GM Foods : A Risk to Human Environment

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Abstract

Genetically modified (GM) foods have been a controversial topic in recent years due to the potential risks they pose to the human environment. These foods are created by altering the genetic makeup of plants and animals in order to enhance their growth and yield. While this technology has been hailed as a solution to global food shortage, there are concerns about long-term effects on the environment and human health. The use of genetically modified seeds can lead to the decline of natural biodiversity and the introduction of new genes into the ecosystem, potentially causing harm to other organisms. As the demand for GM foods continues to grow, it is crucial that we carefully consider the potential risks and take necessary precautions to protect our environment and ourselves.

Keywords: *Genetic engineering, Biodiversity, Ecosystem, Transgenic foods, Resistant seeds*

I. Introduction

An important question that concerns humanity is whether genetic engineering and genetically modified crops can offer a solution to hunger in the developing countries like India? Every year the government boasts of surplus food grain which is either exported or allowed to rot outside the government granaries due to the callous attitude of government officials. Ironically a large percentage of

population (approximately 400 million) is forced to go to bed hungry. Can they not be fed with the surplus food that the country produces?

The food distribution system in India is a complex network that involves various stakeholders such as farmers, food processors, distributors and retailers. India is the second largest producer of food in the world, yet there are still challenges in ensuring that food reaches all parts of the country. The government plays a crucial role in regulating and monitoring the distribution of food through schemes like the Public Distribution System and the National Food Security Act. With continuous efforts and advancements in technology, the food distribution system is gradually improving, ensuring that food reaches every corner of the country.

Those who advocate GM foods to ensure food security in a large country like India, only wish to divert attention and financial resources to irrelevant research. A hungry person who cannot afford normal food grains for his sustenance will not be able to do so even with the introduction of GM foods. People suffer from weak and malnourished bodies because food is not accessible to them. GM technology cannot address the problem of hunger and malnutrition which is a socio-economic problem. In fact GM will only accentuate corporate control over our poor and marginal farmers.

Genetically modified (GM) food has become a highly controversial topic in recent years, with both national and international players involved in its production and distribution. In the United States, major companies like Monsanto, DowDuPont, and Bayer dominate the GM food industry, controlling a large portion of the market. These companies have faced criticism for their use of genetically modified organisms (GMOs) and the potential health and environmental risks associated with them. On an international level, countries like China, India, and Brazil have also become major players in the production of GM crops, with China being the largest

producer of GM cotton in the world. However, the use of GM food is not without its detractors, with many European countries banning or heavily regulating its production and import. The debate over the safety and ethics of GM food continues to be a contentious issue on both national and international levels.

II. What is GM technology?

The term GM foods or GMOs (genetically-modified organisms) is most commonly used to refer to crop plants created for human or animal consumption using the latest molecular biology techniques. These plants have been modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content. The enhancement of desired traits has traditionally been undertaken through breeding, but conventional plant breeding methods can be very time consuming and are often not very accurate. Genetic engineering on the other hand, can create plants with the exact desired trait very rapidly and with great accuracy. For example, plant geneticists can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically-modified plant will gain drought tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used. The best known example of this is the use of B.T. genes in corn and other crops. B.T., or *Bacillus thuringiensis*, is a naturally occurring bacterium that produces crystal proteins that are lethal to insect larvae. B.T. crystal protein genes have been transferred into corn, enabling the corn to produce its own pesticides against insects such as the European corn borer.

Why GM?

The scientists and corporate who patent this technology stand to gain immensely by introducing this worldwide especially in the third world countries. They have made tall claims with regard to this method of agriculture which will revolutionize the entire system of growing crops. The world population is already more than 6 billion and is likely to double itself in the next 50 years with most of it living in the third world countries facing population explosion. Ensuring an adequate food supply for this booming population is going to be a major challenge in the years to come. According to these scientists GM foods promise to meet this need in a number of ways:

- **Disease resistance** - There are many viruses, fungi and bacteria that cause plant diseases. Plant biologists are working to create plants with genetically-engineered resistance to these diseases.
- **Pest resistance** - Crop losses from insect pests can be overwhelming, resulting in devastating financial loss for farmers and starvation in developing countries. Farmers typically use many tons of chemical pesticides annually. These pesticides are potential health hazards when they are consumed along with food crops. The run-off of agricultural wastes from excessive use of pesticides and fertilizers can poison the water bodies and cause eutrification. Scientists claim that growing GM foods such as B.T. corn can help eliminate the application of chemical pesticides and reduce the cost of bringing a crop to market.
- **Herbicide tolerance** - Farmers often spray large quantities of different herbicides (weed-killer) to destroy weeds which is a time-consuming and expensive process, that requires care so that the herbicide doesn't harm the crop plant or the environment. Biotechnology is known to develop crop plants

genetically-engineered which are resistant to very powerful weeds. This can help prevent environmental damage by reducing the amount of herbicides needed.

- **Cold resistant**- Unexpected frost can destroy sensitive seedlings. An antifreeze gene from cold water fish has been introduced into plants such as tobacco and potato. With this antifreeze gene, these plants are able to tolerate cold temperatures that normally would kill normal seedlings.
- **Drought resistant/salinity resistant** - To meet the ever growing demand for food crops, many marginal and waste lands are being brought under cultivation. Since most of these lands are too dry or too saline, biotechnology has helped to develop seeds which are tolerant to drought and saline conditions. This will help farmers to grow crops in formerly inhospitable places.
- **Nutrition**- Malnutrition is common in third world countries where impoverished peoples rely on a single crop such as rice for the main staple of their diet. However, rice does not contain adequate amounts of all necessary nutrients to prevent malnutrition. If rice could be genetically engineered to contain additional vitamins and minerals, nutrient deficiencies could be alleviated. Researchers are also working to develop edible vaccines in tomatoes and potatoes. These vaccines will be much easier to ship, store and administer than traditional vaccines especially in third world countries.
- **Phytoremediation** - GM plants, such as poplar trees, are also genetically engineered to clean up heavy metal pollution from contaminated soil.

However, many environmentalists and ecologists have started to question the very logic behind these claims. Currently, there are a variety of genetically modified foods being produced in the United States and abroad. In the United States, the FDA and USDA have approved over 40 GM plants for commercial production. Going by the results of these plants, it has become imperative to evaluate their use and abuse. Plants range from tomatoes and cantaloupes with longer shelf life, to soybeans and sugar beets with herbicide resistance, to corn and cotton with pest resistance.

One of the main concerns is the impact GM crops have on the environment. However, there have been both positive and negative effects observed. On the positive side, GM crops have reduced the use of harmful pesticides and herbicides, leading to cleaner soil and water. For example, Bt corn, which is genetically modified to produce its own insecticide, has drastically reduced the need for chemical insecticides. Additionally, GM crops have the potential to increase crop yields, which can reduce the need for deforestation and conserve natural habitats. On the other hand, there have been concerns about the potential for GM crops to cross-pollinate with non-GM plants, leading to the spread of modified genes and disrupting natural ecosystems. Overall, the impact of GM crops on the environment is complex and ongoing research is needed to fully understand their effects.

The performance of genetically modified (GM) crops in various ecological and economic settings has been a topic of debate and study. On one hand, proponents argue that GM crops have the potential to increase yields, reduce pesticide use, and address food insecurity in developing countries. In contrast, critics raise concerns about potential negative impacts on the environment and human health, as well as the economic dominance of large biotech corporations. For instance, the introduction of herbicide-resistant GM crops in Argentina has led to the creation of "superweeds" and

increased dependency on costly herbicides. Overall, the performance of GM crops in different settings is complex and requires careful consideration of both ecological and economic factors.

This brings us to the basis of this technology. Transgenic engineering, by definition, is implanting the gene of an organism into the genome of an unrelated species – for example, the gene of a pig into a tomato, the gene of a snake into an orchid. Since every organism has its own natural defense mechanism, the implantation of a foreign gene requires a carrier which can pierce through the target organism's defense barrier. Commonly, viruses, or combinations of viruses or of infectious bacteria are the vehicles for this kind of gene implantation. This technology therefore is powerful enough to break the very fabric of various ecological systems. It is also observed that the foreign gene implanted in a species does not remain confined to it. It is capable of polluting other organisms in its vicinity by secondary, tertiary and quaternary transfers. It can tear apart the genome of every species of the plant and animal kingdom. Shailender Ghosh, in the *Mainstream Weekly*, has argued that it is more lethal than nuclear holocaust ("Genetic Holocaust:The Silent Killer", published in 2006). He has termed this as Genetic Holocaust which will have irretrievable effects lasting till eternity.

This technology will undo what three billion years of evolution has done on earth. Humans will be redesigning living organisms and restructuring nature which is not only unwise but highly dangerous for our very existence. It would breed new animal and plant diseases, new sources of cancer and epidemics. The proponents of this technology have also convinced a large section of population to believe that it can eradicate poverty and hunger in countries like India. During a PIL hearing on GMOs, one honorable judge out of a three-member Supreme Court Bench headed by the Chief Justice, expressed: "GM foods, capable of dramatically increasing productivity, could be the answer to hunger and poverty in

India...GM seeds could possibly be a means to eradicate hunger and poverty. Poverty is probably more than dangerous than the side-effects of GM seeds." (*The Times of India,* 2009).

In the present scenario it is imperative to make inquiries about the experiences of people in other third world countries where this technology was introduced under the aegis of "poverty alleviation through GM crops". GM soya was introduced on a wide scale in Argentina. Today the whole country is paying the price for this disaster. The agro toxins that have contaminated their soils is now forcing them to import many food items. Similarly GM cotton in South Africa, GM maize and sweet potato in Kenya and Uganda all showed lower yields, proliferation of super weeds, increased use of pesticides, soil toxicity and emergence of newer diseases of both mankind and cattle. Back home B.T. cotton which was introduced in several parts of Madhya Pradesh and Gujarat led to farmer suicides due to higher costs and lower yields. Many farmers lost their cattle due to an unknown disease caused by consuming fodder procured from GM plants.

The three-year farm-scale evaluation of three spring-sown GM crops—oilseed rape, beet and maize—in the UK by the Royal Society conclusively showed their damaging effects on biodiversity, which is the very basis of sustainability of agriculture. In the USA itself, studies showed that in most field trials, the GM crops called "Round-up ready" soya bean showed lower yields than the conventional varieties. Still, the clout of GMO producing companies—Monsanto, Novartis, Du Pont etc.— is so strong that they are being allowed to experiment with many GM crops with impunity.

However, it is worth noting that Mexico has imposed a ban on not only the cultivation of GM corn but also on its research. The anti-GM sentiment in the countries of European Union is so strong that

Monsanto, the leading GMO producer, had to discontinue its transgenic wheat and barley seed-making and seed-selling business in Europe as far back in 2003. It had also to withdraw from its kind of research in plant pharmaceuticals.

As a result of widespread and mounting consumer rejection of GM crops in the countries of European Union, the US agribusiness is now seeking to profit more from Africa, Asia and Latin America—all in the name of "poverty alleviation" and "fighting hunger". If they can monopolize the seed market and the market for its concomitant agrochemicals, these will be the richest business corporates in the world.

Not only is the technology non-effective but a potential environmental hazard. It can cause unintended harm to other organisms. B.T. toxins are known to kill many species of insect larvae indiscriminately which may lead to ecological disasters. Some scientists also fear that just as some populations of mosquitoes developed resistance to DDT, many pests will become resistant to B.T. or other genetically modified crops for which new range of pesticides would be required. Besides, there is always a risk of pollen transfer from GM to non-GM crops in nearby fields. To solve this problem Monsanto has created GM plants that are male sterile (do not produce pollen).

III. Impact on Human Health

Another fear is pertaining to GM foods is regarding their impact on human health both short term and long term. According to medical practitioners these foods have not been adequately tested on human beings. Their long term carcinogenic properties cannot be negated. It is likely to open a Pandora of totally new kind of diseases for which doctors will need to find new treatments. They also fear that bacteria in the human digestive tract will pick up the antibiotic-resistant genes

found in GM foods. These genes are placed in GM products as markers so that scientists can quickly determine which plant has incorporated the foreign genes. If bacteria pick up antibiotic-resistant genes, the already growing problem of bacteria adapting to our antibiotics will be magnified.

Genetic modifications might produce proteins in plants that can cause allergies in people. Because genes, and therefore proteins, can be introduced from completely unrelated species, some people fear that the possibility of allergies will be greater than with traditionally bred crops. This is only the case if the introduced protein has allergenic properties, and if the protein exists in the part of the plant that people eat. To demonstrate, peanut allergies are quite common. If peanut genes were spliced into tomato plants, and a peanut protein were produced in the fruit of the plant, then people with peanut allergies would be unable to eat those tomatoes with the peanut protein. If the tomatoes are not labeled as having peanut protein, then some allergic people might eat them unknowingly and get sick.

IV. Economic Repercussions

Some critics think that in the genetically modified future, all farmers, especially small ones, will be reliant on the producers of GM seeds in order to stay competitive. In order to create incentives for GM research, the big seed companies will have patent rights over the seeds they create. If seed companies and large farmers maintain a monopoly over seed supplies, then prices may become too high for poorer farmers, particularly in the developing world. The situation may come to parallel the pharmaceutical industry, which is criticized for being profit driven and for keeping life-saving drugs out of the hands of the poor who need them .

To make matters worse Monsanto has introduced a terminator gene which would render GM seeds sterile after one generation. This

would imply an added expenditure for the poor and marginal farmers in the third world countries. The farmer would have to buy seeds from the supplier each season. They would not be able to preserve seeds for the next crop. The same is true for seedless varieties of fruits such as grapes and dates. In this way all the indigenous varieties of food crops would be lost forever. This will be a major threat to our biodiversity. A country like India boasts of thousands of varieties of each food crop with unique taste and flavor. All this will be lost to the monotony of GM crops which will slowly destroy and pollute the indigenous seeds. This will be an irreversible damage that will slowly make our agricultural economy totally dependent on the big business houses who will patent the seeds. The biggest sufferer would be our poor food producers who will be rendered poorer. They will find it tougher to sustain themselves in case of crop failures.

The future of our economic independence is at stake. Many scholars feel this to be another form of imperialism. The days of military annexation are over and are replaced by economic annexation. In the garb of Globalization, the American companies are controlling markets in all the third world countries. Each day we are being bombarded by aggressive marketing strategies which are changing our lifestyles, food preferences, consumption patterns, entertainment and so on. The biggest psychological impact has been on the youth who gets lured by the sophistication of the west. It is time for us to say no to such onslaughts and be more cautious about adopting new technologies and systems. It is also time to wake up and stop looking towards the west for innovations. We need our own development model which works for us and is more sustainable. The solutions may be found in giving boost to green technology in the agricultural sectors. We also need to create more awareness amongst the people and especially our youth so that they make the right consumer choice.

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