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GM Foods

Are they friendly to the environment and health?

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FOREWORD

There has been significant development of Science and Technology during recent years for using biotechnology tools for the production of foods, feeds and drugs. These include the cultivation of genetically modified (GM) crops, use of genetically modified organisms (GMO), specially recombinant bacteria and development of transgenic animal models, specially using dairy cattle as bioreactors for producing pharmaceuticals to alter the composition of cow's milk to resemble human milk.

The genesis of DNA modification technology can be traced back to 1944, when scientists discovered that genetic material can be transferred between different species. Watson and Crick discovered the double helix structure of DNA in 1954, and the “central dogma” – DNA transcribed to messenger RNA, translated into protein – was established. Nobel Laureate Marshall Nirenberg and others had deciphered the genetic code. In 1973, Cohen and his team developed DNA recombination technology, showing that genetically engineered DNA molecules can be transferred among different species. The history in fact begins with Charles Darwin's notions of species variation and selection.

GM foods make the news nearly every day, and issues surrounding their safety are a source of ongoing bioethics debates in the food and biotechnology industry. The introduction of bacterial genes into cash crops, to enhance their growth, nutritional value or resistance to pests, is becoming rather commonplace in plant technology. The public views of scientists and their understanding about the health risks and benefits of GM foods are mixed and, often, skeptical. The introduction of bacterial genes for natural pesticides into plants eliminate the need for chemical pesticide use. Consumers are concerned over the consequences of ingesting these natural pesticides. Despite efforts to control gene expression, there are many unanswered questions and issues that arise and stand in the way of full acceptance of GM foods by the public. Fear of the unknown is one cause of consumers' reluctance to use GM foods.

With the global population rising quickly towards an expected 9bn in 2050, food demand is rising fast. Despite the controversy surrounding genetically modified crops, they can be an important tool for developing disease-resistant crops that can eliminate the use of pesticides and reduce crop losses.

The present issue details the stand of the Indian government towards GM foods. It discusses issues to be considered when debating the benefits versus safety and risks involved with GM foods. It discusses the relationship of the GM Foods to their potential for positive and negative effects on the environment and human health. It also explains some issues where consumers are skeptical of GM foods.

Genetically modified foods: altering the genetic design of life

Genetic modification is a special set of the gene technology that alters the genetic machinery of living organisms as animals, plants or microorganisms. It is also called biotechnology, gene splicing, recombinant DNA (rDNA) technology, or genetic engineering.

The contemporary genetic modification was developed in the 1970s and essentially transfers genetic material from one organism to another. It is an old agricultural practice carried on by farmers for centuries. The modification of organisms has existed in the form of plant-breeding techniques (such as cross-fertilization) used to produce the desired traits. Now it has been improved by technology with genetic modification. The isolated genes are inserted into plants for the desired trait with a much quicker result than occurs when crossbreeding plants, which can take years. These isolated genes do not have to come from similar species in order to be functional; theoretically, genes can be transferred among all microorganisms, plants and animals.

It opens a totally new dimension for bio prospecting. The search for new genes and their application now enable humans to integrate revolutionary new properties into cultivated plants through inter specific and inter-generic gene transfer, which has not been possible through the traditional approach of crop improvement.

It helps to overcome insurmountable physiological barriers and to exchange genetic materials among all living organisms. The technology - recombinant DNA (rDNA) technology has the potential to allow the creation of an organism which is desired and

http://themodernape.com/wp-content

designed by the human. Techniques of genetic engineering, like new RNAi (RNA interference) - and nuclease-based technologies allow for direct modification of the genome to create new GMOs. These are faster and more economical. The potential benefits are foods that are tastier, more nutritious and resistant to diseases and droughts.

The majority of GM crops available on the global market have been genetically manipulated to express one of the basic traits: resistance to insects or viruses, tolerance to certain herbicides and nutritionally enhanced quality. As per 2016 data released by the International Service for the Acquisition of Agri-biotech Applications (ISAAA), 185.1 million hectares of biotech crops were planted by approximately 18 million farmers in 26 countries. From the initial planting of 1.7 million hectares in 1996 when the first biotech crop was commercialized, the 185.1 million hectares planted in 2016 indicate the approximately 110-fold increase. Thus, biotech crops are considered as the fastest adopted crop technology in the history of modern agriculture. USA is the top producer of biotech crops globally, which planted 72.9 million hectares in 2016, covering 39% of the global biotech

crop plantings. Brazil is on the second spot, with 49.1 million hectares or 27% of the global output. Brazil also had the highest biotech crop growth from 2015 to 2016 with a 4.9% increase. India landed fifth with 10.8 million hectares. The most planted biotech crops are soybean, maize, cotton and canola. Sugar beet, squash, papaya, eggplant and potato are also planted in different countries.

http://www.whale.to/b/300707GMfoods_dees.jpg

As scientific capabilities expand it is essential to discuss the ethics and ideals surrounding GMOs because there are many social and ethical dilemmas associated with GMO's in the food supply.

An article published by Dr. Theresa Phillips in ***Nature Education*** describes "the ethical issues surrounding GMOs include debate over our right to "play God," as well as the introduction of foreign material into foods that are abstained from for religious reasons. Some people believe that tampering with nature is intrinsically wrong, and others maintain that inserting plant genes in animals, or vice versa, is immoral. When it comes to genetically modified foods, those who feel strongly that the development of GMOs is against nature or religion, have called for clear labeling rules, so they can make informed selections when choosing which items to purchase. Respect for consumer choice and assumed risk is as important as having safeguards to prevent mixing of genetically modified products with non-genetically modified foods. In order to determine the requirements for such safeguards, there must be a definitive assessment of what constitutes a GMO and universal agreement on how products should be labeled."

Many researchers have also discussed the issues regarding the ethics and morality of GMO food. The most common concerns are the safety of its consumption, interference of the natural evolution of organisms, disruption of natural biodiversity and the potential impact on ecosystems.

These issues are increasingly important to consider as the number of GMOs continues to increase due to improved laboratory techniques and tools for sequencing whole genomes, better processes for cloning and transferring genes and improved understanding of gene expression systems. Thus, legislative practices that regulate this research have to keep pace. Prior to permitting commercial use of GMOs, governments should perform risk assessments to determine the possible consequences of their use. GMOs, as well as processed foods and ingredients that are produced from GM plants or GMOs, should be labeled to ensure health and safety aspect. Risk assessment both in relation to the environment and human health is required. The purpose of risk assessment, according to the US EPA, is to "evaluate the degree and probability of harm to human health and the environment from such stressors such as pollution or habitat loss"

Source:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3558185/,

http://www.isaaa.org/resources/publications/pocketk/16/,

https://www.nature.com/scitable/topicpage/genetically-modified-organisms-gmos-transgenic-crops-and-732,

http://onlinelibrary.wiley.com/doi/10.1111/1750-3841.13191/full#jfds13191-sec-0050,

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GM Food and Indian Policy

http://www.lifegate.com

India's policy on GM crops has undergone various changes. India set up a regulatory body to screen GM products and started to work in agriculture biotechnology as early as the 1980s. India's Sixth Five Year Plan (1980-85) was the first policy document to cover biotechnology development in the country. The National Biotechnology Board (NBTB) established in 1982 to identify priority areas and develop a long term perspective for biotechnology. A separate Department of Biotechnology (DBT) was finally set up in February 1986 under the Ministry of Science and Technology. There are several other departments also deal with biotechnology research. The different research institutions have also been set up for biotechnology research.

In 1995 the first application for commercialization of a GM crop was accepted and the first GM crop Bt cotton was introduced in 2002. No other GM crop was approved. In 2015 government has released the Draft National Biotechnology Development Strategy -2015-2020. It aims to establish India as a world-class bio-manufacturing hub. It intends to launch a major mission, backed with significant investments, for the creation of new biotech products, creates a strong infrastructure for R&D and commercialization, and empowers India's human resources scientifically and technologically.

Two apex bodies are responsible for implementation of the rules. These are Department of Biotechnology (DBT), Ministry of Science and Technology and the Ministry of Environment, Forests and Climate Change (MoEF & CC), Government of India.

The GM crops are regulated by the Environment Protection Act, 1986. The regulatory framework for GMO crops consists of the following rules and guidelines.

Rules and policies:

- Rules, 1989 under Environment Protection Act (1986)
- Seed Policy 2002

Guidelines

- Recombinant DNA guidelines, 1990
- Guidelines for research on transgenic crops, 1998

Rules 1989 of Environment Protection Act, 1986

The implementation of Biosafety procedures, rules and guidelines under Environment (Protection) Act 1986 and Rules 1989 ensure safety from the use of Genetically Modified Organisms (GMOs) and products thereof in research and application to the users as well as to the environment. This rule is elaborated and revised by the 1990, 1994 and 1998 Guidelines issued by the Department of

Biotechnology (DBT). The Rules, 1989 are very broad in scope and essentially capture all activities, products and processes related to or derived from biotechnology, including foods derived from biotechnology, thereby making Genetic Engineering Approval Committee (GEAC) as the competent authority to approve or disapprove the release of GM foods in the marketplace.

An elaborate regulatory structure involving various departments has been set up to deal with approval for commercialization and use of GM crops.

There are competent authorities as per the rules.

- The **Genetic Engineering Approval Committee** (GEAC) under MoEF & CC is responsible for granting approvals for commercial release of GM products. It is a regulator for transgenic products.
- The **Review Committee on Genetic Manipulation** (RCGM) under DBT authorises controlled field experiments.
- The **Monitoring and Environmental Committee** (MEC) monitors environmental impact.
- The **Recombinant DNA Advisory Committee** (RDAC) looks into Biosafety regulations
- The **Institutional Biosafety Committees** (IBSCs) are into research.
- The **State Biosafety Coordination Committees** (SBCC) and **District Level Committees** (DLC) are also set up.

Recombinant DNA Guidelines (rDNA), 1990

The Biosafety guidelines are designed and applied to research involving recombinant DNA (rDNA) techniques. Production, handling, storing and transportation of genetically modified organism (GMOs) involve different Biosafety issues under different category. The guidelines prescribe specific actions that include establishing safety procedures for rDNA research, production and release to the environment and setting up containment conditions for certain experiments. These guidelines further revised in 1994 to cover R&D activities on GMOs, transgenic crops, large-scale production and

deliberate release of GMOs, plants, animals and products into the environment, shipment and importation of GMOs for laboratory research.

Guidelines for Research in Transgenic Plants, 1998

The revised Guidelines for Research in Transgenic Plants & Guidelines for Toxicity and Allergenicity Evaluation of Transgenic Seeds, Plants and Plant Parts, 1998 is meant for the researchers in the country who are involved in rDNA research on plants. Earlier the Department of Biotechnology in January 1990 issued a compendium of guidelines under the title “Recombinant DNA Safety Guidelines”. The title was amended as “Revised Guidelines for Safety in Biotechnology” in 1994. The current guidelines developed in the light of the enormous progress in rDNA research and its widespread use in developing improved microbial strains, cell lines and transgenic plants for commercial exploitation.

National Seed Policy, 2002

This policy has a dedicated section (No. 6) on transgenic plant varieties. This technology can be used not only to develop new crops/varieties, which are tolerant to disease, pests and abiotic stresses but also to improve productivity and nutritional quality of food. All genetically engineered crops/varieties will be tested for environment and bio-safety before their commercial release, as per the regulations and guidelines of the Environment Protection Act (EPA), 1986. Seeds of transgenic plant varieties for research purposes will be imported only through the National Bureau of Plant Genetic Resources (NBPGR) as per the EPA, 1986. After the commercial release of a

transgenic plant variety, its performance in the field will be monitored for at least 3 to 5 years by the Ministry of Agriculture and State Departments of Agriculture.

Food Safety and Standards Authority of India (FSSAI) Guidelines on Product Approvals

Following the promulgation of the Food Safety and Standards Act, 2006, which empowers the Food Safety and Standards Authority of India (FSSAI) to regulate genetically modified (GM) food.

The FSSAI implements a safety assessment and approval process for GM foods that leverages existing regulatory capacity within the Government of India, notably within the Department of Biotechnology, Ministry of Environment, Forests and Climate Change (MoEF & CC) and the Indian Council of Medical Research (ICMR). There is a provision for a separate scientific panel on genetically modified organisms.

As per provision, no person shall manufacture, process, export, import or sell genetically modified articles of food, organic foods, neutraceuticals functional foods and health supplements as per regulations made there under this Act. The food products falling in the category of genetically modified foods have not been notified as yet for India.

Import policy of GM Food Products

Directorate General of Foreign Trade under General Notes regarding Import Policy in ITC (HS) 2012,

Schedule-1 (Import Policy) has notified the import policy of Genetically Modified Food, Feed, Genetically Modified Organism (GMOs) and Living Modified Organisms (LMOs). As per the policy, import of GM food requires prior approval of the GEAC constituted by the MoEF & CC. Import of food products is regulated by the Food Safety and Standards Act (FSSAI), 2006. Import of food products is regulated under the Food Safety and Standards Act (FSSAI), 2006. Customs can clear food products including Genetically Modified (GM) food products after necessary approval/No Objection Certificate (NOC) by FSSAI.

Labelling Issues

Any products with genetically modified content must be clearly labelled. Ministry of Consumer Affairs, Food and Public Distribution mandates packaged food producers disclose GM ingredients, if any, in a label on their product.

"Every package containing the genetically modified food shall bear at the top of its principal display panel the words 'GM'," under the Legal Metrology (Packaged Commodities) (2 {+n} {+d} Amendment) Rules 2012. These commodity rules apply to 19 products including biscuits, bread, cereals and pulses among others. The FSSAI is working on the final guidelines on the labelling of GM foods. According to news published by the LiveMint on FSSAI website in June 2017, the chief executive officer of FSSAI, Pawan Kumar Agarwal said "Genetically modified items are being used in a lot of processed foods. Consumers

have the right to know which products may have GM items. The scientific panel has already started work on this, and we'll soon finalise the labelling norms."

To date, India allows commercial cultivation of only transgenic cotton (Bt Cotton). While Bt Brinjal has the approval, the government did not introduce this due to widespread protests against the technology. Though the central regulator on the GM crops - Genetic Engineering Appraisal Committee (GEAC) of the MoEF & CC - has allowed scientific field trials of genetically engineered seeds, it has not approved commercial cultivation of any such crop.

Source:
http://pib.nic.in/newsite/PrintRelease.aspx?relid=134035,
http://www.dbtindia.nic.in/wp content/uploads/DBT_Book-_29-december_2015.pdf
http://dbtbiosafety.nic.in/Files/CD_IBSC/Files/transgenic.PDF,
http://pib.nic.in/newsite/PrintRelease.aspx?relid=147678,
http://en.biosafetyscanner.org/pdf/doc/217_allegato.pdf

GM Foods – Effects on human health

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http://indiagminfo.org/wp-content

Scientists genetically engineer seeds for many reasons. They also engineer seeds to give GM foods stronger colours, increase their shelf life, or eliminate seeds. That's why we can buy seedless watermelons and grapes. Some GM foods also have been engineered to have higher levels of specific nutrients, such as protein, calcium, or folate.

Proponents of GM food contend that genetic engineering can help us find sustainable ways to feed people. Specifically, in countries that lack access to nutrient-rich foods. The heartiness of some GM crops makes it so they can grow in marginal environments. The longer shelf life of some GM foods allows them to be shipped to remote areas.

Genetically Modified foods containing genes derived from bacteria and viruses are now starting to appear in the shops, and foods with insect, fish and animal genes will soon follow. These genetic changes are radically different from those resulting from traditional methods of breeding. Many scientists say that genetically modified foods could cause serious damage to health and the environment.

What are the dangers?

Because living organisms are highly complex, genetic engineers cannot possibly predict all of the effects of the introducing new genes into them. This is the case for even the simplest bacterium, not to mention more complex plants and animals. This is probably due to the fact that the introduced gene may act differently when working within its new host or the original genetic intelligence of the host will be disrupted. Moreover the new combination of the host genes and the introduced gene will have unpredictable effects; and therefore there is no way of knowing the overall, long-term effect of genetically engineered foods on the health of those who eat them.

Peer-reviewed studies have found harmful effects on the health of laboratory and livestock animals fed GMOs. Effects include toxic and allergenic effects and altered nutritional value.

What is needed are long-term and multi-generational studies on GMOs to see if the changes found in medium-term studies, which are suggestive of harmful health effects, will develop into serious disease, premature death, or reproductive or developmental effects. Moreover, the system for assessing the allergenic potential of GM foods in place in the EU today-although it is probably the most rigorous of any assessment system anywhere in the world – is inadequate and unlikely to identify new allergens.

Main issues of concern for humans

While theoretical discussions have covered a broad range of aspects, the three main issues debated are the potentials to provoke allergic reaction (allergenicity), gene transfer (Antibiotic resistance) and carcinogenic potential (Cancer).

Allergenicity

As a matter of principle, the transfer of genes from commonly allergenic organisms of non-allergic organisms are discouraged unless it can be demonstrated that the protein product of the

https://gmo.geneticliteracyproject.org

transferred gene is not allergenic. While foods developed using traditional breeding methods are not generally tested for allergenicity, protocols for the testing of GM foods have been evaluated by the Food and Agriculture Organization of the United Nations (FAO) and WHO.

Food allergies are a growing problem in the United States. According to the Centers for Disease Control and Prevention (CDC), food allergies in children less than 18 years of age have increased; from 3.4% between 1997 and 1999 to 5.1% between 2009 and 2011.

Some people believe that spike is linked to GM foods. But there's no evidence that GM foods in general are more likely to trigger allergic reactions than non-GM foods, according to a study from Harvard University.

Others raise concerns about the transfer of specific proteins from one plant to another in genetic engineering. Proteins found in a relatively small number of foods cause most allergic reactions. Tree nuts are one of the most common triggers.

In the mid-1990s, researchers examined a strain of GM soybean that was engineered to contain protein from Brazil nuts. According to their report in the New England Journal of Medicine, the soybeans triggered allergic reactions in people with Brazil nut allergy. Those soybeans never entered the market and aren't sold to consumers.

The Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) have since established protocols for GM foods. They

require GM foods to be tested for their ability to cause allergic reactions. According to the Mayo Clinic, none of the GM foods that are currently on the market have been found to have allergenic effects.

Gene transfer

Gene transfer from GM foods to the cells of the body or to bacteria in the gastrointestinal tract would cause concern if the transferred genetic material adversely affects human health. This would be particularly relevant if antibiotic resistance genes, used as markers when creating GMOs, were to be transferred. Although the probability of transfer is low, the use of gene transfer technology that does not involve antibiotic resistance genes is encouraged.

Antibiotic-resistant bacteria can resist antibiotics, making them harder to kill. According to the CDC, antibiotic-resistant germs infect two million people each year. These infections kill at least 23,000 people per year.

https://i.pinimg.com/originals

Scientists often modify seeds using antibiotic-resistant genes in the genetic engineering process. Some people wonder if there's a link between these GM foods and rising rates of antibiotic resistant bacteria. No studies have confirmed this claim, but more research is needed.

The migration of genes from GM plants into conventional crops or related species in the wild (referred to as "outcrossing"), as well as the mixing of crops derived from conventional seeds with GM crops, may have an indirect effect on food safety and food security. Cases have been reported where GM crops approved for animal feed or industrial use were detected at low levels in the products intended for human consumption. Several countries have adopted strategies to reduce mixing, including a clear separation of the fields within which GM crops and conventional crops are grown.

Cancer

In 2013, the journal Food and Chemical Toxicology retracted a paper that linked the herbicide Roundup and Roundup-tolerant GM corn to cancer and premature death in rats. Due to concerns about the paper, the journal's editor reviewed the researchers' raw data and the peer-review process. They found the researchers had used too few rats, the specific strain of rats was prone to cancer, and the results were inconclusive.

Since then, the paper has been republished in another journal, Environmental Sciences Europe. The controversy surrounding the study's findings has continued.

According to the American Cancer Society, more research is needed to assess the potential long-term health effects of GM foods.

Most studies with GM foods indicate that they may cause hepatic, pancreatic, renal and reproductive effects and may alter hematological (blood), biochemical, and immunologic parameters, the significance of which remains to be solved with chronic toxicity studies.

Source: Antoniou M., Robinson C. & Fagan J. (2012) *GMO Myths and Truths*, Kolkata, India, Earthcare Books. ISBN: 81-85861-44-7.

Datta A., Bhadoria P.B.S.,Rakshit A.,*Genetically Engineered Food A Serious Health Concern*, Yojana July 2003, pp 33-34.

http://www.healthline.com/health/gmos-pros-and-conshealth

http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en

GMO Foods: Effects on Environment

GMO Foods: Effects on Environment

The debate over the environmental impact of genetically modified (GM) crops is growing increasingly complex. GMOs in which genes from another organism are inserted into the targeted organism's DNA, have the potential to both positively and negatively affect the environment.

Assessing the environmental impact of GM crops is often difficult as many factors are considered. Some scientists focus on the potential risks of GM crops, while others emphasize their potential benefits. The technology is still new enough that there is no such reports knowing the effect of GM crop production on the environment.

Adverse Impact

Effects on Biodiversity

Biodiversity means the variety in the type and number of living creatures present in a particular place. The cultivation of these crops has had several impacts on biodiversity. The impacts largely result from the expansion of mono cultures as well as the increased use of certain herbicides. Different herbicides have varying impacts on biodiversity, based on their properties as well as the frequency and ways in which they are applied. The use of herbicides reduces overall plant diversity in agricultural systems, and in doing so, can limit habitat and food sources for untargeted species. The

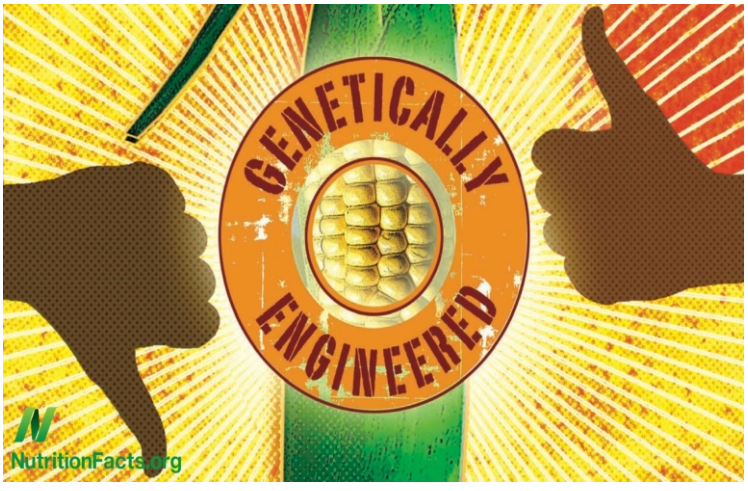
study says that the toxin Cry1Ab has been shown to affect the learning performance of honey bees. It also has adverse effects on Monarch butterfly populations.

Effects of Pollen transfer

A study by the US Environment Protection Agency in 2005 reports that pollen transfer causes neighbouring non-GM crop fields to become infected from invading GM crops, causing unwanted ecological impacts to farmers. “Pollen from transgenic crops may cross with related crops or weeds, potentially transferring the engineered genes.” This has consequences on farmers who try to grow organic crops and are getting infected by GM crops. Organic, by the definition, prohibits the use of genetic engineering, or genetically modified organisms.

Emergence of Resistant “Weeds” & Pests- Super Weeds

This term is often used to describe weeds believed to have special capabilities that are helping them outcompete other plants in ways never experienced before. There is no science-based definition for superweed. As per the Oxford Dictionary,“a weed which is extremely resistant to herbicides, especially one created by the transfer of genes from genetically modified crops into wild plants.” Creating next-generation herbicide-tolerant crops encourage over-use of herbicides.



Herbicide Use and Resistance

These GM Crops are helpful in food production, allowing farmers to use fewer chemicals, and to grow crops in less than ideal conditions. However, increase use of the herbicide has an adverse impact on the surrounding environment. Also, unintended hybrid strains of weeds and other plants can develop resistance to these herbicides through cross-pollination, thus negating the potential benefit of the herbicide. Glyphosate use is not only bad for farmers' health, it is also bad for the environment, specially for certain birds, insects and other wildlife. For example, populations of monarch butterflies have fallen to all-time lows as the result of massive spraying of glyphosate on crop fields. University of Minnesota researcher Dr. Karen Oberhauser identified glyphosate as one of the main causes of the depletion of monarchs in the US and Mexico.

Benefits of GMOs

In spite of the negative impacts that are believed to surround GM foods, there are many beneficial aspects that come from using GM foods and crops.

Increase in Food Production

It increases food production across the world by improving yield through increasing crop pest resistance and abiotic stress tolerance. To make crops, insect repellent, it is a huge advantage when trying to produce a large quantity of food.

Reduction in pesticide use

One of the significant environmental benefits of GM crops is the remarkable reduction in pesticide use, with the size of the reduction varying between crops and introduced trait. By adopting this technology, spraying of pesticide is reduced by 553 million kg (-8.6%) and, as a result, decreased the environmental impact associated with herbicide and insecticide use on these crops (as measured by the indicator the Environmental Impact Quotient (EIQ)) by 19.1%.

Reduction in the release of greenhouse gas emissions

The technology also facilitated a reduction in fuel use and tillage changes, resulting in a major reduction in the release of greenhouse gas emissions from the GM cropping area. In 2013, this was equivalent to removing 12.4 million cars from the roads.

The study by Graham Brookes & Peter Barfoot, PG Economics Ltd, UK presents the findings of research into the global socioeconomic and environmental impact of genetically modified (GM) crops. Farmers using improved seeds and biotech crop varieties continue to see significant economic and on-farm environmental benefits.

It is therefore essential to conduct the risk assessment on a case-by-case basis and to evaluate the environmental impact for the approval for cultivation on the basis of a cost/benefit analysis prior to their release. In addition, post-approval monitoring and better agricultural systems need to be in place to detect and minimize potential risks, as well as to ensure that GM crops continue to be safe after their release. The environmental risk assessments and strict regulations ensure that the only GM crops brought onto the market are those that do not have a greater, negative impact on the environment than their non-GM counterparts. Comparisons among GM, conventional and other agricultural practices, such as organic farming, will bring to light the relative risks and benefits of adopting GM crops.

Source:

http://scholar.colorado.edu/cgi/viewcontent.cgi?article=2140&context=honr_theses,

GM crops: global socio-economic and environmental impacts 1996-2010 by Graham Brookes & Peter Barfoot, PG Economics Ltd, UK,

http://www.greenpeace.org/australia/PageFiles/434214/GM_Fact%20Sheet_Health_%20and_Env_Impacts.pdf,

https://www.nature.com/articles/ncomms14865,

https://gmoinquiry.ca/wp-content/uploads/2015/05/Are-GM-crops-better-for-the-environment_-E-web.pdf

GMOs and FAQs

Because of the prominence of GMOs in the news, consumers are skeptical towards GM foods. It has raised a lot of questions. Some of the questions and answers have been prepared by WHO in response to questions and concerns from WHO Member State Governments with regard to the nature and safety of genetically modified food. Get the facts.....

1. What are genetically modified (GM) organisms and GM foods?

GMOs can be defined as organisms like plants, animals or microorganisms in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination. It allows selected individual genes to be transferred from one organism into another, also between non related species. Foods produced from or using GM organisms are often referred to as GM foods.

2. Why are GM foods produced?

To develop plants based on GM organisms to improve crop protection. These are mainly aimed at an increased level of crop protection through the introduction of resistance against plant diseases caused by insects or viruses or through increased tolerance towards herbicides.

3. **Is the safety of GM foods assessed differently from conventional foods?**

Generally, consumers consider that conventional foods (that have an established record of safe consumption over the history) are safe. Specific systems have been set up for the rigorous evaluation of GM organisms and GM foods relative to both human health and the environment. Similar evaluations are generally not performed for conventional foods. Hence there is a significant difference in the evaluation process prior to marketing for these two groups of food.

4. **How is a safety assessment of GM food conducted?**

   The safety assessment of GM foods generally focuses on:

   - direct health effects (toxicity)
   - potential to provoke allergic reaction
   - specific components thought to have nutritional or toxic properties
   - the stability of the inserted gene
   - nutritional effects associated with genetic modification
   - any unintended effects which could result from the gene insertion.

5. **Are GM foods safe?**

   Individual GM foods and their safety should be assessed on a case-by-case basis and that it is not possible to make general statements on the safety of all GM foods.

6. **Which foods might contain GMOs?**

   Most packaged foods contain ingredients derived from corn, soy, canola, and sugar beet — and the vast majority of those crops grown in North America is genetically modified.

7. **How are GM foods regulated nationally?**

   Regulation of GM foods varies with different countries. Countries which have legislation they focus primarily on assessment of risks to consumer health. Countries which have regulatory provisions they regulate GMOs in general, taking into account health and environmental risks, as well as control- and trade-related issues (such as potential testing and labelling regimes).

8. **Are GMOs labelled?**

   Labeling is mandatory in more than 60 countries. GMOs are not required to be labelled in the US and Canada. The mandatory labeling gives consumers the informed choice they deserve.

9. **What kind of GM foods are on the market internationally**?

   GM crops available on the international market today have been designed using one of three basic traits: resistance to insect damage; resistance to viral infections; and tolerance towards certain herbicides. GM crops with higher nutrient content (e.g. soybeans increased oleic acid) have been also studied recently.

10. **What happens when GM foods are traded internationally?**

    The Codex Alimentarius Commission (CODEX), a body jointly managed by the UN Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) sets international food standards, guidelines, and codes of practice related to the safety of international food trade.

11. **Have GM products on the international market passed a safety assessment?**

    The GM products that are currently on the international market have all passed safety assessments conducted by national authorities. These different assessments in general follow the same basic principles, including an assessment of environmental and human health risk. The food safety assessment is usually based on Codex documents.

For details please visit
http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/
https://www.nongmoproject.org/gmo-facts/

Source: http://www.kidsrighttoknow.com/

The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment & Forests by end of 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

The Ministry of Environment and Forests has identified Consumer Education and Research Centre (CERC), Ahmedabad, as one of the centers to collect and disseminate information on "Environment Literacy - Eco-labelling and Eco-friendly Products". The main objective of this ENVIS Centre is to disseminate information on Eco products, International, and National Eco labeling programs.

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