Biotechnology and Genetic Engineering: Enhancement in Food Quality and Quantity

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ABSTRACT
Biotechnology and genetic Engineering is now able to increase food quality and quantity by introducing modified recombinant genes into the crop plants.Scientists of Hawaii and Cornell University has developed two varieties of papaya which are resistant to papaya ringspot virus by taking genes from virus. Crops like cotton potato have been successfully transformed to make a protein; Cry protein to kill harmful insects. Indian agricultural research institute, New Delhi has also developed many vegetable crops that are rich in vitamin and minerals. Biotechnology and Genetic engineering has developed GM crops like ‘Golden rice' and ‘Flavr Savr' which are far better than natural varieties.

Keywords
Transformation, RDNA, Biofortification, Genetic Engineering, Agrobacterium

1 INTRODUCTION
Biotechnology in combination with genetic engineering, now, able to increase food quality and quantity by introducing modified recombinant genes into the crop plants. These genes are modified for their better expression .Scientists select these genes from other organisms and transform them into the crop plants. In plants the DNA is normally inserted either using Agrobacterium mediated recombination or biolistic methods. In Agro bacterium-mediated recombination, the plasmid is prepared that contains T-DNA, which is responsible for insertion of r-DNA into the host plants. Recombinants genes can also be transformed through electroporation method in plants and animals. Scientists of Hawaii and Cornell University has developed two varieties of papaya that are resistant to 'papaya' ringspot virus' by transferring gene from virus. Farmers can also use modern biotechnology techniques to prevent their crop plants by developing disease resistant, pest resistant and drought resistant. Certain crops like cotton, corn, potato have been successfully transformed to make a protein e.g.. Cry protein from Bacillus thuringiensis which can kill certain harmful insects .Biotechnology is, also, now able to increase nutritional value ,flavor and texture of foods. Transgenic crops in development include soybeans with higher protein content, potato with more starch and improved amino acid content. Rice with improved ß-Carotene content (Golden Rice), a precursor of vitamin A, to help prevent 'Night Blindness' in peoples who have low ß-Carotene content in their diets. Biofortification is also come from biotechnology in which breeding of crops with higher levels of vitamins, minerals, proteins and fats is done.

Maize hybrids which had twice the amount of amino acid-lysine and tryptophan, as compared to existing maize hybrids were developed in 2000. Indian Agricultural Institute IARI, New Dehli, has also developed many vegetable crops that are 'rich' in minerals and vitamins. e.g. Vitamin A enriched carrots, pumpkin and spinach. Vitamin C enriched Bathua, tomato, mustard and calcium and iron enriched spinach and Bathua etc. Artificial seeds can also be produced with the help of Biotechnology. In India artificial or synthetic seeds is being done for sandal wood and mulberry at BARC (Bhaba Atomic Research Centre, Mumbai). Post-Harvest-losses can also be reduced with the help of biotechnology by delayed fruit ripening. In 'Flavr Savr' transgenic tomato, expression of gene producing enzyme-galacturonase which promotes softening of fruits has been blocked. Non-availability of this enzyme prevents over-ripening and enhance the shelf life of fruit.

2 DISEASE RESISTANT CROPS
Plants are mainly infected with certain pathogens bacteria, virus, fungi, nematodes etc. Very important crop plants like wheat, potato are infected with fungi. Fungi causes 'Loose Smut of Wheat', 'Black Smut of Wheat' diseases in wheat and early 'Blight of Potato' and 'Late blight of Potato' diseases in potato .Due to these fungal infections their is great loss to crop plant and food production, So Biotechnology with Genetic Engineering is able to introduce those genes which can protect these plants from great destruction. Genes encoding enzymes, chitinase and gluacanase which are selected from other plants or bacteria and transform in to the crop plants. These enzymes can easily destruct the chitin formed cell wall of fungi. In viral infected plants, genes encoded for 'viral coat protien are introduced to protect and develop viral resistant plants by introducing such modified genes in to the crop plants will increase the crop productivity.

3 PEST RESISTANT CROPS
Insect pest is a serious agricultural problem leading to yield losses and decreases food production.Scientists have used genetic engineering to take the bacterial genes needed to produce Bt toxins and transfer them in to plants. If plants produce Bt toxin on their own, so they can defend themselves against harmful insects. So farmers no longer have to use chemical pesticides to control these insects. This strategy is an eco-friendly, which protect the plants from harmful insects and also keep the environment safe from harmful chemicals.

4 STRESS RESISTANT CROPS
The transcription factors DREB 1 and DREB2 are important in the ABA- independent drought tolerant pathway; that induces the expression of stress response genes. Genes for the these transcription factor increases the tolerance of transgenic Arabidopsis plants to drought, high salinity and cold. But study shows that these DREB genes also reported in important, food crops such as rice, potato, barley, maize, wheat. It means that this is a conserved, universal stress defense mechanism in plants. So DREB genes are important targets for crop improvement for drought through genetic engineering and enhancement of food production.

5 IMPROVEMENT OF SHELF LIFE
Through genetic engineering shelf life of fruits can be improve by delaying the fruit ripening. This makes the long distance transport of fruits like tomato easy. Slow ripening also improves the flavor. Most of this work for delayed fruit ripening has been

done on tomatoes. Fruit ripening in fruits normally promoted by increased respiration and increased and rapid ethylene production. Fruits gets softened by the activity of enzyme like polygalacturonase and methyl esterase. But with the application of genetic engineering the activity of these enzyme can be blocked.

6 BIOFORTIFICATION

Biofortification is a process through which nutritional value of food can be increased. This can be achieved through selective breeding and genetic engineering. Biofortification is an upcoming or rapidly expanding technology for dealing with deficiency of micronutrients in the world. WHO estimated that biofortication could help curing the 2 billion people suffering from iron-deficiency anemia. Golden rice is an example of a GM crops developed for its nutritional value.

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