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GENETICALLY MODIFIED FOODS AND OUR PERCEPTION: A REVIEW

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Abstract:- Genetically Modified Foods (or GM foods) are those foods which are produced from organisms that have undergone specific changes introduced into their DNA using the methods of genetic engineering. These techniques have allowed for the introduction of new traits and greater control over a food's genetic structure than previously afforded by conventional methods such as selective breeding and mutation breeding. Commercial sale of genetically modified crops began in 1994, when Calgenefirst marketed its FlavrSavrvariety of tomato which had delayed ripening. Today, most genetic modification of foods are primarily focused on cash cropswhich are in high demand by farmers such as soybean, corn, canola, and cotton seed oil. These have been engineered for resistance to pathogens and herbicides and have better nutrient profiles. GM livestock have also been experimentally developed. There is broad scientific consensus that food on the market derived from GM crops poses no greater risk to human health than conventional food. However, opponents of GM have always objectedto transgenic foods on several grounds, including safety issues, environmental concerns, and economic concerns raised by the fact that GM seeds (and potentially animals) that are food sources are subject to intellectual property rights (IPR) owned by corporations.

Key Words: Genetically Modified Food (GMF), FlavrSavr, Transgenic Foods

Introduction

The use of food biotechnology dates back to thousands of years ago to the time of the Sumerians and Babylonians. These groups of people used yeast to make fermented beverages such as beer. The use of plant enzymes such as malts was also used millennia ago, before there was even an understanding of enzymes. Further advancement in food biotechnology occurred with the invention of the microscope by Anton van Leeuwenhoek, which allowed humans to discover microorganisms that would be used in food production. Food biotechnology was advanced in 1871 when Louis Pasteur discovered that heating juices to a certain temperature would kill off bad bacteria, affecting wine and fermentation. This process was applied to milk processing, heating milk to a certain temperature to improve food hygiene.

Food science and food biotechnology progressed to include the discovery of enzymes and their role in fermentation and digestion of foods. This discovery enabled further technological development of enzymes. Typical industrial enzymes used plant and animal extracts, but they were later substituted by microbial enzymes. An example is the use of chymosin in the production of cheese. Cheese had typically been made using the enzyme rennet extracted from cows' stomach lining. Scientists began using a recombinant chymosinto effect milk clotting, resulting in cheese curds. Food enzyme production using microbial enzymes was the first application of Genetically Modified Organisms (GMO) in food production. Food biotechnology has grown to include cloning of plants and animals, as well as further development in genetically modified foods in recent years.

Scientists discovered in 1946 that DNA can transfer between organisms. The first genetically modified plant was produced in 1983, using an antibiotic-resistant tobacco plant. In 1994, the transgenic FlavrSavrtomato was approved by the FDA for marketing in the US. The modification allowed the tomato to delay ripening after picking. In the early 1990s, recombinant chymosin was approved for use in several countries, hence replacing rennet in cheese making [1].

Method of Production

Genetically engineered plants are generated in a laboratory by altering their genetic makeup and are tested in the laboratory for desired qualities. This is usually done by adding one or more genes to a plant's genome using genetic engineering techniques. Most genetically modified plants can be modified in a directed way by gene addition (cloning) or gene subtraction (genes are removed or inactivated)[2]. Plants are now engineered for insect resistance, fungal resistance, viral resistance, herbicide resistance, changed nutritional content, improved taste, and improved storage.

Once the plants with desired traits are produced, sufficient seeds are gathered, and the companies producing the seed need to apply for field trials. If these field trials are successful, the company must seek regulatory approval for the crop to be marketed. Once that approval is obtained, the seeds are mass-produced, and sold to farmers. The farmers produce genetically modified crops, which also contain the inserted gene and its protein product. The farmers then sell their crops as commodities into the food supply market, in countries where such sales are permitted[3].

Genetically Modified Foods

In some cases, the plant product is directly consumed as food, but in most cases, crops that have been genetically modified are sold as commodities, which are further processed into food ingredients.

Papaya has been genetically modified to resist the ringspot virus. 'SunUp' is a transgenic red-fleshed Sunset cultivar that is homozygous for the coat protein gene of PRSV. 'Rainbow' is a yellow-fleshed F1 hybrid developed by crossing 'SunUp' and nontransgenic yellow-fleshed 'Kapoho'. The New York Times stated that "in the early 1990s, Hawaii's papaya industry was facing disaster because of the deadly papaya ringspot virus. Its single-handed savior was a breed engineered to be resistant to the virus. Without it, the state's papaya industry would have collapsed. Today, 80% of Hawaiian papaya is genetically engineered, and there is still no conventional or organic method to control ringspot virus[4].

The New Leaf potato, brought to market by Monsanto in the late 1990s, was developed for the fast food market, but was withdrawn from the market in 2001 after fast food retailers did not pick it up and food processors ran into export problems.

In October 2011, BASF requested the European Union Food Safety Authority's approval for cultivation and marketing of its Fortuna potato as a feed and food. The potato was made resistant to late blight by adding two resistance genes, blb1 and blb2, originating from the Mexican wild potato Solanumbulbocastanum. However, in February 2013, BASF withdrew its application.

In February 2015 Arctic Apples were approved by the USDA becoming the first genetically modified apple approved for sale in the United States.Gene Silencing is used to turn down the expression of polyphenol oxidase (PPO), thus preventing the fruit from browning.

Regulations

Governments of different countries have taken different approaches to assess and manage the risks associated with the use of genetic engineering technology and the development and release of genetically modified organisms (GMO) which includes genetically modified crops and genetically modified animals. There are differences in the regulation of GMOs between countries, with some of the most marked differences occurring between the USA and Europe. Regulation varies in a given country depending on the intended use of the products of the genetic engineering. For example, a crop not intended for food use is generally not reviewed by authorities responsible for food safety[5].

One of the key issues concerning regulators is whether GM products should be labeled.

Labeling can be mandatory up to a threshold GM content level (which varies a lot among countries). A study investigating voluntary labeling in South Africa found that 31% of products labeled as GMO-free had GM content above 1.0%. In Canada and the USA labeling of GM food is voluntary while in Europe all food (including processed food) or feed which contains greater than 0.9% of approved GMOs must be labeled[6][7].

Detection

Testing on GMOs in food and feed is routinely done using molecular techniques like DNA microarrays or quantitative PCR. These tests can be based on screening genetic elements (like p35S, tNos, pat, or bar) or event-specific markers for the official GMOs (like Mon810, Bt11, or GT73). The array-based method combines multiplex PCR and array technology to screen samples for different potential GMOs, combining different approaches (screening elements, plant-specific markers, and event-specific markers).

The qPCR is used to detect specific GMO events by usage of specific primers for screening elements or event-specific markers. Controls are necessary to avoid false positive or false negative results. For example, a test for CaMV is used to avoid a false positive in the event of a virus contaminated sample[8].

Conclusion

The major problem with the usage of GM crops is the perception of people. The disagreement includes whether GM foods can be safely consumed, to what extent it harms the environment and/or are adequately tested and regulated or not before its commercial release. The other major concern and question which is asked while using GM crops is what impact it will cast on the local/native crops. But slowly and steadily our perception towards Genetically Modified Organisms (GMO) which includes both Genetically Modified Crops and Genetically Modified Animals is changing and larger section of society is accepting them. This may be attributed to the fact that more and more research is conducted and reported widely which shows no harmful effects in consuming them. Also larger section of society is getting health conscious and thus eats healthy food.

Population is increasing day by day with an alarming rate and at the same time food production is decreasing because of reduction in agricultural land mostly occupied for construction of residential place etc. as well as reduction in the number of farmers engaged in agriculture because of low return in profits. Also because of large number of susceptible crops towards various kinds of diseases the yields per area of land is decreasing.

Hence it is just a matter of time when we fully accept GM crops as it will have the capability to grow in the harshest environment as well as will be resistant to most of the crop diseases, thus solving world food crisis.

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