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A Review on Some Crop Modification Techniques & Traits of Interest in Agricultural Biotechnology

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ABSTRACT- *In agriculture, biotechnology is frequently utilised to boost nutritional value, increase pest and disease resistance, and improve plant growth and yields. In fact, up to 80% of all processed foods currently on the market are thought to include biotechnologically generated components. Examples of biotechnology in agriculture are numerous, ranging from genetically modified crops to the Sterile Pest Technique (SIT) for insect control on fruit trees and grapevines. Today, biotechnology is employed in livestock agriculture to help animals develop faster on less food for better-quality meat. Cloning can even be done using it. Biotechnology can also be used to breed animals that are resistant to disease. Farmers can boost productivity and raise the calibre of animal products by utilising biotechnology technologies .Here we have done a review on some crop modification techniques in agricultural biotechnology giving focus on genes and traits of interest in this field.*
KEYWORDS- *Biotechnology, modified crops, genes and traits etc*

I. INTRODUCTION

Agricultural biotechnology, or agritech, is a branch of agricultural science that focuses on modifying living things, such as plants, animals, and microorganisms, using scientific tools and methods. These include genetic engineering, molecular markers, molecular diagnostics, vaccines, and tissue culture. One area of agricultural biotechnology that has seen significant development recently is crop biotechnology. Desired traits are transferred from one type of crop to another type of crop. These transgenic crops have favourable traits in terms of flavour, floral colour, growth rate, harvested product size, and pest and disease resistance. Without mentioning the higher quality seeds that farmers now have at their disposal, we cannot discuss examples of biotechnology in agriculture. In addition to providing high-quality seeds at harvest time, biotechnology has made it possible to improve the crops that feed our population in more effective and efficient ways. A good crop has always been based on high-quality seeds, and biotechnology has made it possible to improve seeds in a number of different ways.

II. HISTORY

Selective breeding has been used by farmers for tens of thousands of years to modify plants and animals to produce desired features. The development of agricultural biotechnology during the 20th century was facilitated by the selection of features including enhanced yield, pest resistance, drought tolerance, and herbicide resistance. In 1990, the first biotechnology-produced food item was released for sale, and by 2003, 7 million farmers were growing biotech crops. These farmers made up more than 85% of the population in developing nations.

Advantages of biotechnology for plant growth:

- Increased tolerance to stress factors, such as drought or salinity
- Faster growth rates and shorter generation times
- Costs less than traditional breeding methods
- Improving Plant Seed Quality

III. CROP MODIFICATION TECHNIQUES

Traditional breeding

For generations, traditional crossbreeding has been utilised to increase crop quality and yield. By mating two sexually compatible species, crossbreeding produces a new and unique variation with the desired characteristics of the parents. For instance, the honeycrisp apple's distinctive texture and flavour result from its parents' crossbreeding. Traditional methods involve applying pollen from one plant to the female portion of another, creating a hybrid that has the genetic makeup of both parent plants. Plant breeders choose the plants that have the features they want to pass on and keep breeding those species. Keep in mind that crossbreeding is only effective between members of the same or closely related species.

Mutagenesis

In the DNA of any creature, mutations can happen at random. Scientists can haphazardly introduce mutations into plants to produce variation in crops. Radioactivity is used in mutagenesis to cause random mutations in the hopes of discovering the desired phenotype. Radioactivity or modifying chemicals like ethyl methanesulfonate can be used by scientists to introduce random mutations into DNA. Crops are mutated in atomic gardens. A circular garden with an elevated radioactive core in the middle emits radiation into the surrounding plants, causing mutations within a specific radius. Ruby red grapefruits were created through a procedure called radiation-induced mutagenesis.

Polyploidy

In order to alter a crop's fertility or size, polyploidy can be produced to change the number of chromosomes present in the crop. In most cases, organisms are diploid, or having two sets of chromosomes. However, that number of chromosomes can alter, either spontaneously or by the use of chemicals, leading to changes in fertility or crop size. In order to produce a sterile (seedless) watermelon with three sets of chromosomes, a 4-set chromosome watermelon is crossed with a 2-set chromosome watermelon.

Protoplast fusion

The combining of cells or cell parts to transfer features between species is known as protoplast fusion. For instance, protoplast fusion is used to transmit the feature of male sterility from radishes to red cabbages. Plant breeders can create hybrid crops thanks to this male sterility.

RNA interference

A cell's RNA to protein pathway is reduced or disabled during RNA interference (RNAIi), a process that silences genes. In order to effectively silence a gene, this technique of genetic modification interferes with messenger RNA and prevents protein synthesis.

Transgenics

Transgenics is the process of introducing new genes into the DNA of the original organism by inserting a fragment of DNA into the DNA of another organism. By introducing new genes into an organism's genetic makeup, desired features are produced in a new variety. Before being put into the new organism, the DNA needs to be processed and packaged in a test tube. Gene guns and biologics allow for the introduction of new genetic information. The rainbow papaya, which carries a gene modification that confers resistance to the papaya ringspot virus, is an illustration of a transgenic plant.

Genome editing

Genome editing is the use of an enzyme system to modify the DNA directly within the cell. Genome editing is used to develop herbicide resistant canola to help farmers control weeds.

IV. IMPROVE NUTRITIONAL CONTENT

To satisfy the needs of a growing population, agricultural biotechnology has been employed to enhance the nutritional value of a number of crops. Crops made through genetic engineering can have more vitamins. Golden rice, as an illustration, possesses three genes that enable plants to create substances that are transformed into vitamin A in the human body. This rice has been nutritionally enhanced to help fight vitamin A deficiency, the main cause of blindness worldwide. Similar efforts have been made by the Banana 21 project to boost banana nutrition in order to address Uganda's vitamin deficiency. Banana 21 has contributed to the development of a remedy to micronutrient deficiencies by genetically engineering bananas to contain vitamin A and iron. Bananas are a staple meal and a major source of carbohydrates in Africa. Crops can also be genetically modified to generate kinds with allergies removed or to lower toxicity.

V. SOME GENES AND TRAITS OF INTEREST FOR CROPS

Bug resistance & Agricultural traits

Insect resistance is one quality that is greatly desired. This characteristic permits a larger production while enhancing a crop's pest resistance. Crops that have been genetically modified to produce the insecticidal proteins first identified in (Bacillus thuringiensis). A bacterium called Bacillus thuringiensis creates proteins that are safe for humans and repel insects. Numerous crops have received the isolated genes that confer this insect resistance. Bt corn and cotton are already widely available, and research is being done on Bt in connection to cowpeas, sunflower, soybeans, tomatoes, tobacco, walnuts, sugar cane, and rice.

Tolerance to herbicides

For thousands of years, weeds have been a problem for farmers since they compete with crops for soil nutrients, water, and sunlight and can be fatal. Herbicide tolerance is a remedy provided by biotechnology. Herbicide-resistant crops are prevented from thriving by eliminating weeds and their competition through the direct application of chemical herbicides to plants.

Resistance to disease

Frequently, diseases spread by insects affect crops (like aphids). Until recently, the only way to limit the spread of illness among crop plants was to entirely remove the damaged crop. Through the use of genetic engineering to create virus resistance, the discipline of agricultural biotechnology provides a remedy. Cassava, maize, and sweet potatoes are now being developed as GE disease-resistant crops.

Tolerance for temperature and Good qualities

Additionally, agricultural biotechnology can offer plants in high-temperature environments a solution. Genes that assist regulate cold and heat tolerance can be altered to increase production and reduce crop death. For instance, papaya trees have undergone genetic modification to increase their tolerance for extreme heat and cold. Other characteristics include salt tolerance, nitrogen usage efficiency, and water use efficiency. Increased nutritional content, better food processing and storage, or the removal of toxins and allergens from agricultural plants are examples of quality features.

VI. SUMMARY & CONCLUSIONS

By applying DNA technology that targets particular genes important for water uptake during these stressful times, scientists are now able to increase the capacity of seedlings to resist various situations, such as drought or flooding. Additionally, new genetic material that has been inserted into plants by biotechnologists has the potential to increase the nutritional value of many of the foods we consume every day, including fruits, vegetables, cereals, and oilseeds. The use of biotechnology in agriculture to enhance animal health and breeding is another excellent example.

An other application of biotechnology in agriculture is to enhance plant development. Farmers have been breeding plants since the dawn of agriculture to obtain more enticing features like larger fruit size, more robust plant growth, or enhanced flavour. In this instance, a farmer chooses what she considers to be the best specimens from each generation for subsequent breeding. In order to get the desired outcome using this strategy, generations of tests are needed.

However, the development of biotechnology has made it possible to grow plants sustainably swiftly and effectively. These plants are modified in a lab to have a certain feature, such as pest resistance, abiotic stress resistance, and many other things. Once the variety has been developed, it only takes a few generations for farmers to produce specimens that possess all desirable characteristics and grow significantly more effectively because they are no longer concerned with prior growth difficulties.

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