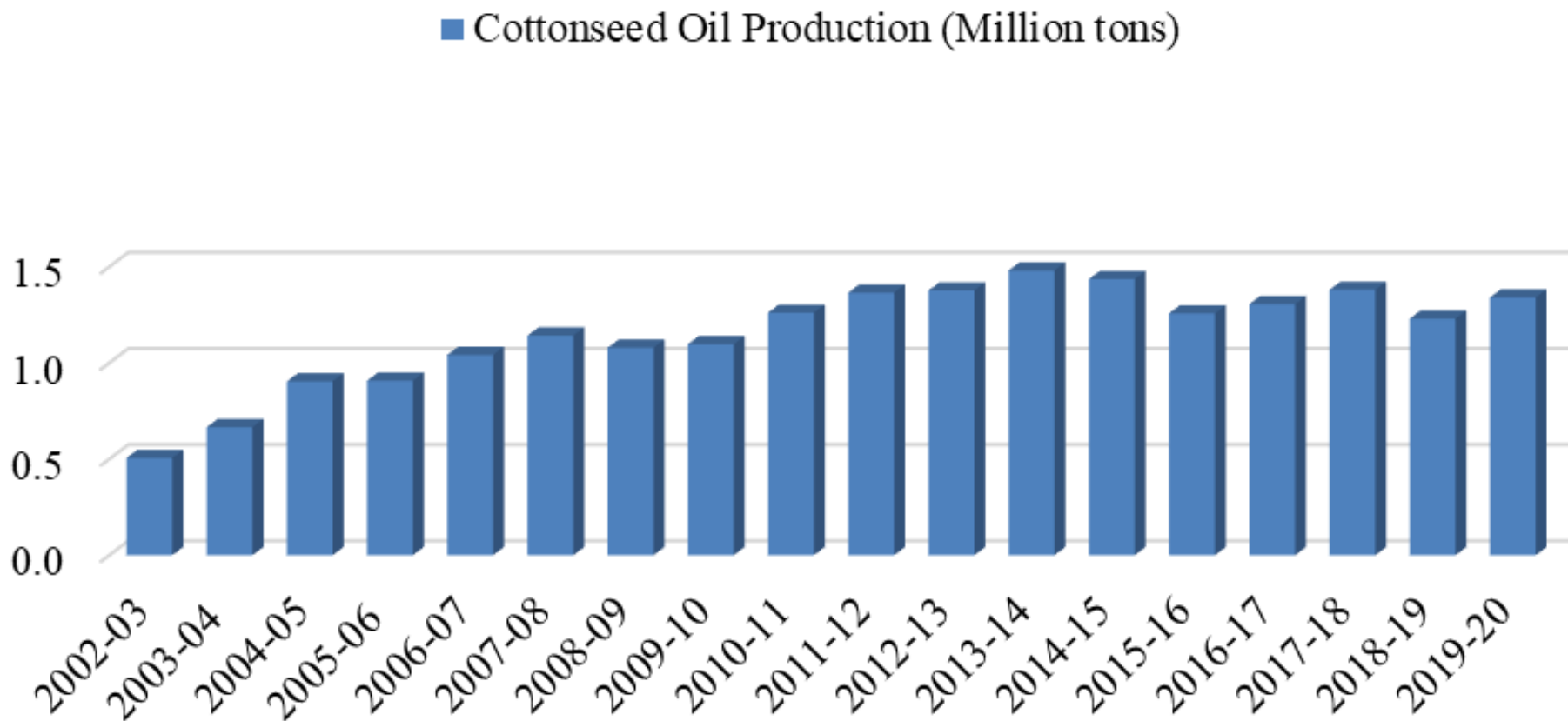


Growing Mushrooms

Advantages

- **Additional income to farmers**
- **Rural Employment**
- **Avenues for Rural Industry**
- **New Raw Materials for industry**
- **Conservation of Natural Resources**

Cottonseed Oil Production, 2002-2019



Source: CAB, 2020; Analysed by South Asia Biotechnology Centre (SABC), 2020

India consumed ~20 million tons of Bt cottonseeds oil from 2002-03 to 2019-20

- **India produced and consumed staggering 20.78 million tons of Bt cottonseed oil from 2002-03 to 2019-20**
- **Cottonseed oil is trans-fat free, contains no cholesterol and can play a role in reducing saturated fat intake**
- **~1.5 million tons of cottonseed oil is produced annually, making cottonseed oil the number one vegetable oil produced from secondary sources**
- **Cottonseed cultivar contains nearly 17-18% edible oil, & almost 12% of extracted with current methods of extraction**
- **5-6% cottonseed oil is left in cottonseed cake**
- **Processors are improving the efficiency of extraction of oil through solvent extraction for hard seeds and expeller extraction for soft seeds to increase oil recovery**

Cottonseed de-oiled cake constitutes the largest share in terms of total availability of meal, followed by soy cake, rapeseed and rice bran in India

- **Cotton de-oiled cake or meal contributes one third of the total meal consumed, and is the preferred feed for cattle and buffaloes in the country**
- **Cottonseed is also a major source of protein, as its by-product oil cake contains a high quality protein (23%) – a necessary ingredient for animal feed**
- **AICOSCA estimates that the availability de-oiled cake significantly boost the manufacturing prospects of compound cattle feed, fish feed and poultry feed**

FUTURE HOPE: Genomics and Biotechnology

- Cultivars suitable for HDPS
- Cultivars suitable for mechanical picking
- Salt and drought resistant varieties /hybrids
- Gene mining for quality fiber specially strength
- Indian cotton can make edge through this

HT Tolerant BGI Cotton



Trials completed and
technical approval granted
BUT technology withheld

FIRs against 12 Maharashtra farmers for illegally sowing Bt Cotton

The move came after several farmers under the banner of Shetkari Sangathana organised multiple sowing of HT BT as a mark of protest against what they said was illegal denial of technology to farmers

Topics

Bt Cotton | Maharashtra | Environment Protection Act

Sanjeeb Mukherjee | New Delhi

Last Updated at June 26, 2019 01:14 IST



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Despite ban, HTBT cotton widely cultivated in Maharashtra

By: Nanda Kasabe | June 18, 2019 12:53 AM

On Monday, activists in Wardha district of Maharashtra held a press conference inviting farmers to participate in the plantation of HTBT cotton on June 20 at Hinghne Ghat village on the field of Madhusudan Hame, who is also an activist of the Shetkari Sanghatana.



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Representational image. Abhijit Bhatlekar/Mint

Illegal cotton seeds sales surge in Maharashtra, other states

3 min read . Updated: 13 Jun 2018, 10:47 PM IST

Sayantana Bera

Soaring sales of herbicide tolerant, genetically modified cotton seeds put farmers across states at risk

'HTBt cotton grown illegally in 3 states'

Vishwa Mohan | TNN | Updated: Jul 3, 2019, 05:29 IST



A-

A+



NEW DELHI: With reports of illegal cultivation of unapproved variety of transgenic cotton, HTBt cotton, coming in from Maharashtra, Telangana and Gujarat, the government on Tuesday told the Lok Sabha that as many as 67 cases were being probed by police since 2017 in these states. Highest 40 such cases were registered against

suspects in Telangana, followed by 20 FIRs in Maharashtra and seven in Gujarat.

"In addition to punitive actions, the state governments have alerted quality control inspectors and district authorities to be vigilant to the illegal production and sale of HT (herbicide-tolerant) cotton seeds," said agriculture minister Narendra Singh Tomar in his written response to a Parliament question.

Need For Cotton Machine Picking Technology

- Cotton Picking is Highly Labour Intensive and expensive
- Scarcity of Labour is making it increasingly difficult for farmers to rely on manual picking of cotton
- With the advent of Cotton high density planting system there will be an increased need for mechanization of cotton picking



Experience with High Density Planting

Early sowing

**The crop escapes bollworms & moisture stress
Overcomes Flooding**

Coragen & Fame control bollworms effectively

Less weed infestation –less cost of weeding

Less crop foliage -less nutrients needed

Early & single picking –less labour needed

Less labour cost on sowing, weeding and picking

Low production cost Rs 15,000/ha

HDPS with Bt Hybrids

PPP Model

Aurangabad, Jalna, Beed, Jalgaon, Dhule, Yeotmal & Wardha

20,031 Farmers

11,100 Acres

331 Villages

	Plants/acre	Yield Q/ac	Production Cost	Gross Income	Net Income
Regular	16250	12.5	28,750	48,750	20,000
HDPS	24,200-43,500	16.87	41,575	65,812	24,237

21% increase in income



A farmer near Jalna in Maharashtra examining his freshly sown Bt cotton field. Express photo

ACREAGE SHIFTS

King Cotton's comeback

The fibre crop, along with maize, seems the most attractive planting option for farmers this kharif

HARISH DAMODARAN

BHASKARRAO MORE last year sowed tur (pigeon-pea) and moong (green gram) on four acres and cotton in the rest of his eight-acre holding. In this kharif season, he has already planted seven acres under cotton, leaving a sole acre for moong.

"I grew more pulses last time only because prices were Rs 9,000-10,000 per quintal. But having got a rate of only Rs 3,500-4,500 for my five quintals of tur and three quintals of moong this February, I have gone back to cotton," notes this farmer from Tupewadi village in Badnapur taluka of Maharashtra's Jalna district.

The same goes for Raosaheb Vittalrao Gavhane from Hiswan Khurd in Jalna taluka, who, like many farmers here, cultivates pulses as an inter-crop with cotton or soyabean. "I usually plant tur in about five rows and cotton in 150 rows every acre. Last year's prices led me to raise the tur planting to 10 rows and reduce the cotton rows to 140. But I realised less from my two quintals this time than from one quintal in 2016," he remarks.

The story of 2017 kharif so far clearly has been about cotton's comeback at the expense of pulses. The Union agriculture ministry's data bear this out: As on June 16, farm-

ers had sown 16.67 lakh hectares (lh) under cotton, as against last year's corresponding all-India area of 12.25 lh. This, even as pulses acreage has dipped from 3.63 lh to 2.22 lh.

"The government declared a minimum support price (MSP) of Rs 5,050 per quintal for tur, but the farmers who tried to sell to state agencies had to wait for 7-8 days for their crop to be lifted. They were told that there are no bardanas (jute bags) to pack the procured produce. Most farmers couldn't afford the cost of waiting so long and chose to offload to private traders at Rs 4,000 per quintal or below," says Gavhane.

The contrast with cotton couldn't have been more. "I did not even have to go to the mandi. The traders themselves came to buy the kapas (raw un-ginned cotton) straight from my fields at Rs 5,600 per quintal this February, compared with Rs 4,000 in the previous year," he adds.

Cotton is typically a 175-180 day crop, with the first harvest ("picking") taking place some 120 days after sowing towards the second week of June. Subsequent pickings — there could be five in all — happen thereafter every 15 days or so. In a normal monsoon year, farmers with access to basic irrigation (stored rainwater conveyed to fields through, say, a three-horsepower motor pump) can harvest about 12 quin-

tal per acre. With drip irrigation, which allows an extra picking, this could go to even 15 quintals.

For farmers, the biggest cost is that of picking. At Rs 500 per quintal for 12 quintals, it works out to Rs 6,000 an acre. The second major expense head is pesticides. About six sprays of branded insecticides such as 'Confidor', 'Actara' and 'Polo' — mainly against sucking pests like thrips, jassids, aphids and whitefly — cost roughly Rs 4,000 per acre, excluding Rs 200 on labour for each round of spraying.

This is followed by weeding (four rounds costing Rs 750 each) and inter-culture (five times; a farmer not owning bullocks will have to hire these each time at roughly Rs 600). Then, there is fertiliser. Gavhane applies one 50-kg bag each of 19:19:19 NPK complex fertiliser (currently retailing at Rs

1,120), 10:26:26 (Rs 1,160), di-ammonium phosphate (Rs 1,260), muriate of potash (Rs 580) and urea (Rs 300) on every acre, adding up to Rs 4,420. The least expenditure is on seeds. A packet of 450-gram Bt cotton seeds sells at Rs 750 and at 1.5 packets per acre, that comes to just Rs 1,125.

"Inclusive of Rs 1,000 for field preparation, my total cultivation cost will be within Rs 25,000 per acre. Even if I get Rs 5,000 per quintal this time on 12 quintals yield, my net return would be Rs 35,000 per acre," explains Gavhane. For farmers like him in Marathwada — or even those from the neighbouring Vidarbha region — the planting choices during the current kharif season essentially reduce to cotton, pulses, soyabean and maize.

At the current market prices, pulses aren't the most attractive option. Soyabean realisations have also plunged to Rs 2,400-2,500 per quintal from Rs 3,600-3,700 a year ago. But this is a crop with cultivation costs at hardly Rs 10,000 per acre. With average yields of eight quintals per acre, farmers still stand to make money. Moreover, given its short duration of 90-100 days — enabling planting of a succeeding rabi winter crop of wheat, *chana* (chickpea) or *Maldandi jowar* (sorghum) — soyabean can not be written off yet.

Farmers sowed 16.67 lh under cotton as on June 16, against last year's corresponding all-India area of 12.25 lh. Pulses acreage, on the other hand, has dipped from 3.63 lh to 2.22 lh

Cotton's real advantage is its relative hardiness. Soyabean can be a washout if it rains heavily during seed setting or harvesting time. Cotton, on the other hand, is picked four-five times. "Even if the rains aren't too good, the farmer is assured of at least two pickings. If the monsoon turns out good, he may give the plant more water and fertilisers for it to yield an extra picking of 2 quintals," points out Usha Barwale Zehr, joint Director of Research at Maharashtra Hybrid Seeds Company.

Cotton apart, the other 'hot' crop this time could be maize. A poor crop last year, courtesy drought in Peninsular India, has meant that the ruling prices, at Rs 1,550-1,600 per quintal, are above the Centre's MSP of Rs 1,425. They may not fall much — one plausible reason being the clampdown on the cattle/buffalo meat trade. That, it is being said, has increased the demand for poultry meat, which also translates into higher feed grain consumption. Like Bt cotton, maize has benefited from technology, with the advent of single-cross hybrids yielding 30 quintals and more per acre over 110-120 days.

The agriculture ministry data show an increase in maize area from 5.62 lh to 6.01 lh so far, while the same for soyabean is down from 1.01 lh to 0.45 lh.



Cotton Is Cool



Image tweeted by @smritirani



Image tweeted by @dreamgirlhema



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