

Maharashtra Hybrid Seeds Co. Ltd.



mahyco[®]
EVERY SEED COUNTS

Scientific Workshop on Biotech Safety Assessment

ILSI-INDIA, IFBiC and DBT

24th September, 2013

Cotton facts – India (Pre Bt cotton era)



- India has an estimated 4 million cotton farmers.
- Some 60 million people depend on cotton and the textile industry to make a living.
- Textiles, in fact, are India's No. 1 export, accounting for about \$8.5 billion in revenue.
- India plants more farmland with cotton than any other country
- 25 percent of the world's cotton acres are in India — yet produces just 16 percent of the world's cotton.
- Average yields, earlier were 300 kgs/ha.



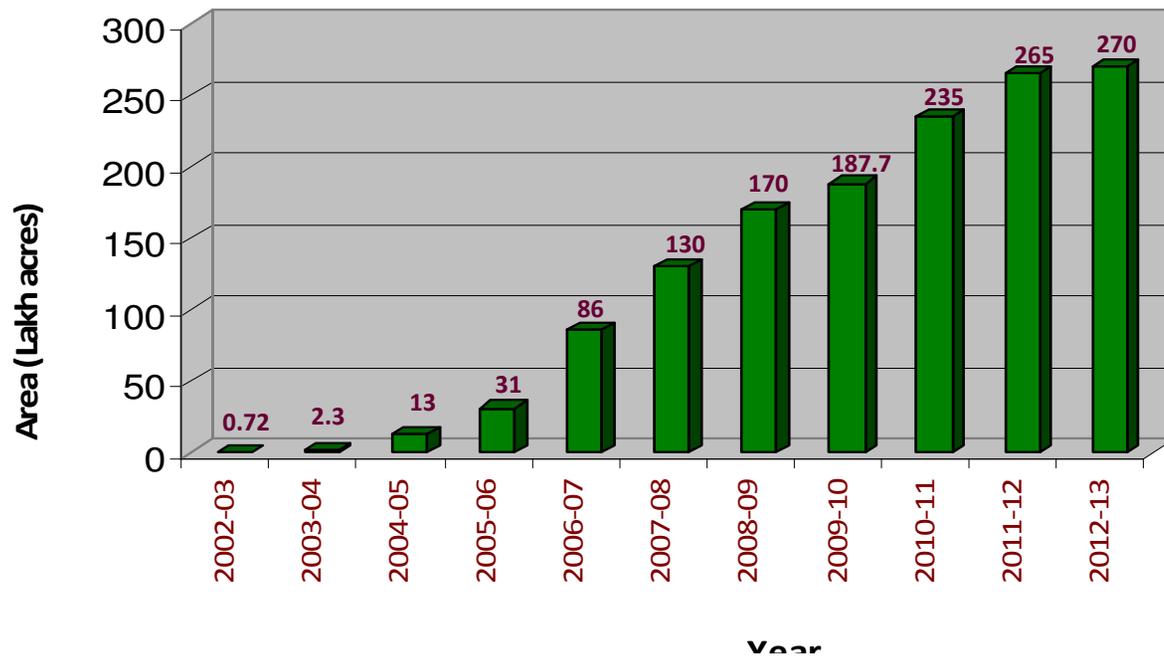
Cotton facts – India (Pre Bt cotton era)

- According to Indian Agricultural ministry, 30% of the crop yield loss is due to pests, diseases and weeds.
- 13% of cotton crop used to suffered due to attack of dreaded insect pest *Helicoverpa armigera*. (01-02)
- In terms of volume the loss was around 15.5 l bales and in terms of value it comes to approximately to Rs. 1363 crores.
- Nearly Rs. 12 billion worth of pesticides were used in India to control just the bollworm complex of cotton.



Acceptance of Bt cotton in India

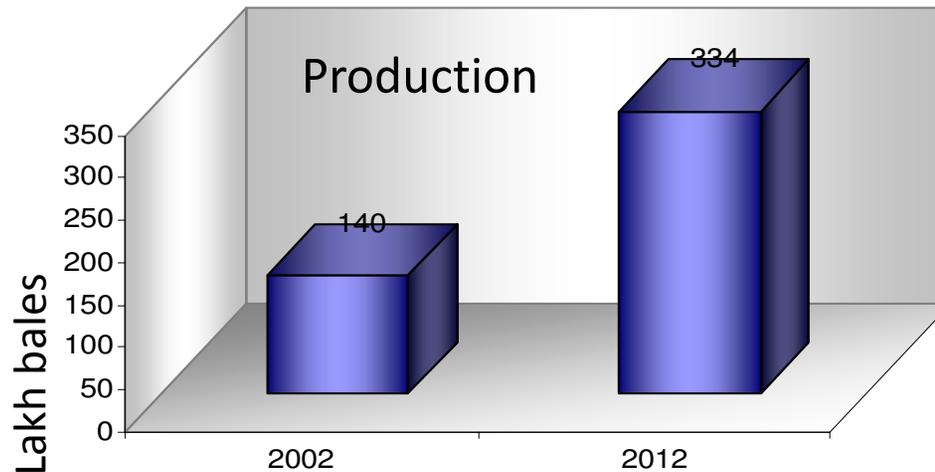
Adoption of Bt cotton in India



Maharashtra is No. 1 state in adoption of Bollgard technology planting approx 99.8 lakh acres under Bt cotton in 2012-13



India's first GM Crop: Mahyco's Bt cotton



As a result India ranks
No. 2 in the world in
cotton production
(334 lakh bales)

Productivity (kg/ha)	302	489
Bt Cotton area (m ha)	0.03	10.8
Exports Revenue (crores Rs)	NA	10270 (2009)



Maharashtra: Cotton data

Pre-Bt Era

Year	Area (lakh ha)	Production (lakh bales)	Yield (kgs/ha)
1996-97	30.85	33	182
1997-98	31.39	21.5	116
1998-99	31.99	26.5	141
1999-00	32.54	38	199
2000-01	30.77	18.25	101
2001-02	29.8	34.25	195

Post-Bt Era

Year	Area (lakh ha)	Production (lakh bales)	Yield (kgs/ha)
2002-03	28.00	26.00	158
2003-04	27.66	31.00	191
2004-05	28.40	52.00	311
2005-06	28.75	35.00	207
2006-07	31.07	50.00	274
2007-08	31.95	62.00	330
2008-09	31.42	62.00	335
2009-10	35.03	63.00	306
2010-11	39.32	82.00	355
<u>2011-12*</u>	40.95	85.00	353



Regulatory Guidelines, India



- Recombinant DNA Safety Guidelines, 1990
- Revised Guidelines for Research in Transgenic Plants, 1998
- Guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, 2008- (ICMR).
- Protocols for Food and Feed Safety Assessment of GE crops, 2008
- Guidelines for the Conduct of Confined Field Trials of Regulated, Genetically Engineered (GE) Plants 2008



Bt cotton chronology

- 1995 -96: 1. Receipt of Bt Cotton Seeds through import permit BT/BS01/004/91-Vol II dated 10.03.1995
2. Limited field trial to assess pollen escape at one location
- 1997:
1. Limited field trial to assess pollen escape at four locations
- 1998: 1. Small scale multi location replicated research trials at 15 locations (HR-2, PB-1, MS-4, GJ-1, AP-4, KT-2, TN-1)
2. Large scale Multi location trials at 25 locations (HR-1, PB-1, RJ-1, MS-6, GJ-2, MP-2, AP-7, KT-3, TN-2)
- 1999: 1. Multi centric trials of Bt cotton conducted at 11 different locations across seven different states (HR, RJ, MS, MP, GJ, AP, TN)
2. 90 day Goat feeding study at ITRC, Lucknow
- 2000: 1. 14 Multi location research trials across four different states (MS, MP, AP, KT)
2. 42 Large scale field trials across five states (MS, MP, KT, AP, TN)



Bt cotton chronology



- 2001: 1. Performance of Bt and Non- Bt Cotton Hybrids at 376 locations in Large scale field trials in Central and South India
- 2. Research Field Trials of Bt Cotton Hybrids at 14 locations in south and central zone
- 3. Molecular characterization of Mahyco Bt cotton hybrids MECH-12, 162 and 184
- 4. Confirmation of the absence of 'terminator gene' i.e. a patented embryogenesis deactivation system in Mahyco Bt Cotton hybrids done by Delhi University
- 5. Effect of feeding Bt cottonseed on feed intake, milk production and composition in lactating water buffaloes conducted by GBPUAT, Pantnagar
- 6. Effect of feeding cottonseed produced from Bt cotton on feed intake, milk production and composition in lactating cows in India done by NDRI, Karnal
- 7. Comparison of chicken performance when fed with diets containing Bt cotton, parental non-Bt line or commercial cotton done by CARI, Izatnagar



Bt cotton chronology

2001: 8. Evaluation of raw cottonseed meal derived from Bt cottonseed as a feed ingredient for Indian catfish (*Clarias batrachus*) done by CIFE, Mumbai

9. Study to generate data on the stability of Cry1Ac gene

10. Pollen flow study

11. Expression levels of Cry1Ac insect control protein found in Bt cotton hybrids during the 2000 growing season

12. An analysis of socio-economic impact of Bt Technology on Indian Cotton farmers by IIM, Ahmedabad

• In addition to above, studies like i. Aggressiveness, germination, weediness ii. Studies on soil microflora, iii. Effect on beneficial and non target insects iv. Protein expression in different plant parts were conducted during 1997-2001.



Studies conducted for Bollgard/BGII



- Digestibility in simulated gastric fluid
- Acute oral toxicity in Albino mice
- Dietary effects on parasitic Hymenoptera
- Dietary effects on honey bees
- Dietary effects on Ladybird beetles
- Green Lacewing Larvae

- Allergenicity in Guinea Pigs
- Allergenicity in BN rats
- Feeding study in SD rats

22+ studies



Farmers' trusted partner for nearly 5 decades



- Founded in 1964 by **World Food Prize 1998 winner** and Padma Bhushan 2001 awardee Dr. B.R. Barwale
- Pioneered use of hybrid seeds since 1960s
- Over 200 trusted products in the market today



First to market biotech crops, starting with cotton, resulting in more growth at less cost to farmers, using less land, water and pesticides and causing less harm to nature



Farmers' trusted partner for nearly 5 decades



Mahyco's product portfolio

Cotton

Wheat

Rice

Sorghum

Bajra

Maize

Pigeon pea

Sunflower

Castor

Soybean

Mustard

Brinjal

Chilli

Okra

Tomato

Cucurbits

Cabbage / Cauliflower



HEALTHY RETURNS