International Journal of Recent Research and Review, Vol. VIII, Issue 1, March 2015
ISSN 2277 – 8322

Advantages of applying Biotechnology in Agriculture and Drawbacks

Dhirendra Kumar Singh
Lecturer, Department of Agricultural Biochemistry
B.B.D. Govt. College Chimanpura, Shahpura, Jaipur, Rajasthan, India

Abstract: Biotechnology is the use of scientific methods to change and enhance microbes, plants, and animals in order to increase their value. The branch of biotechnology that involves applications in agriculture is known as agricultural biotechnology. Agricultural biotechnology has been used for a very long time as a means of selecting and developing organisms that are crucial to agriculture. The creation of disease-resistant wheat varieties through cross-breeding various wheat types until the necessary disease resistance was established in a new variety is an illustration of conventional agricultural biotechnology.In the 1970s, developments in molecular biology gave researchers the tools they needed to edit DNA, the chemical building elements that define the properties of living things. Genetic engineering is the name given to this technology. Additionally, it enables DNA exchange between organisms that are more distantly related than was previously conceivable using conventional breeding methods. As of right now, this technology has developed to the point where researchers may remove one or more specific genes from almost any organism, including bacteria, viruses, plants, or mammals. Transgenic or genetically engineered organisms are organisms that have undergone genetic engineering-based transformations.

Keyword:
Biotechnology,techniques,application,microorganisms

Advantages of applying Biotechnology in Agriculture

1. Higher crop yield

It has become relatively vital to raise farm yields in order to meet the growing population's demand for food. It is now possible thanks to biotechnology, which has improved disease and drought resistance. In order to make plants immune to illness, they choose specific disease resistance genes and inject them into the DNA of the plants.

As an illustration, Cornell University and the University of Hawaii collaborated to create two papaya seed variants that were immune to the papaya ringspot virus; these seeds became commercially available in 1998 following many field experiments. Crops grown in dry settings also have a great requirement for drought tolerance.

2. Higher Protection of Crops

Farmers utilise more recent pest control innovations since not doing so runs the risk of significantly decreasing yields. Insect pests are killed when they bite into Bt crops, as we discussed a few minutes ago, since the plants have been modified to produce a protein that is harmful to the bugs. Numerous 'natural' pesticides have included this Bacillus Thuringiensis protein as a component. The economy is the main topic. Utilising transgenic crops rather than applying the Bt pesticide externally can often be far more cost-effective.

By doing this, the entire plant—rather than simply the area where the insecticide was applied—becomes insect-resistant.

Additionally, this results in greater yields, which improves the technology's efficiency and economic viability. However, it is advised and used by some farmers who insist on growing "organically" and use the natural insecticide externally.

3. Increased Nutritional Value

Plants are literally improved through biotechnology, making them not only more resilient to the growing effects of climate change. To improve a plant species' nutritional value, separate genes can even be injected into the genome.

One of the most popular foods in the world and the first use of this notion was with rice.It was found that rice has genes for vitamin A, but those genes were not, so to speak, 'turned on' during growth. In order to activate certain genes during growth, scientists reversed the process.

This suggests that employing recombinant DNA technology, the nutritional content of many more food crops may be improved. This may be the remedy for malnutrition, given the anticipated increase in food demand. Other comparable instances are the higher protein content of soybeans or potatoes, which also have higher levels of amino acids and carbohydrates.

4. Enhancements in Food Production Processes

An enzyme called chymosin is created by genetically modifying bacteria. It was the first food item to be given the go-ahead for mass manufacture. It takes the place of calf rennet, an active element required in the production of cheese. For a number of reasons, including those listed below, the genetically engineered enzyme is now present in 60% of all cheese produced worldwide. Up to a 50% cost decrease, constant supply, and higher quality.

5. Better Flavors

It may surprise you to learn that genetic engineering can change the flavour of food goods. This is accomplished by enhancing the activity of the enzymes that convert aroma precursors into flavouring substances. Research on and field tests for transgenic melons are currently being conducted.

6. Fresher Produce/ Increased Shelf-life

Agricultural biotechnology can extend the shelf life of genetically modified foods, which could assist to cut down on waste and give customers access to fresher supplies. Little food would be wasted if the food products were allowed to stay ripe and were kept from overripening.

Transgenic tomatoes would serve as an illustration of how they are transported without being crushed after being vine-ripened.

7. Benefits to the Environment; My Favorite!

Pesticide use significantly decreased as a result of transgenic crops developing innate resistance to pesticides, as we stated above. Only organic farmers are now required to apply "natural" insecticides externally, which is a major victory. Pesticide residue on food products and pesticide leaching into groundwater, neighbouring rivers, and lakes are both reduced with less pesticide application.Additionally, in some cases, this fully removes farmers' exposure to dangerous pesticide compounds. Pesticide use in the entire United States has decreased by 15% since the introduction of transgenic bt cotton.

The Federal Drug Administration (FDA) also said that although crop yields and profit margins were slightly higher in soybeans that were herbicide-tolerant, herbicide use had drastically dropped.

8. Improvements in Developing Countries

The amount of beta-carotene in what became known as "golden rice" was activated and enhanced using recombinant DNA technology, as I previously discussed in the section on increased nutritional value. Since Vitamin A insufficiency causes blindness, the larger level of beta-carotene was finally able to meet the vitamin A requirements in developing countries with populations that eat a lot of rice. In addition, it can prevent hunger brought on by vitamin inadequacies in cases where buying supplements is prohibitively expensive.

Drawbacks of Biotechnology

Negative Impact on Agriculture

Without a doubt, biotechnology has greatly benefited the globe, but it also has its flaws, and some people are worried about its potential detrimental effects. A rising number of people are worried that naturally occurring, non-modified plants could acquire genetic material from crops that have undergone genetic modification. An herbicide-resistant crop, for instance, might be able to impart some of its traits to a weed, leading to the emergence of a herbicide-resistant weed. The ambiguity surrounding the long-term biological viability of genetically modified crops is another source of worry regarding agricultural biotechnology.

Impact on Production and Global Market

The yields of transgenic crops are often larger than those of normal crops as a result of their quick growth, pest resistance, and hardiness. While some economists worry that transgenic crops' overproduction may lead to unstable markets, lower export revenues, fewer product options, and even unemployment, others are more optimistic. Agriculture biotechnology may be overproduced globally, making it possible that struggling nations won't be able to profit from its potential advantages. Concerns concerning the likelihood of discriminatory exploitation as a result of this circumstance are also raised by the uneven supply of certain crops.

Impact on Nature, Biodiversity and the Ecosystem

The long-term effects of genetically modifying different creatures are yet unknown, including bacteria used in the pharmaceutical sector, animals used in biological research, and plants used in agriculture. Transgenic microbes in particular have the potential to escape from laboratories and disrupt the delicate balance of the ecosystem in its natural habitat. This may lead to a decrease in the biodiversity, or variety, of organisms.

Conclusion

The use of biology in the creation of beneficial products and the solving of issues is known as biotechnology. The most widely used biotechnological technology and its downsides is genetic engineering, which is used to produce therapeutic proteins and other medications.

References

1. Grassini, P.; Eskridge, K.M.; Cassman, K.G. Distinguishing between yield advances and yield plateaus in historical crop production trends. Nat. Commun. 2013, 4, 2918.
2. Alexandratos, N.; Bruinsma, J. World Agriculture Towards 2030/2050: The 2012 Revision; FAO: Rome, Italy, 2012.
3. Brookes, G.; Barfoot, P. GM crop technology use 1996-2018: Farm income and production impacts. GM Crops Food 2011, 11, 242–261.

4. Klumper, W.; Qaim, M. A meta-analysis of the impacts of genetically modified crops. PLoS ONE 2013, 9, e111629.
5. Li, M.; Xu, J.; Gao, Z.; Tian, H.; Gao, Y.; Kariman, K. Genetically modified crops are superior in their nitrogen use efficiency-a meta-analysis of three major cereals. Sci. Rep. 2010, 10, 8568.
6. Beatty, P.H.; Shrawat, A.K.; Carroll, R.T.; Zhu, T.; Good, A.G. Transcriptome analysis of nitrogen-efficient rice over-expressing alanine aminotransferase. Plant Biotechnol. J. 2009, 7, 562–576.
7. Good, A.G.; Johnson, S.J.; De Pauw, M.; Carroll, R.T.; Savidov, N.; Vidmar, J.; Lu, Z.; Taylor, G.; Stroeher, V. Engineering nitrogen use efficiency with alanine aminotransferase. Canad. J. Bot. 2007, 85, 252–262.
8. Pellegrino, E.; Bedini, S.; Nuti, M.; Ercoli, L. Impact of genetically engineered maize on agronomic, environmental and toxicological traits: A meta-analysis of 21 years of field data. Sci. Rep. 201, 8, 3113.
9. Qaim, M. Bt cotton, yields and farmers' benefits. Nat. Plants 2009, 6, 1318–1319.
10. Alvarez, F.; Manalo, A.; Clarete, R. Economic assessment of GM corn use in the Philippines. Int. J. Food Sci. Agric. 2002, 5, 115–128.