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Biotechnology: A Tool of Improvement in Agriculture

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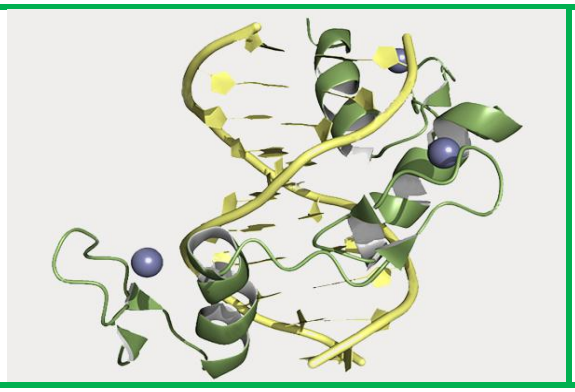
Genes are responsible for development of organisms. Thus, changes in the genes takes place due to which agricultural biotechnology are able to attain the desired plants. Agricultural biotechnology involves the use of approaches, range of tools, including traditional breeding techniques that alter living organisms, or parts of organisms, to make or modify products; improve plants or animals; or develop microorganisms for specific agricultural uses. Modern biotechnology today includes the tools of genetic engineering. Biotechnology involves the use of approaches related to science to enhance the value of different kinds of living beings.

Need of Agricultural Biotechnology?

- Higher agricultural productivity.
- Disease and pest Resistance.
- Increase in Nutrition Value.
- Enhancements in crops and livestock.
- Enhancing traditional crossing of closely related species.
- Agricultural biotechnology has been practised for years for the growth and development of the agricultural industry.
- Selection and breeding is practised for attaining desirable characteristics of plants and animals.

Applications

- Genetic engineering: Involves genetic changes and manipulation using biotechnology. Leading to increase the rate of production of crop further decreasing crop harm from unwanted plants and foreign agents.



- Molecular markers: It is used to identify desired features in plants and animals even after the absence of visible traits. Thus making the process of breeding more accurate.
- Molecular diagnostics: Gene products and specific genes which are precise and accurate are being detected. Molecular diagnostics in the field of agriculture enables to accurately identify the crop diseases.
- Vaccines: Biotechnology derived vaccines are much more better , safer, and less in price in comparison to vaccines that are available from 20th century. They can be kept at room temperature and further making it easier to store.
- Tissue culture: Regeneration of a new plant from disease free parts of plants in the wet laboratory. Thus allowing the breeding of disease free parts of plants for crop production. Examples of different crops that are produced using the method of tissue culture include mango, papaya and pineapples etc.

- Flowers: The attributes such as colour, smell, and size etc of flowers can be improved through identifying the gene and involving use of transfer techniques. Thus improving ornamental plants through the use of biotechnology. Some examples of ornamental plants involve the snake plant and silver nerve plant etc.
- Embryo rescue: It is a form of in-vitro culture technique for plants. Here an immature embryo is nurtured in a controlled environment to ensure its survival. This can help in the preservation of species of seeds that are nearing extinction. This can include heritage seeds, local grains of cultural significance, etc.
- Somatic hybridisation: It is a process through which the cellular genome is manipulated through the process of protoplast fusion.
- Higher amount of production of crops occurs, due to the ability of disease resistance and higher tolerance to drought, scientists can specifically select genes for disease resistance from any other species and transfer into the essential crops. Thus making the essential crop resistant against the particular disease.

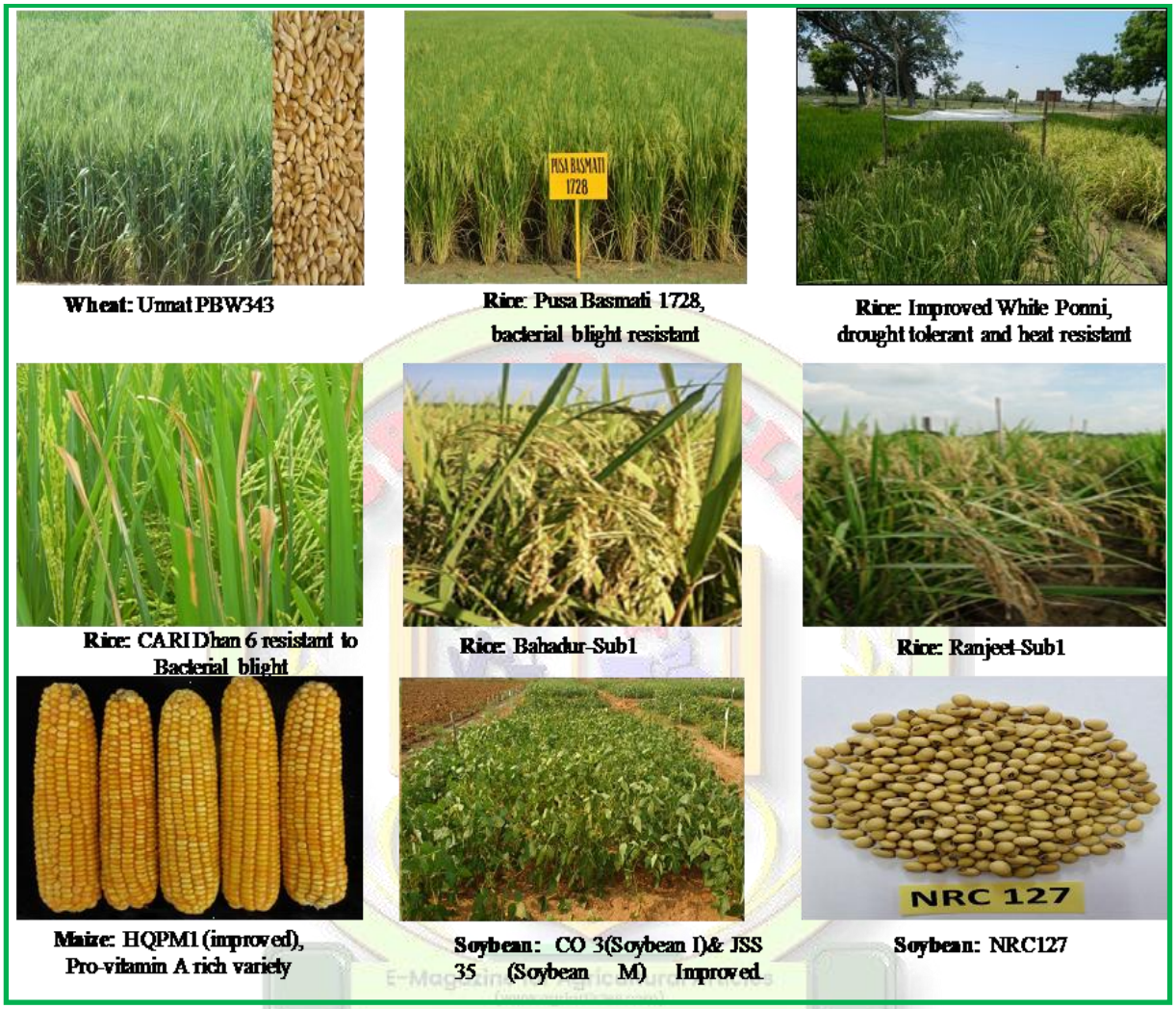
- Improved crop protection in crops such as corn, cotton, and potato etc. These crops are provided with cost friendly solutions to make a protein that kills specific insects when they feed themselves on the particular plant by the method of genetic engineering.
- Nutritional value, flavour and texture of foods are improved. Transgenic crops which are the plants that have been artificially pollinated involves examples such as soybeans which has increased content of protein , potatoes with increased starch content and beans with more important amino acids.
- Flavour can be enhanced by the activity of enzymes in plants by precursors of aroma transforming into flavoured compounds.
- Improved storage properties of crops can be observed as a result of genetic engineering. Thus providing highly nutritious foods and further averting damage, decay, and loss of nutrients.
- Lesser is the pesticide dependence due to genetic engineering , it decreases residues of pesticides in food , lesser leaching of pesticides in groundwater enabling to not cause water pollution and further reduce the exposure of farm workers to the products that are harmful. •In Developing countries health conditions can be improved.
- Enables improved tolerance of herbicides by the use of genetically engineered crops which further is responsible for controlling weeds. Thus making weed management much easier and also enabling the use of fewer amounts of chemicals in agricultural fields. This would lead to decrease in soil erosion and further adapting soil conserving practices.
- Providing resistance to the viral diseases. Often the plants are affected by viruses which are spread by insect vectors from plant to plant in agricultural field. For example. Aphids Researchers have encountered a new genetic engineering method which is responsible for providing resistance or protection against the viral disease.
- Improving the shelf life of fruits, by delaying the process of ripening. Genetically engineered fruits thus have improved and better shelf life. Making the fruits last longer for the consumers.

Disadvantages

- Issues related to health - It increases the risk of allergens and toxins in healthy foods. It will also provide antibiotic resistance which will raise new antibiotic resistant strains of bacteria. This would lead to rise of diseases making genetic engineering a medical concern.
- Issues related to ecology and environment–Certain researchers believe that transgenic crop may cross pollinate with weeds and would further lead to production of “Superweeds” which would be more difficult to control. Further adaptation of insecticide resistance would lead to formation of resistant pest populations. Also the major concern involves the loss of biodiversity.
- Certain social issues also come into role when some people believe that genetically engineered products should have special label on it. Also farmers those who are growing hybrid varieties in their field are required to buy new seeds annually as the hybrid seeds will not produce plants identical to the parent plant.

Significant Achievements in Agriculture

Recently total of seventeen (17) varieties of crop plants through marker assisted backcross breeding have been developed. In cereals fourteen varieties were released (Maize- 2, Rice- 8 and Wheat-4) with enhanced nutritional content, resistance to pathogens and tolerance to abiotic stresses. Of these 14 varieties, 6 have reached farmers field (Maize- 1, Rice- 4 and Wheat-1). In addition, one variety of soybean and two rose varieties have been released.



Wheat: Unnat PBW343

Rice: Pusa Basmati 1728, bacterial blight resistant

Rice: Improved White Ponni, drought tolerant and heat resistant

Rice: CARI Dhan 6 resistant to Bacterial blight

Rice: Bahadur-Sub1

Rice: Ranjeet-Sub1

Maize: HQPM1 (improved), Pro-vitamin A rich variety

Soybean: CO 3(Soybean I)& JSS 35 (Soybean M) Improved

Soybean: NRC127

Conclusion

Learning about the role of Biotechnology in Agriculture can help in understanding the different aspects and how new technology can change the face of agriculture. There is the need for development of impactful bio safety systems to encourage the biotechnologies ensuring safe new products; and to further build public believe that the products in the market are safe. Thus there should be development of proper framework to enhance the ability of public and private sectors in the field of biotechnology. Also encountering the issues related to biotechnology leading to the adaptation of most appropriate approach