

Controversies and Moratoriums Associated With Genetically Modified Crops/Foods: Indian Perspective

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ABSTRACT

Genetically Modified (GM) is a technology that involves inserting DNA into genome of the organism. Plants can be genetically modified by inserting a particular DNA sequence into their genome to confer new or different traits. The growing demand for genetically modified (GM crops is a result of features like insect and herbicide tolerance. High nutritional content, improved production, and extended shelf life are further advantages of genetically modified crops. Whereas the human health, environmental safety, labelling, consumer choice, and intellectual property rights are frequently the topics of debates and public concern regarding GM foods and crops. A Pew Research Centre study performed between October 2019 and March 2020 found that 48% of respondents believed GM foods to be dangerous, 13% claimed they were safe, and 37% were unable to voice an opinion because they lacked the necessary information. This paper would discuss the controversies and moratoriums associated with GM crops/foods in India. Further this paper also highlights the approach of the higher judiciary towards the biosafety issues posed by the commercialization of Genetically Modified crops/food.

Keywords: GM Crops/Food, Controversies and Moratoriums, Human Health, Environment Safety, Higher Judiciary

INTRODUCTION

A major challenge for agricultural productivity will be posed by the daily increase in the human population. The 2022 Global Hunger Index places India 107th out of 121 countries with a score of 29.1 (serious level), despite the fact that it has made enormous progress in recent decades in terms of food grain production and a decline in malnutrition rates. Despite recent advances, there are still many people who are malnourished and suffer from micronutrient-deficient illnesses, particularly women and children.¹ Though the report of the Ministry of Women and Child Development Global Hunger Report 2022 has methodological issues and is based on an erroneous measure of hunger, three out of the four indicators used in the index calculation are related to children's health, which cannot accurately represent the entire population.

The fourth most crucial indicator estimate of the proportion of undernourished population is derived from an opinion poll on a small 3000-sample population.² Genetic engineering is a specific form of gene technology that modifies the genetic code of living things like plants, animals, and microorganisms. Recombinant DNA technology, which combines genes from many organisms, is referred to as "Genetically Modified (GM)", "Genetically Engineered," or "Transgenic" organisms.³ The advancement of GM plant technology poses both scientific and ethical concerns. Science seeks to comprehend the world in which we live, especially the causal connections that shape it. One such connection is the relationship between the molecular sequence of a gene and the traits it expresses, such as resistance to frost. If we want to modify or change the properties of plants in an informed way, we must comprehend such causal

¹"India | World Food Programme," March 31, 2023. <https://www.wfp.org/countries/india> (accessed June 5, 2023)

²"Global Hunger Report 2022- The Index Is an Erroneous Measure of Hunger and Suffers from Serious Methodological Issues," n.d.

<https://pib.gov.in/PressReleasePage.aspx?PRID=1868103> (accessed October 19, 2023).

³ A. S. Bawa and K. R. Anilakumar, "Genetically Modified Foods: Safety, Risks and Public Concerns - A Review," *Journal of Food Science and Technology* 50, no. 6 (December 2013): 1035-46, <https://doi.org/10.1007/s13197-012-0899-1>.

processes. Contrarily, ethics is concerned with what we should or shouldn't do. Ethical principles provide guidelines for assessing policies or practices, such as stating that a particular genetic change is unacceptable because it might endanger human health or be harmful to the environment. It does not necessarily follow that carrying out a particular experiment or introducing a novel crop variety for commercial planting would be morally acceptable.⁴ There is hope for the future in genetically modified (GM) technology, but there are also concerns about the technology's effects on the environment, ethics, labelling, and safety. Quick adoption of genetically modified (GM) crops has occurred since their commercialization in 1994, enabling growers to increase agricultural productivity while simultaneously managing pests and preserving food, feed, and the environment. With 95% adoption of Bt cotton in 2014, India contributed 25% of the world total, which is close to ideal. However, groups concerned about possible environmental impacts have stepped up their opposition to genetically modified organisms, and the debate over GMOs has heated up. Food safety, environmental impacts, and socioeconomic concerns have all been sparked by the growing number of genetically modified (GM) crops. All genetically modified organisms (GMOs) in India are subject to regulation by the Ministry of Environment, Forests, and Climate Change (MoEFCC), which is responsible for developing and implementing biosafety standards. Through the application of genetic engineering, farmers have been able to optimise crop yields while decreasing their need for harmful pesticides. Nevertheless, safety considerations must be taken into consideration, with an emphasis on hazards that have been more conclusively proven than those that are purely theoretical. The research method for the present research work has been purely doctrinal. The doctrinal method involves a descriptive and analytical study. This doctrinal method included a meticulous study of materials and a literature review. The literature for research work has been collected

from various primary and secondary sources. The primary sources are international conventions, national legislation, regulations, and judicial decisions. Secondary sources are books, booklets, journals, articles, magazines, newspapers, and websites.

ADVANTAGE AND DISADVANTAGES OF GENETICALLY MODIFIED CROPS/FOOD

The use of GM techniques in agricultural plants can have many advantages, which include higher yields, improved yield protection, resistance to pests and diseases, lower food costs, less use of pesticides that harm the environment, improved nutritional value, and tolerance to drought, which reduces the need for groundwater.

Despite these numerous advantages, GM crops continue to face severe challenges. Even though the Food and Drug Administration (FDA) has investigated the effects of eating GM foods and found that these crops are safe, many consumers and international governments remain dubious. Critics contend that because they are so recent, it is hard to predict their long-term health impacts. Biodiversity is also an issue since wind and pollinators can transport GM seeds into areas with non-GM plants, potentially leading to the contamination of native vegetation. Another major problem is insect resistance. Insects are more likely to develop a tolerance to a pesticide—or, in this case, a GM crop that creates its own toxins—the more often it is applied. It is more difficult to kill insects that develop resistance to these poisons. Many farmers do not adhere to the recommendations made by businesses like Monsanto, which encourage farmers to rotate their crops annually in an effort to reduce weed resistance. As a result, certain GM crops are beginning to lose their potency, and superbugs with resistance are starting to appear. For instance, rootworm attacks on crops have increased as a result of their resistance to the Bt gene, which targets them.⁵

⁴ Kennedy et al., Nuffield Council on Bioethics, ed., *Genetically Modified Crops: The Ethical and Social Issues* (London, 1999).

⁵ “The Pros and Cons of Genetically Modified (GM) Crops.”

https://Harbert.Auburn.Edu/Binaries/Documents/Center-for-Ethical-Organizational-Cultures/Debate_issues/Pesticide.Pdf, n.d. (accessed June 8, 2023).

PUBLIC DEBATE ON GENETICALLY MODIFIED CROPS/FOODS AT THE COMMUNITY AT LARGE?

In many parts of the world, there is a public discussion about the marketing of GM foods and the release of GMOs into the environment. This discussion is expected to go on, most likely in the context of other applications of biotechnology (such as in human medicine) and its effects on human civilizations. The debate's conclusion varies from country to country, despite the fact that the issues being discussed (costs and advantages, safety concerns) are sometimes fairly similar. There is currently no global agreement on topics like the labelling and traceability of GM foods as a means of addressing consumer preferences. Regardless of the lack of consensus on these issues, the Codex Alimentarius Commission made great strides and created Codex texts pertinent to the labelling of foods made with modern biotechnology in 2011. This was done to ensure consistency in any labelling strategy used by Codex members with already-adopted Codex provisions.⁶

In India, there are also numerous worries over GM crops' long-term effects on the environment, people, and natural biodiversity. The adoption of technology is likewise fraught with moral and ethical problems. Furthermore, the fact that it is herbicide-tolerant raises serious issues, causing farmers to assume that they will still need to use toxic pesticides. A number of NGO and environmental organizations have vehemently opposed the adoption of GM crops, calling the crops "hazardous and unsafe for humans." Activists fiercely opposed Bt cotton and spread stories saying that the crop had failed in the field. The controversy surrounding Bt Brinjal, a genetically modified variety of the plant, prompted the government to ban its commercial production in

India. The debate has centred on concerns with consumer choice, human health, and farmers' rights.⁷ Recently, in October 2022, the controversy intensified again after India's biotechnology regulatory body under the environment ministry recommended the environmental release of genetically modified mustard (GM) DMH-11 for its seed production. Whereas the principal scientific advisor to the Prime Minister at the 108th Indian Science Congress contends that GM crops cannot be disregarded any longer, the issue is that debates on technology are usually based on emotions and feelings, but the discussion about GM crops needs to be based on science, not emotion or fear.⁸

REGULATIONS

The Cartagena Protocol on Biosafety elaborates on the biosafety laws governing LMOs and specifies the biosafety standards for GM agricultural research and its function during the commercialization and deregulation processes. When the National Biotechnology Board was founded in 1982 with the purpose of developing biotechnology safety guidelines to conduct biotech research in laboratories, the regulation of biotechnology goods in India officially began. Later, in 1986, the Ministry of Science and Technology transformed the National Biotechnology Board into the Department of Biotechnology (DBT). According to the 1961 Government of India (Allocation of Business) Rules, MoEF is responsible for protecting the environment and preserving biodiversity. The Environmental Protection Act of 1986 (EPA 1986), passed by the Indian Parliament in 1986, is the law that the Ministry of Environment and Forests (MoEF) first used to regulate genetically modified organisms and their products.⁹

In India, the regulation of all activities related to GMOs and products thereof is as per "Rules for the

⁶ "Food, Genetically Modified," May 19, 2022. <https://www.who.int/news-room/questions-and-answers/item/food-genetically-modified> (accessed July 12, 2023).

⁷ Kaushiki. "To Eat or Not to Eat: Bt Brinjal." <https://prsindia.org/>, n.d. (accessed October 21, 2023).

⁸ Choudhary, Srishti, and Srishti Choudhary. "Can't Ignore GM Mustard': PSA Prof Sood on Why Debate Over GM Crops Should Be Scientific,

Not Driven By Fe." News18, January 4, 2023. <https://www.news18.com/news/india/cant-ignore-gm-mustard-psa-prof-sood-on-why-debate-over-gm-crops-should-be-scientific-not-driven-by-fear-6753439.html> (accessed October 19, 2023)

⁹ Manish Shukla et al., "Status of Research, Regulations and Challenges for Genetically Modified Crops in India," *GM Crops and Food* 9, no. 4 (October 2, 2018): 173–88, <https://doi.org/10.1080/21645698.2018.1529518>.

Manufacture, Use, Import/Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms, or Cells, 1989” (commonly referred to as Rules, 1989) under the provisions of the Environment (Protection) Act, 1986. The Rules of 1989 are quite comprehensive in their coverage, effectively encompassing the full range of GMO-related operations, including sale, storage, exportation, importation, production, manufacture, packing, etc. The Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, and state governments all participate in the implementation of these regulations. Under the Rules, 1989, six competent authorities, their makeup, and their responsibilities have been announced. The function of these six competent authorities is given in Table 1.¹⁰ Indian has ratified the Cartagena Protocol, which requires the establishment of a regulatory body. Presently the GEAC under the Ministry of Environment, Forests and Climate Change in charge of approving genetically modified products in India. In order to

expedite the introduction of contemporary biotechnology products to India, the Indian government is in the process of establishing the Biotechnology Regulatory Authority of India (BRAI). For the purpose to establish an independent regulatory body for the regulation of organisms and products of modern biotechnology, including GMOs, the Biotechnology Regulatory Authority of India (BRAI) bill was introduced in the Lok Sabha in 2013. The BRAI will regulate the development, manufacturing, delivery, importation, containment, environmental release, and usage of biotechnology products. BRAI will issue regulatory approval following a multi-level assessment process that is carried out by scientific professionals. The safety of the product developed for its intended usage will be certified by BRAI. All other laws governing the item will still be in effect. The BRAI law is currently lapsed, however it is anticipated to be developed once more under the current administration following significant amendments.

Statutory Committee	Function	Housed at
rDNA Advisory Committee (RDAC)	Review biotechnology developments and suggest appropriate safety guidelines for recombinant DNA research, usage, and applications.	Department of Biotechnology, Ministry of Science and Technology
Institutional Biosafety Committee (IBSC)	Responsible for ensuring adherence to safety guidelines for experimentation at designated location	All organizations engaged in activities involving GMOs
Review Committee on Genetic Manipulation (RCGM)	Review all ongoing rDNA projects and approve experiments falling in risk category III and above; also responsible for bringing out manuals of guidelines for conduct of GMO research and use	Department of Biotechnology, Ministry of Science and Technology
Genetic Engineering Appraisal Committee (GEAC)	Authorized to review, monitor and approve all activities including import, export, transport, manufacture, use or sale of GMOs and products thereof from environment angle	Ministry of Environment, Forest and Climate Change
State Biotechnology Coordination committee (SBCC)	Monitoring and supervision at state level	Concerned State Governments
District Level Committee (DLC)	Supervision and compliance at district level	Concerned State Governments

¹⁰ “2019 Handbook for Food Safety Officials – Genetically Modified Foods Safety Assessment and Regulations.Pdf,” n.d., Ministry of Environment

Forests and Climate Change and Biotech Consortium India Limited 2019.

STAGES OF DEPARTMENTAL STRUCTURES INVOLVED IN THE LIFE-CYCLE OF A GENETICALLY MODIFIED ORGANISM

A genetically modified organism's or a GMO-based product's life cycle typically involves four phases of departmental structures. There are pre-research, research, release, and post-release phases. The pre-research phase is observed by the Recombinant DNA Advisory Committee, as this group is responsible for approving the study that will be done. In a GMO's life cycle, the release phase is regulated by the Review Committee on Genetic Manipulation (RCGM) and the Genetic Engineering Appraisal Committee. The RCGM examines the research process and experimental releases, but the direct or indirect commercial release of GMOs is under the surveillance of the Genetic Engineering Appraisal Committee (GEAC). The Monitoring and Evaluation Committee, the State Biotechnology Coordination Committee (SBCC), and the District Level Committee (DLC) are the occupants in the post-release stage. These committees tend to overlap in the research stages as well through data provisioning submitted to the RCGM. Finally, the Institutional Biosafety Committee implements the standard safeguards at the research and development sites under the headship of the RCGM, the SBCC, and the DLC.¹¹

GENETICALLY MODIFIED CROPS IN INDIA: A TIMELINE OF CONTROVERSIES AND MORATORIUM

2002- Introduction of Bt. Cotton in India

The commercial clearance of Bt cotton in 2002 was a game-changing move that revived the nation's struggling cotton industry. At that time, the cotton sector had been characterised by a decline in cotton yield, a decline in cotton production, and an excessive reliance on cotton imports for many years. The average cotton yield in India, which used to

have one of the lowest yields in the world, increased from 308 kg per hectare in 2001-02 to 567 kg per hectare in 2007-08 and continued to hover near 500 kg per hectare in 2011-2012 before reaching the highest national cotton yield of 570 kg per hectare in 2013-14. This coincides with the rapid increase in the adoption of Bt cotton between 2002 and 2014. The area cultivated for cotton in India increased dramatically from 7.7 million hectares in 2002-2003 to 12.25 million hectares in 2013-2014, the biggest quantity ever planted for cotton in Indian history. Similar to this, the number of small-scale cotton farmers increased significantly, rising from 5 million in 2002-2003 to more than 8 million in 2013-2014. Of these, 7.7 million were Bt cotton farmers, accounting for roughly 95% of all cotton farmers in 2013-2014 who planted and greatly benefited from Bt cotton hybrids.¹² In 2019-2020 12.58 million hectares of land was used for cultivation of cotton and output was 436 kg per hectare.¹³

2006- Public Interest filed against Genetically Modified Crops in Supreme Court of India

At the Supreme Court in 2006, a public interest litigation was filed by Aruna Rodrigues against the release of GM crops in India. It was contended in the case Aruna Rodrigues and others v. Union of India¹⁴ that a grave and hazardous situation, raising bio safety concerns, is developing in our country due to release of Genetically Modified Organisms (GMOs). The GMOs are allowed to be released into the environment without proper scientific examination of biosafety concerns, affecting both the environment and human health.¹⁵ Since Rodrigues broadly contended that the Genetic Engineering Appraisal Committee (GEAC) did not lay out proper guidelines and questioned its independence in granting approvals, the case did not fall under the jurisdiction of the National Green

¹¹Bhuvan Bhaskar Jha and Ashutosh Shankar, "EVALUATING THE LAW ON REGULATION OF GENETICALLY MODIFIED CROPS IN INDIA," *Jamia Law Journal*, vol. 2, 2017, www.manupatra.com.

¹² Choudhary, Bhagirath, and Kadambini Gaur, "Biotech Cotton in India, 2002 to 2014: Adoption,

Impact, Progress & Future." *The International Service for the Acquisition of Agri-Biotech Applications (ISAAA)*, n.d. <http://www.isaaa.org/>.

¹³ "Cultivation of GM Crops," n.d. <https://pib.gov.in/PressReleasePage.aspx?PRID=1605056> (accessed June 13, 2023).

¹⁴ W.P.(C) No.260/2005

¹⁵Ibid

Tribunal (NGT), the appellate authority for challenging GEAC's approvals.¹⁶

2010- Impediments in the release of Bt. Brinjal

In the case of Dr. K. Thiruthanikachalam v. Union of India and Others¹⁷, the petitioner attempted to appeal the GEAC's clearance of Bt Brinjal to the High Court but was instead sent to the NGT, the appellate authority. The court observed that the appellate body, in this case, the NGT, is ultimately responsible for making any decisions regarding an appeal against GEAC approvals¹⁸. Due to a lack of consensus among scientists and opposition from the brinjal-growing state, the then environmental minister Jairam Ramesh blocked the release of Bt. Brinjal until further notice. No objection certificates from states were made mandatory for field trials.¹⁹

2012-37th Report on Agriculture's Standing Committee

The Standing Committee on Agriculture's 37th report, titled "Cultivation of Genetically Modified Food Crops: Prospects and Effects," was delivered under the chairmanship of Basudeb Acharya. On August 9, 2012, the report was introduced in Parliament. It evaluates the advantages and disadvantages of the use of genetic modification in food crops. The report's main finding was that the system for regulating GM crops had a number of flaws. It also pointed out that the existing framework does not mandate state government consultations or request their consent to undertake open field experiments on GM crops like Bt cotton and brinjal. The study suggested that all transgenic agricultural research and development be done solely in laboratories in light of these discoveries and that all existing field experiments be stopped across the entire country.

Despite the guidelines, Aruna Rodrigues argued in 2012 that the release of GM crops into the environment as a result of inadequate scientific review was endangering biosafety. She sought to halt the production, importation, and release of all GM products. The Technical Expert Committee (TEC), which consists of specialists in environmental safety, gene toxicology, food safety, nutritional sciences, plant biotechnology genetics, and agricultural sciences, was subsequently established by the Supreme Court to investigate the biosafety of GM crops. Given the shortcomings of the current regulatory framework, the TEC issued an interim report on October 7, 2012, advocating for a 10-year embargo on GM crops. The biotech industry challenged this report, claiming that it lacked focus and relied only on information from a few carefully chosen sources.²⁰

2013- Final Report of Technical Expert Committee to the Apex Court

In the final report, the Technical Expert Committee (TEC) said to the Supreme Court, "Based on the examination of the safety dossiers, TEC has found in unambiguous terms that at present, the regulatory system has major gaps, and these will require rethinking, investment, and relearning to fix. These need to be addressed before issues related to tests can be meaningfully considered. Till such time, it would not be advisable to conduct more field trials." A deeper understanding of the process of risk assessment is needed within the regulatory system.²¹ Concerning Bt food crops intended for commercialization, the Committee stated categorically that it could not think of any compelling reason for India to be the first nation to consume a Bt food crop (such as a Bt brinjal) and called for a moratorium on field trials of Bt food

¹⁶"The Science and the Law Behind the Genetically Modified (GM) Regulatory Logjam | Centre For Civil Society," n.d. <https://ccs.in/science-and-law-behind-genetically-modified-gm-regulatory-logjam> (accessed June 18, 2023).

¹⁷ 10 Feb 2010

¹⁸ Ibid

¹⁹ Sudha M Rani et al., "History, Status and Impact of Genetically Modified Crops in India," ~ 2735 ~ *International Journal of Chemical Studies* 6, no. 5 (2018), www.isaaa.org.

²⁰"The Science and the Law Behind the Genetically Modified (GM) Regulatory Logjam | Centre For Civil Society," n.d. <https://ccs.in/science-and-law-behind-genetically-modified-gm-regulatory-logjam>. (accessed June 21, 2023)

²¹The Economic Times. "Put Genetically-Modified Crop Trials on Hold for Now: Supreme Court Panel," July 22, 2013.

<https://economictimes.indiatimes.com/news/economy/agriculture/put-genetically-modified-crop-trials-on-hold-for-now-supreme-court-panel/articleshow/21259129.cms> (accessed June 27, 2023).

crops "until there is more definitive information from sufficient number of studies as to their long-term safety." The Committee further recommended that it should not be permitted to release GM crops for which India is a hub of origin or diversity. The TEC also advocated against GE herbicide-tolerant crops, citing the potential harm they may do to the environment, rural livelihoods, and agriculture.²²

The Union Government contested the interim report due to the absence of participation from plant genetics and agricultural sciences. The Court then appointed Dr. R. S. Paroda as the Agriculture Ministry's nominee. The introduction of GM crops was prohibited indefinitely until the regulatory system's shortcomings were fixed, according to the TEC's final report. Dr. Paroda, however, had a different viewpoint. By focusing on the contribution of biotechnology to India's agricultural growth, he argued for the continuation of the GM field experiments. The National Academy of Agricultural Sciences (NAAS), a group of 500 eminent Indian agricultural experts, supported Dr. Paroda's report. The TEC's final report was also denounced by the NAAS, which said that the committee failed to hold formal talks on the concerns presented by Dr. Paroda.²³

2014- Approval of field trails for new types of Genetically Modified Crops

Manmohan Singh, a former prime minister, viewed biotechnology as essential to ensuring food security and cautioned against succumbing to "unscientific prejudices". GM experiments, however, were halted by two of Singh's own environment ministers. The procedure for sanctioning the one-acre field trials didn't begin again until eerappa Moily assumed the

position of environment minister at the beginning of this year.²⁴ Field tests for 11 different crops, including maize, rice, sorghum, wheat, peanuts, and cotton, were allowed by GEAC (the UPA administration). The NDA Government approved field trials for 21 new genetically modified (GM) crop types, including rice, wheat, maize, and cotton, in July 2014. Out of the 28 proposals available for evaluation, the Genetic Engineering Appraisal Committee (GEAC), which is primarily composed of biotechnology advocates, rejected just one. Six ideas were turned down for lack of details.

2016- Supreme Court Stayed the order of GECA to the green signal of the field trial of GM Mustard

The panel of government and independent specialists granted technical approval for locally manufactured GM mustard seeds on August 11 after many evaluations of crop experiment data collected over nearly ten years.²⁵ However, it disagreed with the environmentalist Aruna Rodrigues' argument that open field experiments and the commercial release of GM mustard should be prohibited. The government's top legal representative, Mukul Rohatgi, said in court that "GM mustard will significantly reduce the import of canola oil." Rodrigues submitted the application in an ongoing legal matter. Rodrigues' attorney, Prashant Bhushan, had earlier informed the court that the Center had neglected to make the biosafety dossier public and that just a synopsis had been provided up to this point. Additionally, the petitioner requested that a commission of inquiry be established and instructed to provide a report on the field experiments and application procedure for GM mustard crops. The problematic possibility, according to the petition, is the commercial release of the GM mustard crop due

²²"India's Supreme Court Expert Committee Recommends Indefinite Moratorium on GE Field Trials « Biosafety Information Centre," n.d. <https://biosafety-info.net/articles/policy-and-regulation/asia/indias-supreme-court-expert-committee-recommends-indefinite-moratorium-on-ge-field-trials/> (accessed June 30,2023).

²³ "The Science and the Law Behind the Genetically Modified (GM) Regulatory Logjam | Centre For Civil Society," n.d. <https://ccs.in/science-and-law-behind-genetically-modified-gm-regulatory-logjam.> (accessed June 29, 2023).

²⁴Reporter, Guardian Staff. "India Puts GM Crop Trials on Hold." the Guardian, February 22, 2017. <https://www.theguardian.com/environment/blog/2014/jul/31/india-gm-crop-trials-bjp-rss> (accessed July 3, 2023)

²⁵Das, Mayank Bhardwaj Krishna N. "India Government Panel Clears GM Mustard but Hurdles Remain -Sources." U.S., August 25, 2016. <https://www.reuters.com/article/india-gmo-idUSL3N1B62B8> (accessed July 7, 2023).

to "various counts of fraud and regulatory collusion in field trials" done over the years in several areas. The demonstrations that followed the commercial introduction of Bt brinjal were noted.²⁶ However, the Apex Court stayed the order of GEAC to the green signal of GM mustard for field trial and also sought public opinion for the same.

2022- Two genetically modified mustard strains were approved for environmental release at a GEAC

The application for the commercial cultivation of genetically modified (GM) mustard has once again been approved by the Genetic Engineering Appraisal Committee (GEAC), an organization that reports to the Union Environment Ministry. The recommendation will once again be submitted for the Environment Ministry's approval. The proposal had been approved by the GEAC in 2017, but the Ministry had refused it and recommended that the GEAC conduct additional research on the GM crop. Two genetically modified mustard strains were approved for environmental release at a GEAC meeting on October 18, 2022, so that the Indian Council of Agriculture Research (ICAR) could use them to create new parental lines and hybrids. The meeting's minutes stated that the mustard hybrid Dhara Mustard Hybrid (DMH-11) was to be released into the environment for seed production and testing in accordance with current ICAR standards and other existing rules and regulations prior to commercial release. Additionally, it was permitted to perform field demonstration research on how GE mustard affects honeybees and other pollinators.²⁷

²⁶ Vishwanath, Apurva. "Govt Tells SC It Won't Release GM Mustard without Court's Nod | Mint." *Mint*, October 24, 2016.

<https://www.livemint.com/Politics/EtXwwUAxaYOzYTHH6TquxL/Govt-tells-SC-it-wont-release-GM-mustard-without-courts-no.html> (accessed July 9, 2023)

²⁷ The Hindu. "Genetic Engineering Appraisal Committee Approves Commercial Cultivation of Genetically Modified Mustard yet Again," October 27, 2022.

<https://www.thehindu.com/news/national/geac-approves-commercial-cultivation-of-genetically-modified-mustard-yet-again/article66058092.ece> (accessed July 13, 2023).

Deepak Pental, a geneticist and former vice chancellor of Delhi University, developed the seeds with his team over the course of more than a decade. India purchases more than 70% of the edible oils it needs from countries including Argentina, Brazil, Indonesia, Malaysia, Russia, and the Ukraine, where it spends tens of billions of dollars annually.²⁸

CHALLENGES AND FUTURE DIRECTION

To ensure the safety of the crops as food, animal feed, and an integral component of the ecosystem, GE crops go through a rigorous product development procedure. These crops' development-related safety research has helped to support a number of significant findings. For instance, GE crops go through a safety evaluation that is stricter and more in-depth than evaluations of any other food crop in history, including traditional foods sold in stores. The safety evaluation approach makes sure that the safety of GE crops is examined by several regulatory authorities in compliance with various risk assessment methodologies and with national and international safety assessment standards. Two essential inquiries need to be answered: Is the food or feed suitable for consumption by both people and animals? And how about the plants' environmental safety? Technology developers and regulators assess any possible consequences of added features in GE plants using the highest standards of food, nutritional, and environmental safety.²⁹

CONCLUSION

The increase in the human population poses a major challenge to agricultural productivity. Despite progress in food grain production, malnutrition rates

²⁸ The Economic Times. "India Gives Environmental Approval for Gene-Modified Mustard," October 27, 2022.

<https://economictimes.indiatimes.com/news/economy/agriculture/india-gives-environmental-approval-for-gene-modified-mustard/articleshow/95117009.cms?from=mdr> (accessed July 19, 2023).

²⁹ Prado, Jose Rafael, Gerrit Segers, Toni A. Voelker, Dave Carson, Raymond C. Dobert, Jonathan Phillips, Kevin Cook, et al. "Genetically Engineered Crops: From Idea to Product." *Annual Review of Plant Biology* 65, no. 1 (April 29, 2014): 769–90. <https://doi.org/10.1146/annurev-arplant-050213-040039>.

in India are steadily increasing. Genetic Modification has potential benefits for agriculture, but it also raises scientific and ethical concerns. GM crops have advantages such as higher yields, improved yield protection, and resistance to pests and diseases. However, they face challenges such as uncertainty about long-term health impacts, biodiversity issues, and insect resistance. Many NGOS, civil society, and international governments remain dubious about the long-term health impacts of GM crops/foods. There will be a never-ending public debate about whether GM crops/foods are safe or harmful, despite the fact that there is scarcely any convincing scientific evidence in their favor. However, the Technical Expert Committee (TEC) found major gaps in India's regulatory system for GM crops and recommended a moratorium on field trials until long-term safety is established. The TEC also advised against releasing GM crops for which India is a hub of origin or diversity and GM herbicide-tolerant crops due to potential harm to the environment, rural livelihoods, and agriculture. To ensure the safety of GM crops as food, animal feed, and for the ecosystem, regulatory institutions in India should undergo a rigorous safety evaluation, which is a stricter and more in-depth study and research of GM technology. This evaluation examines both the safety of consumption and the environmental safety of the plants, using national and international safety assessment standards and various risk assessment methodologies. The setting up of an online portal and single-window system for the evaluation, oversight, and approval of GM crops is urgently required. This kind of portal would be highly advantageous and user-friendly, connecting not only all stakeholders in GM crops but also spreading goodwill among the general public on GM food research, safety, and its current status.