

Recent Biotechnological Advances in Agriculture: Benefits and Risks

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SUMMARY

Biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Biotechnology allows for the manipulation, synthesis and eventual creation of genes. Genes are the encoded road map for an organism's development. Thus, by manipulating genes, agricultural biotechnology is able to engineer the plants they desire down to the "roots."

INTRODUCTION

Agricultural biotechnology is the use of different scientific techniques to modify plants and animals. The undesirable characteristics like susceptibility to diseases and low productivity are bred out. If there is a particular trait that the plant or animal can benefit from, it can be bred in by using a gene that contains the characteristic. Biotechnology has especially been beneficial in improving agricultural productivity and increasing the resistance of plants to diseases. Scientists do this by studying the DNA. They first identify the gene that would be beneficial to the plant or animal then work with the characteristics conferred in a precise and exact manner to achieve the desired outcome.

History:

Agricultural biotechnology has been practiced for a long time. For about 10,000 years, farmers have been improving wild plants and animals through the selection and breeding of desirable characteristics.

- In 1990 -The first food product of biotechnology (an enzyme used in cheese production and yeast used for baking) appeared on the market.
- In 1995, farmers have been growing GE crops.
- In 2003, 7 million farmers in 18 countries more than 85 percent of them resource-poor farmers in the developing world were planting biotech crops. Almost one third of the global biotech crop area was grown in developing countries.

Applications

- **Genetic engineering:** all crops improved with transferred DNA to date have been developed to aid farmers to increase productivity by reducing crop damage from weeds, diseases or insects
- **Molecular markers:** scientists can use molecular markers to select plants or animals that possess a desirable gene, even in the absence of a visible trait. Thus, breeding is more precise and efficient.
- **Molecular diagnostics:** Molecular diagnostics are methods to detect genes or gene products that are very precise and specific. Molecular diagnostics are used in agriculture to more accurately diagnose crop/livestock diseases.
- **Vaccines:** Biotechnology-derived vaccines are used in livestock and humans. They may be cheaper, better and/or safer than traditional vaccines. They are also stable at room temperature, and do not need refrigerated storage;
- **Tissue culture:** Tissue culture is the regeneration of plants in the laboratory from disease-free plant parts. This technique allows for the reproduction of disease-free planting material for crops. Examples of crops produced using tissue culture include citrus, pineapples, avocados, mangoes, bananas, coffee and papaya.
- **Flowers** there is some simply aesthetic application and an example of this is the use of gene recognition and transfer techniques to improve the color, smell, size and other features of flowers. Biotech has been used to make improvement to other common ornamental plants, in particular, shrubs and trees.

Benefits

Following are a few examples of benefits resulting from applying currently available genetic engineering techniques to agricultural biotechnology.

Increased crop productivity: Biotechnology has helped to increase crop productivity by introducing such qualities as disease resistance and increased drought tolerance to the crops. , researchers can select genes for disease resistance from other species and transfer them to important crops.

Enhanced crop protection: It is provide cost-effective solutions to pest problems crops such as corn, cotton, and potato have been successfully transformed through genetic engineering to make a protein that kills certain insects when they feed on the plants.

Improved nutritional value: it has allowed new options for improving the nutritional value, flavor, and texture of foods. Transgenic crops in development include soybeans with higher protein content, potatoes with more nutritionally available starch content and beans with more essential amino acids.

Better flavor: Flavor can be altered by enhancing the activity of plant enzymes that transform aroma precursors into flavoring compounds. Transgenic peppers and melons with improved flavor are currently in field trials.

Fresher produce: Genetic engineering can result in improved keeping properties to make transport of fresh produce easier, giving consumers access to nutritionally valuable whole foods and preventing decay, damage, and loss of nutrients

Environmental benefits: When genetic engineering results in reduced pesticide dependence, we have less pesticide residues in foods, we reduce pesticide leaching into groundwater, and we minimize farm worker exposure to hazardous products.

Benefits for developing countries: Genetic engineering technologies can help to improve health conditions in less developed countries. Growth of crops in industrial and developing countries.

Herbicide tolerance: Chemical herbicides are frequently used to control weeds. Researchers realized that if a crop plant is genetically engineered to be resistant to a broad- spectrum herbicide, weed management could be simplified and safer chemicals could be used. It is often argued that such GE varieties reduce soil erosion, because they make adoption of soil-conserving practices such as “no-till” easier.

Virus resistance: Many plants are susceptible to diseases caused by viruses, which are often spread by insects (such as aphids) from plant to plant across a field. It can be very difficult to control and crop damage can be severe. Insecticides often have little impact on the spread of the disease. Scientists have discovered new genetic engineering methods that provide resistance to viral disease.

Delayed fruit ripening: Delaying the ripening process in fruit is of interest to producers because it allows more time for shipment of fruit from the farmer’s fields to the grocer’s shelf, and increases the shelf life of the fruit for consumers. Fruit that is genetically engineered to delay ripening can be left to mature on the plant longer, will have longer shelf-life in shipping, and may last longer for consumers.

Risks

There are potential long-term impacts. Some consumer-advocate and environmental groups have demanded the abandonment of genetic engineering research and development. which include some issues and fears Issues and fears.

- Health-related issues
- Environmental and ecological issues
- Social issues

Health-Related Issues:

Allergens and Toxins

People with food allergies usually react only to one or a few allergens in one or two specific foods. A major safety concern raised with regard to genetic engineering technology is the risk of introducing allergens and toxins into otherwise safe foods.

Antibiotic Resistance: Antibiotic resistance genes are technique ensures that a gene transfer during the course of genetic modification was successful. Use of these markers has raised concerns that new antibiotic resistant strains of bacteria will emerge. The rise of diseases that are resistant to treatment with common antibiotics is a serious medical concern of some opponents of genetic engineering technology.

Environmental and Ecological Issues:

Potential gene escape and super weeds: There is a belief among some opponents of genetic engineering technology that transgenic crops might cross pollinate with related weeds, possibly resulting in “superweeds” that become more difficult to control.

Insecticide resistance: another concern Involves the question of whether insect pests could develop resistance to crop-protection features of transgenic crops. There is fear that large-scale adoption of Bt crops will result in rapid build-up of resistance in pest populations. Insects possess a remarkable capacity to adapt to selective pressures, but to date, despite widespread planting of Bt crops, no Bt tolerance in targeted insect pests has been detected.

Loss of biodiversity: Many environmentalists, including farmers, are very concerned about the loss of biodiversity in our natural environment. Increased adoption of conventionally bred crops raised similar concerns in the past century, which led to extensive efforts to collect and store seeds of as many varieties as possible of all major crops.

Social Issues

Labeling: Some consumer groups argue that foods derived from genetically engineered crops should carry a special label. In the USA, these foods currently must be labeled only if they are nutritionally different from a conventional food

Terminator technology: Most farmers in the USA and elsewhere buy fresh seeds each season, particularly of such crops as corn, green peppers, and tomatoes. Anyone growing hybrid varieties must buy new seeds annually, because seeds from last year’s hybrids grown on the farm will not produce plants identical to the parent.

CONCLUSION

The development of an effective national biosafety system is important to encourage the growth of domestic biotechnologies; to ensure safe access to new products and technologies developed elsewhere; and to build public confidence that products in the marketplace are safe. The absence of a suitable framework affects the ability of the public and private sectors to invest in biotechnology and to make the products of biotechnology available so that the benefits they afford can be realized.

REFERENCES

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