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Opinion Article

Biosafety Issues of Genetically Modified Organisms

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DESCRIPTION

Genetic engineering (GE) and genetically modified organisms (GMOs) provide powerful tools for sustainable development in agriculture, healthcare and many other industries. GMOs are those which were genetically engineered in a laboratory by incorporating a small foreign DNA fragment carrying a gene of interest into the native DNA of the organism. The foreign gene is attached with the necessary regulatory elements to help its expression in the new genetic environment. This expression pattern may be different from its original expression to the extent that GMO may overproduce, under produce, differently produce or may not produce the protein it has been known to produce. Until recombinant-DNA is engineered in a laboratory and transferred into an organism, it is within the confines of the specialized laboratory with skilled scientists and people handling the GMO who are trained to deal with the positive and negative outputs as well the unperceived consequences which may comprise of the risks involved. When it comes out of the laboratory confinement, the element of risk associated with it passes into the hands of those who may not be aware about the unique features of the GMO or who may not have complete understanding of the technologies used. Hence, GMO requires to be handled within the confinements until it is established by tests and trials that its release into the environment would not be harmful. Even post-release monitoring plays a crucial role in environmental risk assessment and management, and it is undertaken to gather information on long-term effects of the GMO on the environment, if any.

GE has been successfully used to increase the level of particular protein, enzyme or series of enzymes in microbial cells, plants and animals. Some of the achievements of GE and GMO technologies include production of life-saving drugs in microorganisms, use of genetically modified (GM) crops and animals in agriculture, use of GM plants and animals as bioreactors for production of enzymes and chemicals for industrial uses, production of biodegradable plastics, development of biosensors, superbug etc. for tackling some of the environmental problems.

GE has been used for crop improvement to enhance resistance to insect pests, diseases, abiotic stresses and to improve nutritional quality of the produce. Increased crop yields and better food quality have reduced world hunger and malnutrition

Use of GMOs is common now in healthcare industry and agriculture, often for the production of better quality products. While healthcare industry is highly regulated and the products are generally life-saving drugs, agriculture is more open and deals with crops, their protection from insect pests and diseases, improving their taste, quality and acceptability to the consumers. With the adoption of GM crops in 19 developing and 8 industrial countries, it is grown over 175 million hectares world over. Hence, biosafety concerns associated with the use of GMOs are widely discussed. The biosafety concerns in agriculture may not be necessarily associated with the characteristics of the products used, but the way it is produced. Since GM crops and animals are grown under open environment and they can interact with other organisms in the surrounding environment, GMOs in agriculture have become a more sensitive issue than they are in the healthcare industry.

Revolutionary strategies have been developed by which fruits can be used as delivery vehicles to facilitate immunization of people even in economically deprived regions of the world. GE has been successfully used to produce more effective and efficient vaccines, antibiotics, and other therapeutics. More than 500 GE drugs and vaccines are currently in clinical trials targeting more than 200 diseases, including various cancers, other deadly diseases, heart disease, multiple sclerosis, AIDS and arthritis. Using gene therapy technique, scientists are making attempts at curing genetic diseases by replacing defective copy of the gene with normal/healthy ones.

Genetically engineered microorganisms (GEMs) are used to decompose and clean up contaminated sites by bioremediation technique. Use of GEMs in hazardous waste management is very promising and the use of recombinant microorganisms for bioremediation will become one of the most important applications of GEMs. GE has also been used to develop alternative fuels. GEMs are used to decompose sludge and landfill wastes. GEMs or enzymes produced by them are used to convert biomass into feed stocks for biofuel production and manufacturing biodegradable plastics."

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