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RESEARCH ARTICLE

EFFECTS OF GENETICALLY MODIFIED PLANTS PRODUCTS ON THE HUMAN AND ENVIRONMENT

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ABSTRACT

Humans have always transformed the genomes of both plants and animals, which is basic knowledge. Originally, this intrusive processwhich has persisted for millions of years despite numerous errors and setbacks, was accomplished by crossing species that possessed advantageous traits. The purpose of this endeavor was to generate and nurture novel plants that would give advantages to humankind, such as improved food quality, increased productivity, immunity to diseases, and so on. However, the process of developing genetically modified organisms is achallenging task.

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INTRODUCTION

Genetically modified foods are created and promoted because there is a perceived benefit to the food's producer or consumer.Biotechnology has developed many procedures that specialize in genetic recombination; the attempt to move genes from one organism to another or to change the genes present in a specific organism results in the expression of new attributes that were not present in the original state. The above procedures that allow gene alterations of a food or an organism result in Genetically Modified (GM) food or Genetically Modified Organisms (GMO). The concept of gene altering has initiated many debates, with one side criticizing the unknown effects and risks on both public health and the environment, and the other supporting the genetic modification's benefits on the economy and hunger elimination.The tomato is the first genetically engineered crop and whole food approved by the FDA. The protein quality of foods and feeds has been elevated by genetic engineering, and there is less risk of allergies from GM foods than in common foods (such as Brazil nut and peanut) already in the market or in plants produced by classical breeding methods which introduce dynamic allergens into the product.Plants like potatoes and tobacco have been genetically modified to have an antifreeze gene derived from cold-water fish.There is compelling evidence that plants that have undergone genetic modification seem to interact with their surroundings.

It is a common belief in scientific circles that research needs to be continued to assess the risks and benefits of crops more accurately and adequately. There are other risks to human health. It's possible for GMO plants to give humans antibiotic resistance or to produce new allergies mistakenly.

Genetically Modified Organisms (GMOs): Organisms (plants, animals, or microbes) that have had their genetic material (DNA) altered in a way that does not happen normally through mating and/or natural recombination are known as genetically modified organisms (GMOs). The technology is sometimes referred to as "genetic engineering," "recombinant DNA technology," or "modern biotechnology." It permits the transfer of specific genes, even between unrelated species, from one organism to another. GM foods are commonly defined as foods made from or utilizing genetically modified organisms (1). The United States Food and Drug Administration (FDA) approved the first genetically engineered animal for human consumption on November 19, 2015 [2]. Genetically modified foods are created and promoted because there is a perceived benefit to the food's producer or consumer. This should result in a product that is more affordable, more beneficial (in terms of longevity or nutritional content), or both. The creators of genetically modified seeds initially sought approval from farmers and focused on creating breakthroughs that directly help farmers. Enhancing crop protection is one of the goals of creating plants derived from

genetically modified organisms. With enhanced tolerance to herbicides or resistance to plant diseases brought on by insects or viruses, the main goal of the GM crops now on the market is to increase crop protection.

Positive Effects of Genetically Modified Foods

Evolution in fruit and vegetable shelf-life: Bio-preservation systems in foods are of increasing interest for industry and consumers. GM has led to high shelf-life and organoleptic quality in some crops. The tomato is the first genetically engineered crop and whole food approved by the FDA (3). it was produced by Calgene Corporation. It was bio-engineered to ripen on the vine, and have the longest shelf-life by having delayed ripening, softening and rotting processes. Delayed maturity of fruits and vegetables (via ethylene control technology and suppression of cell Wall destructive enzyme, polygalacturonase) leads to excellent flavor, color, texture, longer shelf-life and better shipping and handling features (4). At present, sweet-tasting, firmer, seedless peppers and tomatoes have been grown.

Figure 1. Three views of papaya, cultivar "Sunset", which was genetically modified to create the cultivar 'SunUp', which is resistant tothe Papaya ringspot virus

Improved nutritional quality and health benefits: Nutrients and health opportunities are among the customized and added value features of genetically modified crops. The production of milk by cows is accelerated by bovine growth hormones. Recombinant porcine somatotropin (rPST), a growth hormone, is another hormone that can be given to pigs to increase their output of meat and decrease their fat content, resulting in low-fat pork. It is also possible to bioengineer soybeans to produce a massively tasty and nutritious crop (5).

Increase protein quality by GM foods: The protein quality of foods and feeds has been elevated by genetic engineering, and there is less risk of allergies from GM foods than in common foods (such as Brazil nut and peanut) already in the market or in plants produced by classical breeding methods which introduce dynamic allergens into the product. Prosperous protein quality may involve an increase in the necessary amino acid content of the crop, for example, a rise in the methionine and lysine content of the protein [6]. Additionally, it can entail improvements to the functional attributes, such as organoleptic features, which would increase the application of plant protein in various food systems. For example, efforts are underway to withdraw the beany flavor in soybeans through the withdrawal of lipoxygenases. Fish, which is a good source of dietary protein, could be grown cheaply through genetic engineering, and these could be conditioned to grow richer in a short period, thus becoming a viable option for aquaculture.

Figure 2. Golden rice is genetically modified for an increased nutrient level, which has a different color and protein content

Genetic modified potato for modification of carbohydrates (starch) in storage organs: The initiation of starch biosynthesis in storage organs inevitably requires the mobilization of sucrose into glucose-6-phosphate (G6P), import of G6P into the amyloplast through inorganic phosphate (Pi) exchange, and subsequent conversion of G6P into glucose-1-phosphate (G1P) by plastidial phosphoglucomutase. The first committed step to starch synthesis is the formation of ADP-glucose (ADP-Glc) through ATP activation of G1P, catalyzed by ADPG pyrophosphorylase (AGPase). AGPase has a heterotetrameric structure with two small subunits and two large subunits.Potato starch, composed of 80% amylopectin and 20% amylose, is synthesized in tuber amyloplasts (12). Amylopectin is used in various industries for the manufacture of paper and adhesives among others. However, it is necessary to remove the amylose from the starch with a chemical pre-treatment which increases costs and can cause environmental damage (12,13,14). Amylose is a trait with monogenic control, synthesized by the granule-bound starch synthase (GBSS). Knocked-out gene expression prevents the synthesis of amylose, producing a normal starch from the morphological point of view, but with altered chemical characteristics. This allows the direct industrial use of the amylose-free raw material.

Reduction of pestresistance: Crop losses due to insect pests can be enormous, causing famine in developing nations and terrible financial losses for farmers. The annual use of many tonnes of chemical pesticides is common among farmers. Due to possible health risks and the possibility of agricultural waste from the overuse of pesticides and fertilizers poisoning water supplies and damaging the environment, consumers do not want to consume food that has been treated with pesticides. A crop's cost of marketing can be decreased and chemical pesticides can be avoided by cultivating genetically modified foods like B.t. corn.

Cold tolerance: Sensitive seedlings may be destroyed by unexpected frost. Plants like potatoes and tobacco have been genetically modified to have an antifreeze gene derived from cold-water fish. These plants have an antifreeze gene, which allows them to withstand low temperatures that would ordinarily be fatal to unaltered seedlings.

Negative Effects of Genetically Modified Foods

Environmental Hazards: There is compelling evidence that plants that have undergone genetic modification seem to interact with their surroundings. This implies that genes inserted into genetically

engineered plants could spread to other plants or possibly to other creatures living in the same environment (7). Pollen is the means through which genes are transferred between plants, particularly those that are related. This process leads to genetic contamination.Because natural wild plant varieties are likely to have a competitive disadvantage against genetically modified crops, they may not be able to survive, resulting in the reduction or disappearance of wild varieties. Changing biodiversity worldwide will result in increased resistance of several species of weeds, others to dominate and others to decline or disappear, thus creating a complete and general deregulation in ecosystems (8). It is a common belief in scientific circles that research needs to be continued to assess the risks and benefits of crops more accurately and adequately.

Allergic reactions: There may be allergenic effects - especially in people who are predisposed to allergies - or other adverse effects on human health. Experimental studies in animals have shown weight gain, changes in the pancreas and kidneys, toxic effects to the immune system, and changes in blood biochemistry among other effects. Moreover, the lack of large-scale long-term epidemiological studies that lead to safe conclusions about the allergenic effects of genetically modified plants makes researchers skeptical about the use of genetically modified products. This is because the introduction of a gene that expresses a non-allergenic protein does not mean that it will produce a product without allergenic action. Also, allergies from genetically modified products may be more intense and dangerous, as the allergenic potential of these foods is stronger than that of conventional plants (9).Allergies can be brought on by eating genetically modified foods, but only if the genetic alteration causes the creation of an allergen. For example, there is a remote possibility that a person with a nut allergy could experience an adverse reaction to products created with soybeans if scientists merge a gene from a Brazil nut with a soybean (10).

Human health: There are other risks to human health. It's possible for GMO plants to give humans antibiotic resistance or to produce new allergies mistakenly. Genes that provide antibiotic resistance are put into genetically modified organisms (GMOs) as "markers" as part of the method, but when taken by humans, these genes may transmit resistance to these antibiotics. However, it was already known that the gene inserted into the potatoes was poisonous to mammals. The gene was never meant for human or animal consumption—researchers just selected it to test the methodology. Pharmaceuticals made from plants and fed to animals are ingested by people when pollen spreads, sometimes with undetermined effects (11).

CONCLUSIONS

Genetic engineering has recently assumed a key role in the world with the application of genetic modification techniques like genetically modified crops. It would result in the development of new crop varieties with specialized features that satisfy end-user needs together with increased yields and lower input requirements. It is important to recognize the power of genetic modification of long-term consequences of genetics. The effects of changed foods on people will make for fascinating study topics.Despite certain limitations, genetically modified crops have both potential benefits and active ingredients. We concluded from the analysis of this review article that we can embrace genetically modified foods due to their positive effects.

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