

# Role of Biotechnology in Agriculture

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**Abstract** – This research generally shows how agriculture has advanced with the help of biotechnology

Biotechnology is a technology based on biology that harnesses cellular and biomolecular processes to develop technologies and products that help improve our lives and health of our planet.

Today, biotechnology covers many different areas such as genetics, biochemistry, molecular biology. New technologies and products are developed every year within the areas of medicine, agriculture, industrial sector and the development of various vaccines that can be effective in decreasing the effect of deadly viruses and also biotechnology has enabled the use of transferring genes from one living thing to another.

**Key Words:** biotechnology, agriculture, genetic engineering

## 1. Introduction

Agricultural biotechnology is generally a collection of scientific techniques that is used to improve the quality of plants, animals and microorganisms.

Scientists have developed many solutions to increase agricultural productivity like the ability to identify genes that may give various advantages on certain crops.

Biotechnology enables improvements that are not possible by traditional crossing of related species alone.

## 2. Objective

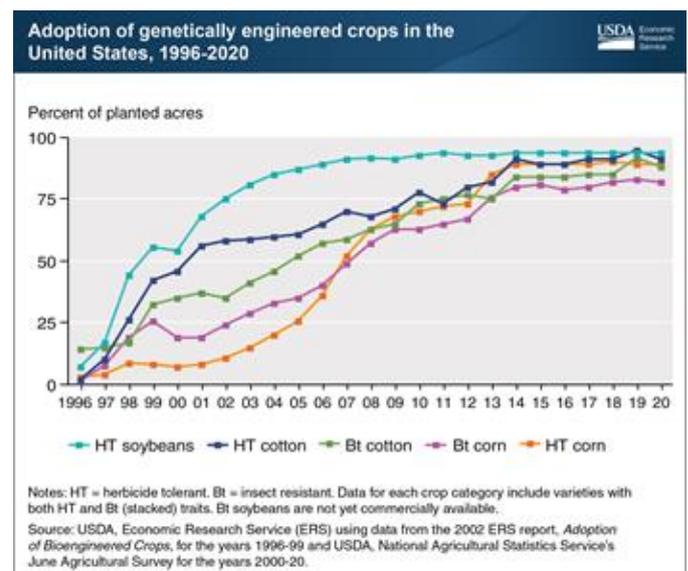
The objective of this research paper is to understand that how biotechnology has helped to develop agriculture in various aspects.

## 3. Data Charts

One of the methods of Agricultural biotechnology is Genetically Engineered (GE) crops.

Genetically engineered (GE) seeds were commercially introduced in the US for major field crops in 1996 with the adoption rates increasing rapidly. Figure 1 shows that genetically engineered soybeans, cotton and corn seeds have been widely adopted and are on high demand in USA.

Figure 1



Currently, 90% of US corn, soybeans, cotton are produced using GE varieties. Most of these GE seeds are Herbicide tolerant (HT), insect resistant (Bt) or it can be both. The soybeans acres planted with HT seeds have risen from 7% to 68% in 2001, before rising to 98% in 2014. Also, the HT cotton have expanded from 10% to 95% in the year 2014.

The adoption rate of HT corn was really slow at the start, but it picked up rapidly to 89% in 2014. There was an increase in adoption rates of Bt corn due to it being resistant to earthworms. Rates of Bt corn also increased from 8% to 82% in 2014.

This data chart generally shows genetically engineered crops have been adopted quite smoothly and it has improved quality of various crops.

#### **4. Methods**

##### Genetic Engineering –

Scientists have learned how to transfer the genes of one organism into another. This is generally called Genetic Engineering (GE). This process allows to transfer useful characteristics like resistance to disease to plants, animals by inserting genes of other organisms. Crops have improved with the help of transferred genes to aid farmers in increasing productivity by reducing crop damage.

##### Molecular Diagnostics –

These are methods to detect genes that are very precise or maybe specific. Molecular diagnostics are generally used in agriculture to diagnose crop diseases more accurately.

##### Vaccines –

Biotechnology-driven vaccines are used in humans and also in livestock. These vaccines are safe as compared to other traditional vaccines. They are stable at room temperature and provide protection against infectious diseases. In Philippines, this type of vaccines has helped to protect buffalo against deadly disease like hemorrhagic septicemia.

##### Tissue Culture -

Tissue culture is considered as the regeneration of plants in the laboratory from disease free plant parts. This process or technique allows to produce disease free plant material for crops. Crops produced using tissue culture generally include mangoes, pineapples, avocado etc.

#### **5. Social and Economical Impacts**

A safe and sufficient food supply is necessary for humanity. Since their introduction, crops that were improved using biotechnology have been handled safely with benefits such as reduction of pesticide use. Agricultural biotechnology is the only one factor that is influencing the health and welfare of farmers and other citizens of the world.

Generally, as biotechnology continues to evolve, it will become vital to define the role it should play in the society. The economical effects may include impact on

farmers and the food system, agribusiness, and consumers.

#### **6. Benefits**

##### Increase In Crop Production –

With better disease control and also increased tolerant to draught and flooding, biotechnology has led to much needed rise in crop production. This does not just match up with the growing demand for food but also helps farmers to lower their losses.

##### Better Crop Protection –

The technique of biotechnology generally serves as cost effective solution to problems about pests. Because of transfer of genes from one plant to another, farmers have been able to grow GE crops like cotton, corn, potato to synthesize a protein that can tackle pests.

##### Increase In Nutrition Value –

Biotechnology has enabled farmers to produce crops of higher nutritional value and also enhanced flavour. Technology has made it possible to cultivate soybeans into high protein content, beans with more amino acids, and potato with starch.

##### Chemical Tolerance –

Many of the farmers rely on herbicides to control the growth of weeds which generally results in soil erosion. However, genetically engineered food is resistant to variety of chemicals and also the scale of soil erosion becomes significantly low.

##### Disease Resistant –

Viral infections are always difficult to contain and the use of insecticides can have adverse effect on soil and quality of product. Genetically modified crops are less susceptible to viral infection and also make it easier for farmers to contain the crop damage.

Resistance to antibiotics, resistance to insecticides, growth of superweed, decrease in biodiversity are some the major fears that may risk the use of biotechnology in agriculture. However, everyone can hope that with the rise in technology, scientists will find a way to somehow tackle the fears and also reduce the risk related to crops

Such benefits are always necessary to ensure that the quality of the crop is good at most of the times. In the

coming future, most of the diseases can be eradicated with the help of agricultural biotechnology.

## 7. Genetically Modified Crops (GMO)

Genetically modified crops are the latest advancement by biotechnology in the agricultural field. These crops are generally a result of alteration of genetic makeup of crops. Modification of such crops have several great advantages like less loss after harvesting, crops modified to have more nutrition value, crops are modified to be highly efficient, decrease the use of insecticide and pesticide to ensure less pollution, more tolerance to natural calamities.

One of the most common example is Bt cotton. Bt stands for *Bacillus thuringiensis* which is introduced in plants to develop resistance against pests like bollworms and corn borer and also there is HT which stands for Herbicide Tolerant that are introduced to tolerate specific broad spectrum-herbicides which kills the surrounding weeds, but leave the cultivated crop intact. GMO crops have really helped in completing the process of agriculture. Advancement in agricultural biotechnology have resulted in a variety of GMO crops to be disease resistant, insect resistant etc.

## 8. GE Crops and Food Assessment for Safety

Generally agricultural biotechnology has increased the scope of genetic changes in plants that can be used as food, it does not result in food being less safe than those produced by traditional techniques. This indicates that earlier used techniques for assessing food safety are still applicable on products of agricultural biotechnology. However, these products can be judged based on individual safety, toxicity, nutrition rather than on method of production.

The safety assessment of agricultural biotech crops is generally based on the principle that it should be compared with traditional food that have a history of safe use.

Specific safety issues have been discussed by international and expert consultations to evaluate these new foods. Knowledge of the biology of plant and also its history of safe use as a food is necessary to understand the natural range and variation of nutritional components like vitamins, minerals, potential allergens.

All the plant breeding methods have the potential to change the nutritional value of the plant. Food safety assessment takes in account the potential change in nutritional components, especially key components that have serious impact on diet. Laboratory analyses are used to compare the new plants with conventional counterparts for some of the constituents like fiber, vitamins, minerals, fatty acids, amino acids etc.

Generally, assessing the environment safety of an agricultural biotech plant requires understanding of the biology of the plant itself and also the practices that are used in its cultivation. This type of knowledge is generally important to identify the potential environmental risks and in constructing appropriate risk management measures. Most countries must use environmental risk assessment approach like evaluating the role of a particular gene in a plant, the spread of newly introduced traits to related plants, potential impact on biodiversity. In china, the biodiversity of insects have enhanced the growth of Bt cotton crop

## 9. Conclusion

The main conclusion is that agricultural biotechnology has enabled the farmers to harvest genetically enhanced crops so that the crops can be with more added nutritional content and also less tolerant to insect, natural disasters etc.

Biotechnology has advanced in every field and particularly in agricultural field, it has helped a lot by using genetic engineering. Many countries have started to gain access to genetic engineering technology as it can transfer the genes of one specific plant to another to make it capable of surviving diseases.

Agriculture requires such technology to ensure that every crop is providing the required nutritional value for food safety. The development of an effective biotechnology system is important to ensure safe access to new products and to build public confidence that these GE products are safe to consume.

Private sectors should invest in biotechnology and make the products of agricultural biotechnology available so that benefits of these products can be realized. The future of agricultural biotechnology can depend on how much the government and private sectors are invested in it.

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