SCENARIO OF COTTON IN INDIA

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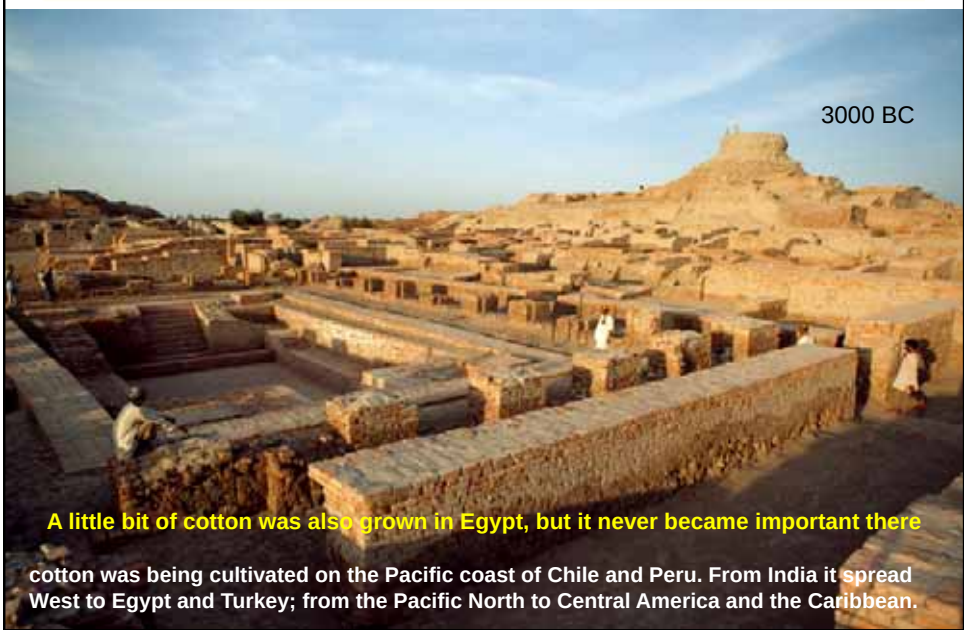
COTTON

- **Major fibre crop of global importance with high commercial value.**
- **Known as White Gold.**
- **Harvested as seed cotton & ginned to separate lint and seed.**
- **Commercially grown in temperate and tropical of more than 80 countries**

Cultivated Species

New world cotton (2n=56)	Old world cotton (2n=26)
American cotton -- *G. hirsutum*	Asiatic cotton - *G. arboreum*
Egyptian cotton -- *G. barbadense*	- *G. herbaceum*

5000 years ago cotton was grown in India & textile technology was only with the Indus Valley



A little bit of cotton was also grown in Egypt, but it never became important there

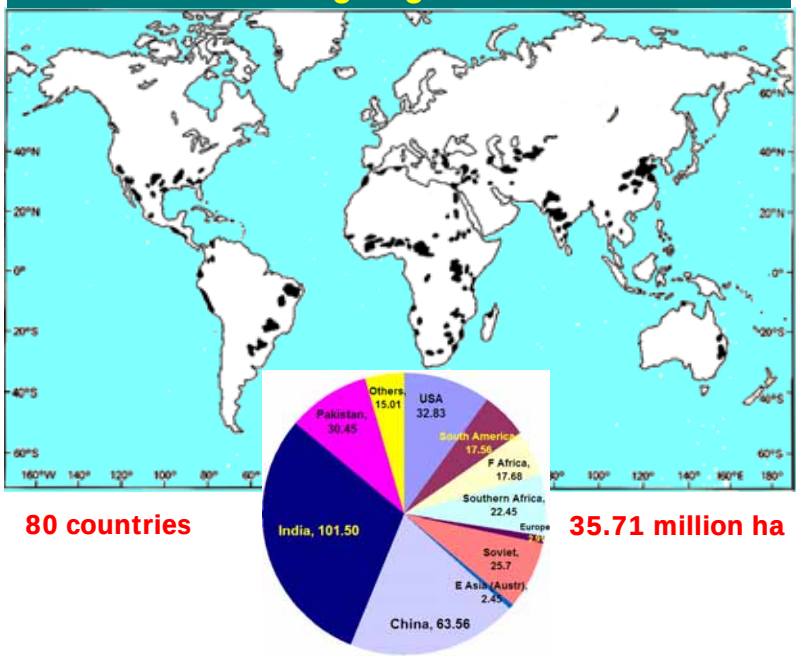
cotton was being cultivated on the Pacific coast of Chile and Peru. From India it spread West to Egypt and Turkey; from the Pacific North to Central America and the Caribbean.

220 years of American Cotton in India

The British wanted alternative source of raw American cotton to suit their mills so they introduced *Gossypium hirsutum* into India. Since India had cheap labour, they set up spinning mills in Calcutta (1814), Bharuch (1843) and Mumbai (1854)

1790	*Gossypium hirsutum* (punctatum race) Var Bourbon and *G. barbadense* (Egyptian cotton) introduced and tested in Mumbai & Madras province. (Coimbatore). Unsatisfactory results
1840	*G. hirsutum* (latifolium race) Var New Orleans introduced in Gujarat, Deccan & Konkan
1862	72,313 ha *G. hirsutum* grown in Hubli successfully. Not successful in Punjab
1905	*G. hirsutum* Var Cambodia introduced successfully into Madras Presidency
1902	Seeds called 'Punjabi Narma' (*G. hirsutum*) were found growing in parts of Punjab
1909	Experiments in UP from 1826, established Cawnpore-American variety in 1909
1917	Milne selected a variety '4F', resistant to jassids from Punjabi Narma, which was grown in 72,846 ha out of 1,11,697 ha under American cotton in Punjab
1933	Labh Singh developed a late maturing variety LSS (Labh Singh Selection) from F4
1929	Hilson and Ramanatha Iyer released Co.1 and Co.2 from Cambodia cotton

Cotton Growing Regions of the World



80 countries

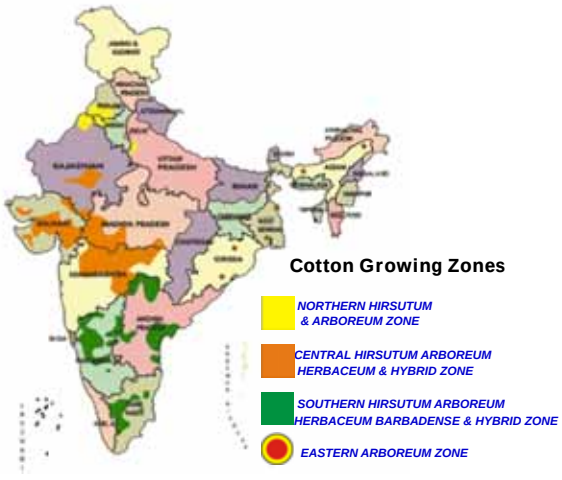
35.71 million ha

Growth in Average yield of Cotton (kg lint/ha)

Year	China	USA	India	World
1980-81	550	453	169	411
1990-91	807	711	267	574
2000-01	1093	1008	278	612
2006-07	1286	912	521	770
2007-08	1278	985	560	797
2008-09	1270	911	526	767
2009-10	1260	868	502	725
2010-11	1301	943	516	759
2011-12	1326	865	482	754
India deficit	63.65%	44.27%	-	36.07%

Source : AICCIP Annual Report, 2011-12

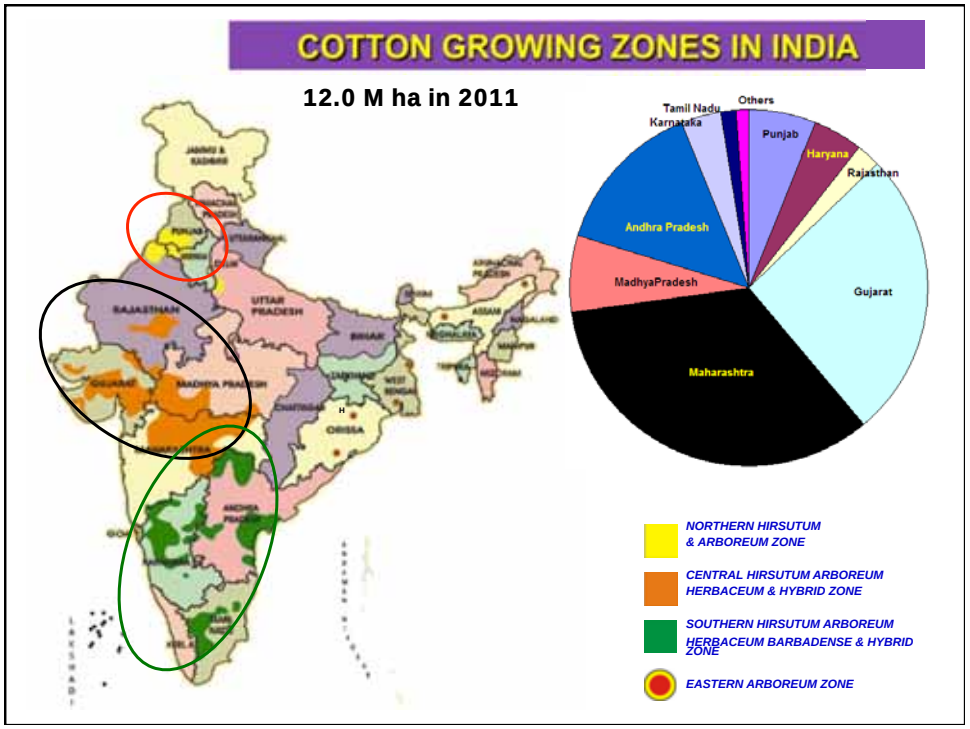
Indian Agriculture & Cotton

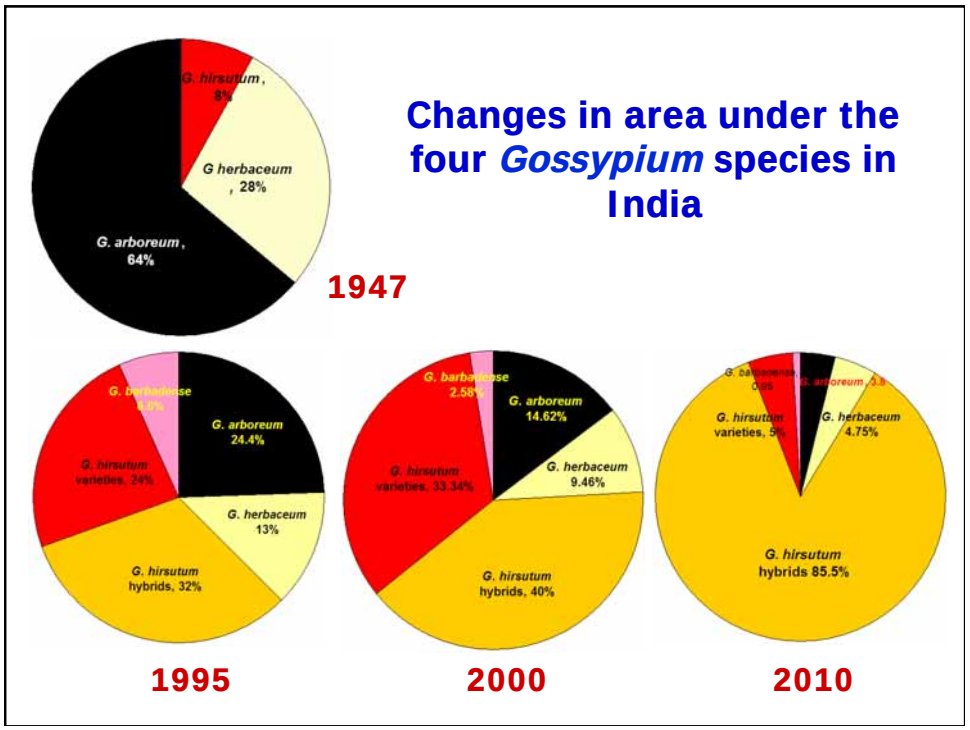


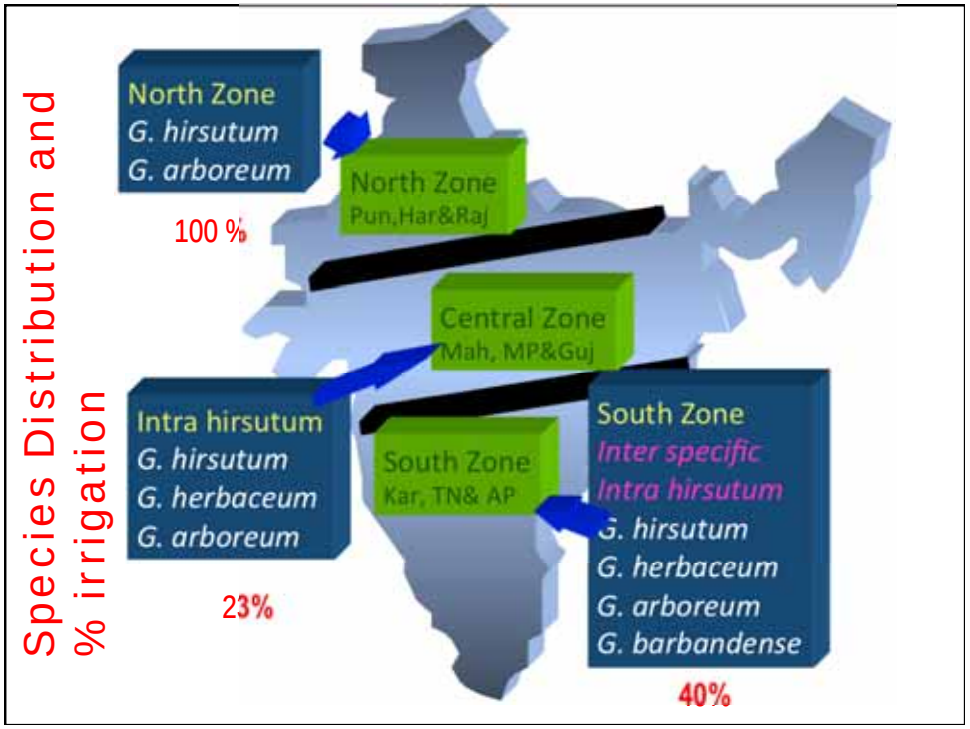
India
- Gross area 328.7 m.ha
- Net sown area 141.0 m.ha
- 134% Cropping Intensity
- work force 58%
- 21% of total GDP
- 11.1% of total export
- 4.5% annual Growth Rate
- 60.4 % engaged in farming
- Holding less than 1.0 ha

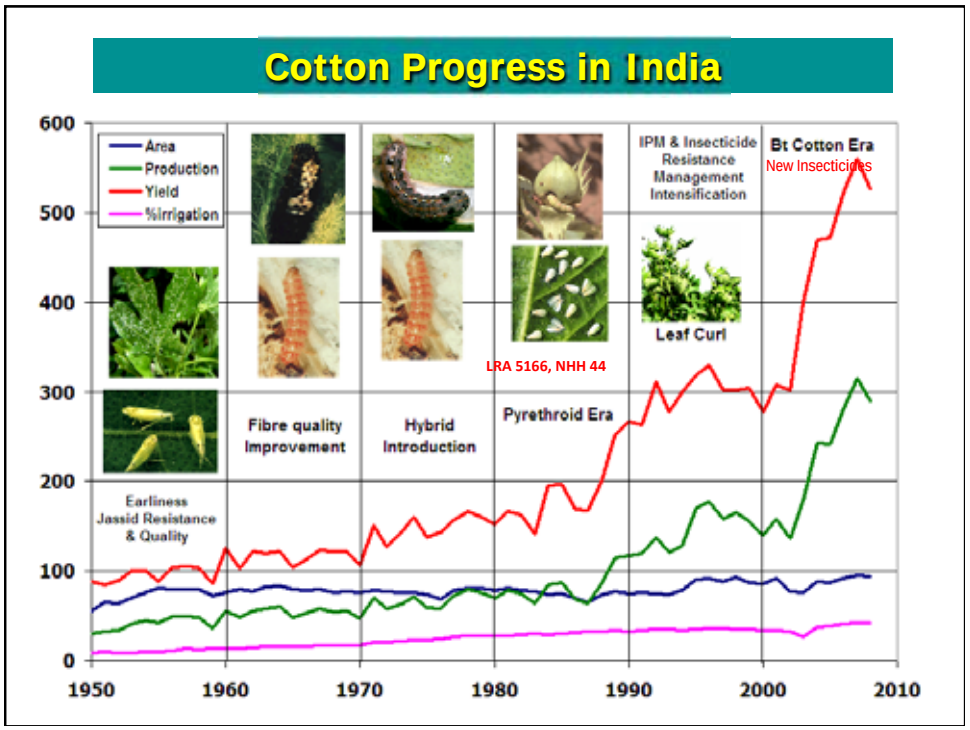
Cotton
- 6.7% of total sown area
- 6.4 million cotton farmers
- Average cotton area 1.5 ha
- 65% dry land cotton
- 85% hybrid cotton
- 30% Indian Agril. Gross domestic product

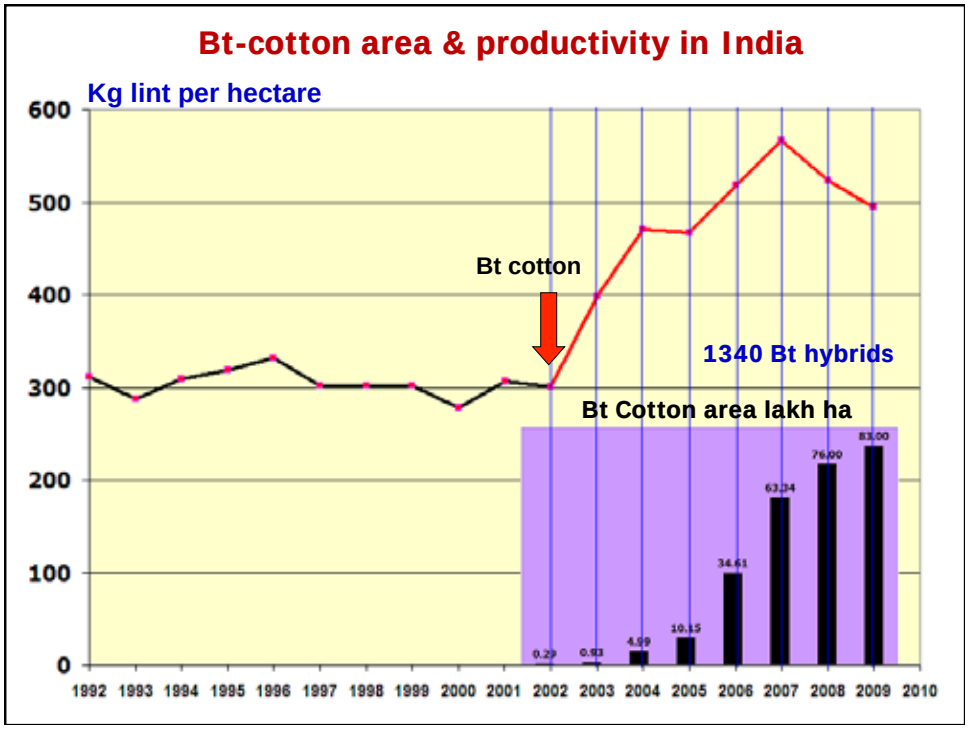
In Global Textile
- Largest area, 1/4th global cotton area
- 2nd largest producer, consumer & exporter, 16% global cotton production
- 2nd largest producer of cotton yarn
- Largest exporter of cotton yarn
- Highest loom capacity

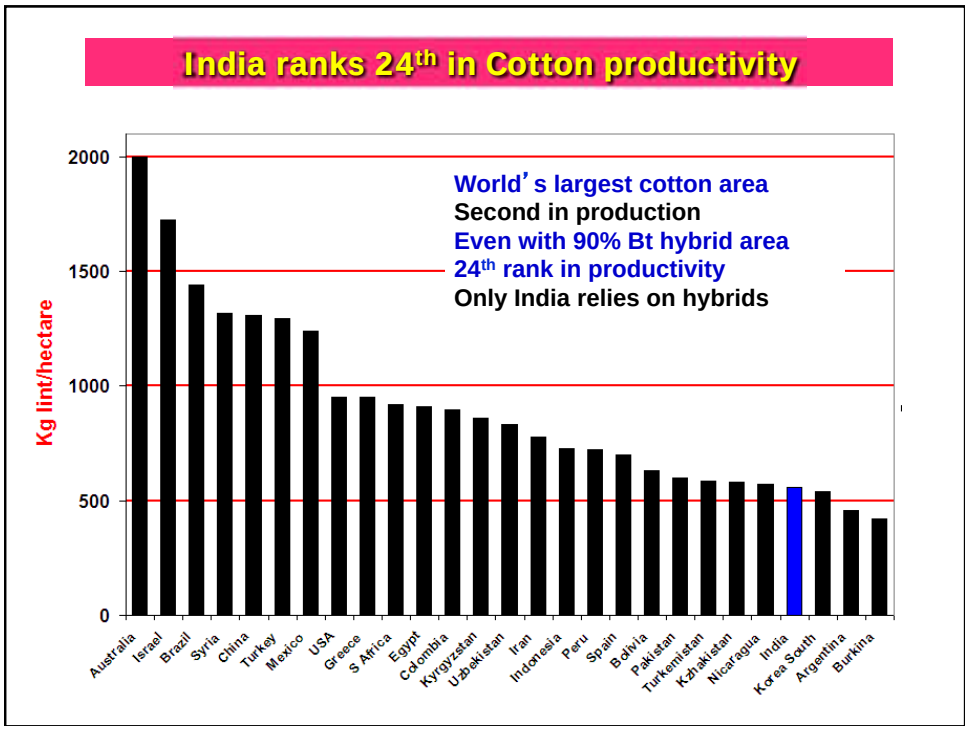

COTTON GROWING ZONES IN INDIA
12.0 M ha in 2011
Tamil Nadu
Karnataka
Others
Punjab
Haryana
Rajasthan
Andhra Pradesh
MadhyaPradesh
Gujarat
Maharashtra
NORTHERN HIRSUTUM & ARBOREUM ZONE
CENTRAL HIRSUTUM ARBOREUM HERBACEUM & HYBRID ZONE
SOUTHERN HIRSUTUM ARBOREUM HERBACEUM BARBADENSE & HYBRID ZONE
EASTERN ARBOREUM ZONE


Changes in area under the four Gossypium species in India
G. hirsutum, 8%
G herbaceum, 28%
G. arboreum, 64%
1947
G. barbadense 8.6%
G. arboreum 24.4%
G. hirsutum varieties, 24%
G. herbaceum 13%
G. hirsutum hybrids, 32%
1995
G. barbadense 2.58%
G. arboreum 14.62%
G. hirsutum varieties, 33.34%
G. herbaceum 9.46%
G. hirsutum hybrids, 40%
2000
G. hirsutum varieties, 5%
G. herbaceum 4.75%
G. hirsutum hybrids 85.5%
2010

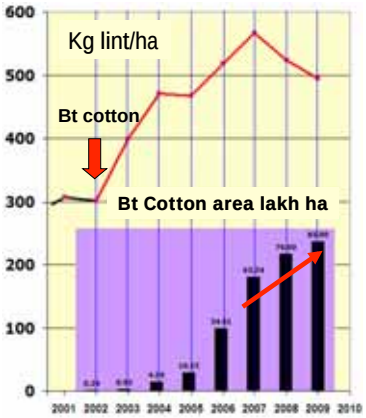

Species Distribution and % irrigation
North Zone
G. hirsutum
G. arboreum
100 %
North Zone
Pun,Har&Raj
Central Zone
Mah, MP&Guj
Intra hirsutum
G. hirsutum
G. herbaceum
G. arboreum
23%
South Zone
Kar, TN& AP
South Zone
Inter specific
Intra hirsutum
G. hirsutum
G. herbaceum
G. arboreum
G. barbandense
40%


Cotton Progress in India
600
500
400
300
200
100
0
1950
1960
1970
1980
1990
2000
2010
Area
Production
Yield
%Irrigation
Earliness
Jassid Resistance
& Quality
Fibre quality
Improvement
Hybrid
Introduction
LRA 5166, NHH 44
Pyrethroid Era
IPM & Insecticide
Resistance
Management
Intensification
Leaf Curl
Bt Cotton Era
New Insecticides


Bt-cotton area & productivity in India
Kg lint per hectare
600
500
400
300
200
100
0
Bt cotton
1340 Bt hybrids
Bt Cotton area lakh ha
0.29
0.93
4.99
10.15
34.61
63.24
76.00
83.00
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010


India ranks 24th in Cotton productivity
Kg lint/hectare
2000
1500
1000
500
0
World's largest cotton area
Second in production
Even with 90% Bt hybrid area
24th rank in productivity
Only India relies on hybrids
Australia
Israel
Brazil
Syria
China
Turkey
Mexico
USA
Greece
S Africa
Egypt
Colombia
Kyrgyzstan
Uzbekistan
Iran
Indonesia
Peru
Spain
Bolivia
Pakistan
Turkemistan
Kzhakistan
Nicaragua
India
Korea South
Argentina
Burkina

Immediate Issues.....



1340 Bt hybrids need package of practices
The 30 Seed Companies should enlist their 2 best Bt-hybrids for each of the 13 agro-ecological sub zones & sell only these in the specific sub-zones

New Emerging pests & diseases
Mealybugs, mirid bugs, thrips, *Spodoptera,* gall midges, *Perigea capensis*, CLCuV, grey mildew and tobacco leaf streak virus,

Leaf Reddening
Hybrids have low harvest index: More vegetation, More fertilizer and pesticide requirement. High soil nutrient depletion. Wilt & leaf reddening is now severe in rainfed tracts.

Jassid Resistance to Gaucho All seeds are treated & crop is also sprayed with Imidacloprid

International Pressures
India's leadership in Organic Cotton & Exports, has hit USA & others.

No refugia compliance
90% Area under Bt-cotton, high risk of bollworm resistance development

Some Priorities

1. **Resistance Management**: Intensive use of Bt Cotton has resulted in the possible threat of bollworms developing resistance to Bt Cotton and sucking pest resistance to imidacloprid.
2. **Organic cotton**: India has emerged as a world leader of organic cotton during the last 4 years. We produce 50% of the global organic cotton.
3. **Extra long staple cotton**: There is an immense demand for ELS cotton from several countries, at a premium price. The area under ELS in India has declined significantly.
4. **Desi cotton**: The area has declined from 25% to 2.5% within the last 5 years. Research needs to be intensified to exploit the abiotic and biotic resistant attributes of desi cotton
5. **Development of new GM cotton** & refinement of the strategies for GM crops: There is need for research on the parameters to be evaluated to decide upon the appropriate placement of the relevant GM technologies for specific regions

Commercial release of different Bt cotton events

Sr. No.	Event	Developer	Year of approval
1	MON 531	Mahyco / Monsanto	2002
2	MON 15985	Mahyco / Monsanto	2006
3	Event – 1	JK Agri-Genetics	2006
4	GFM Event	Nath Seeds	2006
5	Cry 1 Ac Event	CICR (ICAR) & UAS, Dharwad	2008
6	Cry 1 Ac Event 9124	Metahelix Life Sciences, Bangalore	2009

Phule Anmol : *G. arboreum* Genotype Released for Quality Fibre Introgresed from *G. anomalum*

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G. arboreum

Native of India

Drought resistant

Resistant to sucking pest

Less cost of production

Current demand of Indian Textile Industry

10% short staple cotton and 53% medium staple

Short staple cotton is in great demand particularly in fabrics like denim

It fetches price on at par with long staple cotton.

Mainly used for production of absorbent cotton in medical industry but facing a acute shortage today.

- **Cotton is one of the most important cash crop in Maharashtra and occupies 40.95 lakh ha area (2011-12).**
- ***G. arboreum* basically possess a coarse, rough and medium fibre used to be commercially rated lower than *hirsutum* cotton.**
- ***Desi* cotton is very well adapted to the fluctuating rainfall and poor growth conditions and hence suit well to scanty recourses of the poor farmer.**
- ***Desi* cotton is also resistant to many biotic and abiotic stresses. Looking to the present trend of growing cotton organically *desi* cotton can be a suitable alternative.**

G. anomalum

- **The wild species *G. anomalum* is having high fibre length, fineness, strength and maturity.**
- **This species is also resistance to jassids, mites, bollworms, rust and bacterial blight and CLCV.**
- **To introgress these characters into cultivated *G. arboreum*, efforts were made by crossing and as a result of this, the strain RAC-024 was developed.**

G. arboreum L.
A_2 genome

X

G. anomalum
Wawra ex Wawra & Peyr.
B_1 genome

- Cultivated diploid
- Drought tolerant
- Resistant to sucking pests
- Low fibre strength
- Coarse fibre

- Wild diploid
- High fibre strength, length, fineness and maturity
- Resistance to jassids, mites, bollworms, rust and BLB and CLCV

F_1

Drought tolerant, Resistant to sucking pests, Good fibre length, strength and micronnaire

Individual Plant Selection

Progeny row of individual plants to advance each generation

Uniform and promising Progenies selected
Bulk harvested for evaluation

F_3 to F_7

Preliminary yield trial

Advance trial

Phule Anmol (RAC-024)

Performance of RAC-024 in different Station/ MLT/ Co-ordinated trials.

Sr. No.	Trial	Location	RAC-024	JLA-794 (C)	Other Checks
Station trials					
1	TMC MM 1.3 trial Surat (2003-04)	1	2290	-	981 G.Cot.16 (C)
2	TMC MM 1.3 trial Nanded (2004-05)	1	2528	-	1139 PA-183(C)
3	TMC MM 1.3 trial Nanded (2005-06)	1	2015	-	1041 PHH-316 (C)
4	TMC MM 1.1 trial Rahuri (2006-07)	1	1452	1235	1165 PA-255 (C)
5	TMC MM 1.3 trial Rahuri (2006-07)	1	1058	780	667 PA-255 (C)
6	Station trial (2009-10)	1	2083	1732	-
1	Drought Screening Trial TMC MM 1.3 Nanded (2005-06)	1	1708	-	1958 PA-402 (C)
	Mean		1876	1249	1159
Multilocation trials					
1	MLT 2006-07	3	994	1314	-
2	MLT 2007-08	3	1138	1540	-
	Mean		1066	1427	-
Co-ordinated trials					
1	Mean of 16 locations (2010-11)	16	1144	914	-
	Mean		1144	914	
	Overall Mean		1305	1077	
	% increase over JLA-794			21.16	

Fibre properties

Table: Fibre quality parameters (tested at CIRCOT, Mumbai)

Sr. No.	Genotypes	2.5 % SL	UNIF %	MIC Value	STRE. g/tex	ELON %	SFC %	SL ratio
1	RAC-024 *G. arboreum*	26.1	49	4.5	22.4	5.4	12.9	0.86
2	JLA-794 (C)	25.6	49	4.9	20.0	-	-	0.78
3	Phule-688 (C) *G. hirsutum*	27.0	50	4.0	22.1	8.0	-	0.82
Fibre Norms		26-27	48-50	3.5-4.5	21-22	-	-	Above 0.80

Fibre quality parameters tested in AICCIP trial

No. of locations : 10

Sr. No.	Genotypes	Zone	2.5 % SL	MIC Value	Strength g/tex	SL ratio
1	**RAC-024**	**Central**	25.9	4.0	22.2	0.86
		North	27.4	4.6	22.1	0.81
		South	25.6	4.3	22.2	0.87
	Mean		**26.30**	**4.30**	**22.17**	**0.85**
2.	JLA-794 (C)	Jalgaon	24.78	4.93	20.46	0.82

PEST REACTION

Sr. No	Name of variety	Aphids	Jassids	Thrips	White fly
1	RAC-024	7.00	1.00	0.83	3.50
2	JLA-794 (C)	4.66	0.03	0.02	1.73
3	PA-255 (C)	3.00	0.83	0.03	2.20
SE ±		0.75	0.13	0.08	0.27
CD at 5%		2.40	0.41	0.27	0.85
Economic threshold level		10/leaf	2/leaf	10/leaf	5/leaf

DISEASE REACTION

Sr. No	Name of variety	Disease grade		
		ALB	BLB	Dahiya
1	RAC-024	0	1	0
2	JLA-794 (C)	0	2	1
3	PA-255 (C)	0	0	1

Salient features of Cotton genotype RAC-024

- **RAC-024 was adjudged as best entry in the trial in respect of fibre length and strength. This genotype recorded best fibre length (26.4 mm) and strength (22.2 g/tex) along with Micronnaire (4.4) in AICCIP trials during *Kharif* -2007.**
- **This genotype was found promising as drought tolerant for consistently two years.**
- **In different trials the entry Phule Anmol (RAC-024) recorded highest seed cotton yield (1305 kg/ha) over check JLA-794 (1077 kg/ha) which is 21.16 % higher over check.**
- **It has shown resistant reaction to BLB and disease free reaction to *dahiya* and ALB and was found resistant to sucking pests**

Recommendation:

Phule Anmol, a *desi* cotton genotype has given higher seed cotton yield, better fibre length, strength and micronnaire than the check (*desi* cotton) varieties and also comparable with fibre properties of American cotton. This genotype is recommended for cultivation in *Khandesh* region of Maharashtra.

G. arboreum cotton variety RAC-024


Thank You