

Bt cotton

1. Bt cotton is a genetically modified organism (GMO) or genetically modified pest resistant plant cotton variety produced by Monsanto which produces an insecticide to bollworm.
2. Bt cotton has been genetically modified by the insertion of one or more genes from a common soil bacterium, *Bacillus thuringiensis*. These genes encode for the production of insecticidal proteins, and thus, genetically transformed plants produce one or more toxins as they grow. The genes that have been inserted into cotton produce toxins that are limited in activity almost exclusively (Lepidoptera) However, other strains of *Bacillus thuringiensis* have genes that encode for toxins with insecticidal activity on some (Coleoptera) and (Diptera).
3. When ingested by insects, the Cry toxins are dissolved and activated by the high pH environment of the animal's gastrointestinal system. In the midgut, the activated Cry molecules bind to cells comprising the brush border membrane and form ion channels allowing potassium ions to flow from the cells. As the control of potassium ion concentration is critical to the survival of every living cell, they are tightly regulated under normal function. There is subsequent efflux of potassium ions, the affected epithelial cells lyse which creates gaps in the brush border membrane, and the insect dies after ingesting a Bt crop.
4. In 1996, Bollgard cotton (a trademark of Monsanto) was the first Bt cotton to be marketed in the United States. The original Bollgard cotton produces a toxin called Cry 1Ac that has excellent activity on tobacco budworm and pink bollworm.
5. Bollgard II was introduced in 2003, representing the next generation of Bt cottons. Bollgard II contains a second gene from the Bt bacteria, which encodes the production of Cry 2Ab.
6. Bt cotton has several advantages over non-Bt cotton. The important advantages of Bt cotton are briefly :
 - a. Increases yield of cotton due to effective control of three types of bollworms, viz. American, Spotted and Pink bollworms.
 - b. Reduction in insecticide use in the cultivation of Bt cotton in which bollworms are major pests.
 - c. Potential reduction in the cost of cultivation (depending on seed cost versus insecticide costs).

- d. No health hazards due to rare use of insecticides (particularly who is engaged in spraying of insecticides).

7. Disadvantages

- a. Seeds are more expensive than local, non-genetically modified varieties. Seeds are now unaffordable to farmers due to high royalties charged by Mahyco, Monsanto Biotech (MMBL) which has a near monopoly on Bt cotton seeds and that this has led to a market failure.
- b. Seeds cannot be reused and farmers need to buy new stock for every growing season. This, along with licencing agreements with local seed companies, has given Monsanto a near monopoly on cotton seeds in India that has been the biggest worry for activists.

Mechanism of Bt

- Bt produces Bt toxins which are inactive protoxins.
- When an insect ingests it, inactive protoxin gets converted into active form due to alkaline pH of the insect's gut.
- This led to swelling of gut and ultimately death of insect

