

## A Review of Genetically Modified Crops by the Use of Bio - Technology in Maharashtra

**Prof. Mrs. Sonali Anil More – Madhale**, Assistant Professor, Department of Economics, Nowrosjee Wadia College, Maharashtra, Pune.

**Prof. Rahul P. More**, Assistant Professor, Department of Economics, Abeda Inamdar Senior College, Maharashtra, Pune.

### ABSTRACT

*Agricultural biotechnology is a collection of scientific techniques used to improve plants, animals and microorganisms. Based on an understanding of DNA, scientists have developed solutions to increase agricultural productivity. Starting from the ability to identify genes that may give advantages on certain crops and the ability to work with such characteristics very precisely, biotechnology enhances breeders' ability to make improvements in crops and livestock. Biotechnology enables improvements that are not possible with traditional crossing of related species alone. This paper tries to explain the various beneficial and the controversial effects as well as the risk involved in the genetically modified crops. It also includes some cases like BT Cotton as well as the BT Brinjal and some of the advances made in plant bio-technology.*

### Key words:

Biotechnology, Genetically Modified Crops, BT Cotton, BT Brinjal, Agricultural Biotechnology, Plant Bio-Technology, Bio-safety Etc.

### INTRODUCTION:

Over the past two decades, the advances made in modern agricultural biotechnology have opened up new frontiers in agricultural production. The new techniques for understanding and modifying the genetics of living organisms have led to large investments in agro biotechnology research and development ( R & D ).

Biotechnology is broadly defined as any technique that uses live organisms viz. bacteria, viruses, fungi, yeast, animal cells, plant cells etc. to make or modify a product, to improve plants or animals or to engineer micro-organisms for specific uses. It encompasses genetic engineering, inclusive of enzyme and protein engineering plant and animal tissue culture technology, biosensors for biological monitoring, bioprocess and fermentation technology.

Agricultural biotechnology is a collection of scientific techniques used to improve plants, animals and microorganisms. Based on an understanding of DNA, scientists have developed solutions to increase agricultural productivity. Starting from the ability to identify genes that may confer advantages on certain crops, and the ability to work with such characteristics very precisely, biotechnology enhances breeders' ability to make improvements in crops and livestock. Biotechnology enables improvements that are not possible with traditional crossing of related species alone.

### Some Examples of Genetically Modified Food: <sup>(1)</sup>

1. **Flavr Savr tomatoes**, one of its gene, responsible for ripening is modified using genetic engineering technique, so that the shelf life of tomato is increased, or in other words, process of tomato ripening is slowed by genetic modification by reducing the expression of already existing gene.
2. **Bt Corn or Bacillus thuringensis corn**, this corn is genetically modified by adding the powerful gene from the bacteria *Bacillus thuringensis*, these produce toxins which are toxic to the insect larvae which feed on the corn leaves, as a result insects are killed, hence the plant become insect resistant.
3. **Golden Rice**, in this case two genes are introduced from daffodils and the third one from the bacteria, this type of genetically modified rice contains high amount of beta - carotene or vitamin A, hence it reduces the vitamin A deficiency in rice consumers.

### Beneficial Effects of Genetically Modified Food:

1. Improves nutritional quality of food and hence improve the general health of individuals who consume these foods.
2. Improved shelf life, also increases the quality of fresh fruits and vegetables
3. Genetically modified plants have improved resistant to pesticide, herbicide and other chemical compounds. This also reduces the usage of chemicals like herbicide and pesticide, hence helps in maintain the pollution free environment.

4. Genetically modified food producing plants are produced more economically by increasing the yield.
5. This technique also reduces the wastage of food by insect and pest attack, as this technique can be used to produce insect and pest resistant plants.
6. This technique can be used to produce crops which can be used as vaccines.
7. Using these technique pharmaceutical compounds can be produced in genetically modified food.

#### Controversies Surrounding Genetically Modified Food:

1. Genetically modified food may impact human health, as they may act as potential allergens
2. Genetically modified food may act as environmental pollutant
3. Scientists and researchers play with nature by mixing genes among species, future impact of this technique is still unknown
4. This shifts power from agriculture to biotechnology; this increases the dependence on industrialized nations by developing countries.

#### Biotechnology in agriculture can help in 4 different areas: <sup>(2)</sup>

- ✓ By raising the tolerance of crops to pests such as insects, diseases and weeds ;
  - Low use of chemicals
  - Less burden on environment
- ✓ By endowing crops with tolerance to a biotic stress such as drought, salinity, high and low temperature.
  - Enable production in unfavorable condition.
- ✓ By enhancing the yield and quality with higher photosynthesis, control of maturity and nutritional value.
  - Increase food security
  - Reduce malnutrition
- ✓ By adding value and diversifying the use of crops other than food and feed such as medical and industrial purposes.
  - Raise value of crop
  - Increase farm income
  - Better the quality of life

#### Biosafety Concerns:

- ✓ **Risks for animal and human health:**
  - Toxicity & Food quality/safety
  - Allergies
  - Pathogen drug resistance (antibiotic resistance)
- ✓ **Risks for the environment**
  - Persistency of gene or transgene or of transgene products (accumulative effects )
  - Susceptibility of non target organisms
  - Increased use of chemicals in agriculture

- Unpredictable gene expression or transgene instability
- ✓ **Risks for agriculture:**
  - Resistance / Tolerance of target organisms Weeds or Super weeds.
  - Alteration of nutritional value (attractiveness of the organism to pests)
- ✓ **General concerns:**
  - Lack of familiarity
  - Higher cost of agriculture
  - Field trials not planned for risk assessment
  - Ethical issues (labelling)
- ✓ **THE CASE OF BT COTTON <sup>(3)</sup>**



The Maharashtra Hybrids Seed Company (Mahyco) jointly with the US seed company Monsanto developed the genetically modified BT Cotton to tackle the bollworm problem that had devastated cotton crops in the past, by introducing into the cotton seed a gene of the common soil microbe called *Bacillus Thuringiensis* that encoded an insecticidal protein lethal to the bollworm. In 2002, BT Cotton became the first and only transgenic crop approved by the GEAC for commercial cultivation in six States namely, Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu. It has been further extended to Punjab and Haryana. The BT Cotton seeds were marketed by the Monsanto-Mahyco joint venture. Though the public opinion has been divided on this issue, the Government has indicated satisfactory performance of the BT Cotton. It has been argued that BT Cotton cultivation has resulted in adverse economics for farmers, highly priced seeds, changed pest ecology in cotton fields, increased incidence of diseases (requiring more pesticides to control these), unpredictable crop performance and more resources being used by farmers as part of their risk insurance mechanisms. Stress tolerance of the BT Cotton, such as surviving adverse weather conditions, has been said to be very low. There have been reports of adverse impact on soils, human health as well as toxicity in animals grazing on the BT Cotton fields. There have also

been reports of large scale contamination and rapid explosion of various illegal varieties.

✓ **THE CASE OF BT BRINJAL**



In India, Brinjal is grown all over the country and is one of the most popular vegetables. It is mainly grown in small plots as a cash crop by the farmers. The main growing areas are in the States of Andhra Pradesh, Bihar, Karnataka, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. There are many local varieties in India, in addition to improved varieties and hybrids. It is estimated that the damage caused by the Fruit and Shoot Borer, which has been the major pest for the past two decades or so, ranges from 50 to 70 percent. It is to lend tolerance to this pest primarily that the BT Brinjal has been developed. BT Brinjal is a transgenic Brinjal created out of inserting a gene from the soil bacterium *Bacillus thuringiensis* into Brinjal. The insertion of the gene into the Brinjal cell is being done alongwith other genes like promoters, markers, etc. This is said to give the Brinjal plant resistance against lepidopteran insects like the Brinjal Fruit and Shoot Borer. It is reported that upon the ingestion of the BT toxin by the insect, there would be disruption of digestive processes, ultimately resulting in the death of the insect. BT Brinjal is being developed in India by the Maharashtra Hybrid Seeds Company (Mahyco). Recently, the GEAC has cleared BT Brinjal—country's first genetically modified food—for commercial use.

**Advances Made In Plant Bio-Technology:** <sup>(4)</sup>

- According to the Department of Science and Technology, plant biotechnology has made significant strides in past twenty years, encompassing developments in plant molecular biology and genetic engineering. Variety of traits has been introduced in plant species which include :
  - ✓ Herbicide resistance
  - ✓ Pest resistance
  - ✓ Viral resistance
  - ✓ Slow-ripening
  - ✓ Fungal and bacterial resistance

- ✓ Quality improvement (protein and oil)
- ✓ Value addition (Vitamins, micro-and macro-elements)

- First commercial GM food crop variety 'Flavr Savr' tomato, released in 1994, was engineered for slow-ripening character. List of GM food crop species that have been commercialized in past fifteen years is given below :

- ✓ Herbicide resistance:- Corn, Soybean, rice, corn, and Sugar beet
- ✓ Insect Pest resistance:- Corn, rice tomato and potato
- ✓ Viral resistance:- Papaya, Squash and potato
- ✓ Slow-ripening and softening -Tomato and melon
- ✓ Improved oil quality:- Canola and soybean
- ✓ Male sterility:- Canola and corn

**Problems and prospects of BT in indian economy:** <sup>(5)</sup>

The problems of BT in the context of india are as follows :

1. The main bottlenecks is poor understanding of the project.
2. Long gestation period of the projects, high cost of investment, lack of skilled and trained personnel and lack of awareness among the end users are the shortcomings.
3. Creation of common awareness among the public about the benefits of genetically modified products is necessary.
4. Funding is a problem for bio-tech industries in india.
5. Lack of adequate research and placement of bio-tech scientists is another problem.

**CONCLUSION:**

Genetically Modified crops can reduce some environmental risks associated with conventional agriculture, but will also introduce new challenges that must be addressed. Society will have to decide when and where genetic engineering is safe enough. Arguments both for and against the cultivation and use of the GM crops are varied and there is a wide consensus that assessment should take place on a case-by-case basis before genetically modified food is brought to the market. These assessments should be done by Government or an independent credible regulatory authority or private agencies and these should not be driven by any commercial interests. Moreover, educating public opinion is also very important as food is always a sensitive cultural issue. Merely indicating whether a product is genetically modified or not, without providing any additional vital information, would not serve any purpose; rather information on its content and possible risks or benefits should be provided.

**REFERENCES:**

- [1] “ Genetically Modified Food - Advantages and Disadvantages ” By Nidhi Uppangala Available on <http://www.biotecharticles.com> Accessed 25<sup>th</sup> August, 2014
- [2] An article on “ Biosafety Concerns Regarding Genetically Modified Crops ” By Mr. Mahendra K Modi
- [3] A research report on “ Genetically Modified Crops Issues And Challenges In The Context Of India ” published by Research Unit (Larrdis) Rajya Sabha Secretariat, New Delhi, in December 2009 website : <http://rajyasabha.nic.in>
- [4] Thirty Seventh Report on “Cultivation Of Genetically Modified Food Crops – Prospects And Effects” By the Committee On Agriculture in August, 2012, Published by Ministry Of Agriculture ( Department Of Agriculture And Cooperation ) India.
- [5] An article on “ Biotechnology and Indian Economy ” By Dr. Subhransubala Mohanty, Orissa Review, Janyary 2006.