

# Bollworm-resistant GM cotton rescued Indian cotton farmers

## A steady state of tragedy

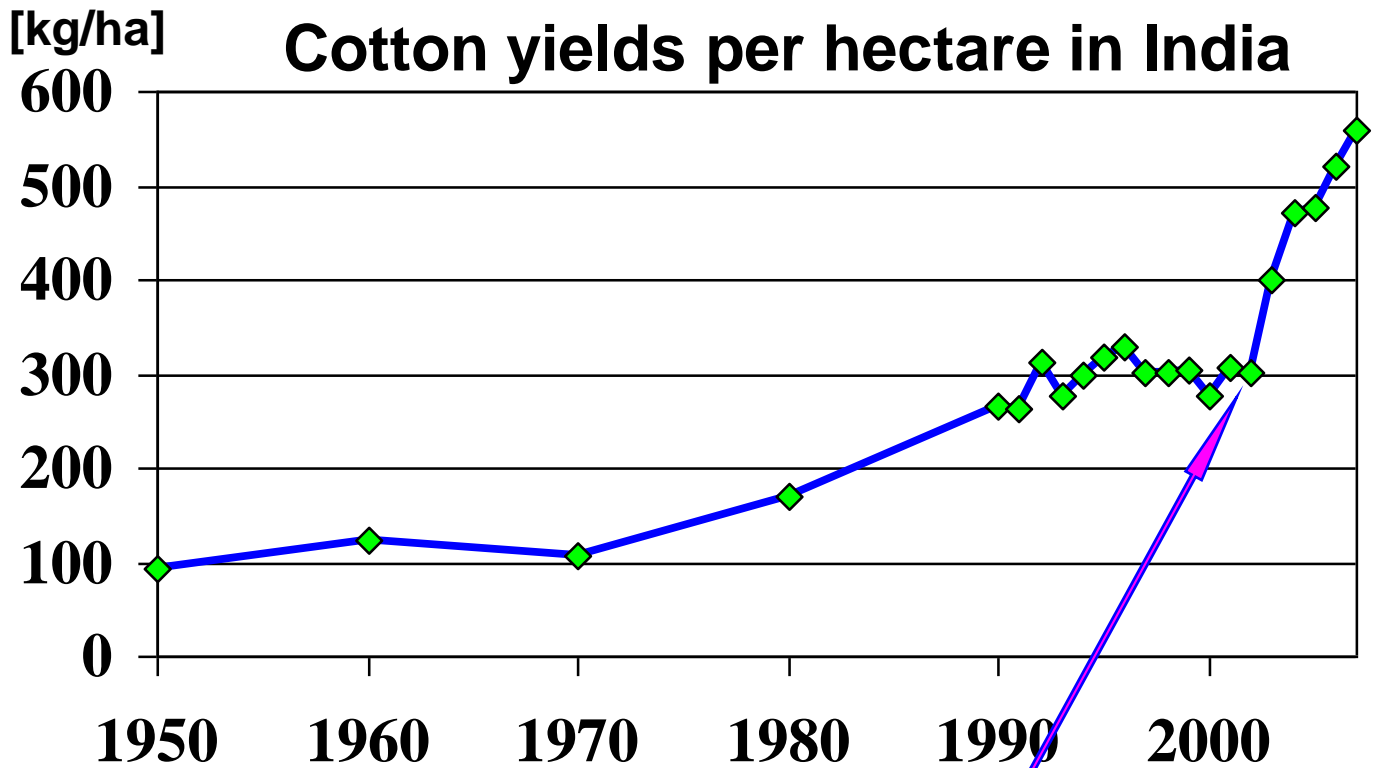
Contrary to popular myth (cf. Vandana Shiva) , the introduction in 2002 of *Bt* cotton is **not** associated with a rise in suicide rates among Indian farmers



(Nature, May 2, 2013)

- ❖ Bt-cotton cultivation has not increased but in fact slightly **reduced** farmer suicides in India (see — ) as is concluded in an independent study review ([IFPRI 2008](#))
  - ...by diminishing their risk to crop failures
  - ...and by improving their cotton yields, income and occupational safety & health ([Tammisola 2006](#))

# Bollworm-resistant GM cotton rescued Indian cotton livelihoods



- ❖ Bt-cotton cultivation in the country started in 2002
  - Varieties resistant to cotton bollworm are now being cultivated in over 90 % of Indian cotton acreage
  - Yields per hectare have risen 80 % during but 6 years ([Official Cotton Statistics](#))
- ❖ Inexpensive Bt-cotton varieties suited for non-irrigation areas have been released by public research sector in India
- ❖ Water shortages can be met with cotton modified for drought-resistance (under development)



**Are we occupying natural resources for the production of cotton or invasive bollworms?**





## Edible cottonseed – high-quality protein to feed half billion people in developing countries

- ❖ Protein deprivation damages human health among the poor in the Third World
  - ...where 'hunger' often translates to shortage of protein
  - For example, it hurts brain development in children
- ❖ Cotton is very toxic due to gossypol, a terpenoid aldehyde
  - 2,2'-bis-(Formyl-1,6,7-trihydroxy-5-isopropyl-3-methylnaphthalene)
  - ...which can only be digested by ruminant microflora, but only to a certain level
- ❖ Cottonseed is rich in protein (22 %) of very high quality
  - ... gone to waste hitherto, due to its high gossypol content
  - ...though cottonseed (44 billion kg/year) could provide new, high-protein food for 500 million people annually
- ❖ Edible cottonseed has now been bred using RNAi
  - ...a gene silencing method awarded with Nobel prize in medicine in 2006
  - ...though it has been used in plant GM since decades ago
- ❖ Production of gossypol was only silenced in the seed
  - ...so that the indigenous chemical defence against pests was successfully retained in other plant parts
- ❖ That is not possible applying "traditional" breeding methods
  - Gossypol production was silenced by traditional mutagenesis in experimental cotton lines already in 1970's
  - ...with the consequence that such defenceless plants were destroyed altogether by pests and diseases in the field
- [Sunilkumar et al \(2006\)](#). Engineering cottonseed for use in human nutrition by tissue-specific reduction of toxic gossypol. PNAS 103: 18054–18059
- Field trials: <http://agnews.tamu.edu/showstory.php?id=1399>