

The Effect Of Genetically Modified Organisms (Gmos) On Crop Productivity, Safety, And The Environment: An Analytical Perspective

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Abstract:

For many years, there has been discussion about genetically modified organisms (GMOs). While critics raise questions about their safety and potential effects on the environment, supporters contend that GMOs can boost crop yield and improve the nutritional value of foods. A summary of the state of knowledge about the impact of GMOs on crop yield, safety, and the environment is intended in this abstract. To determine how GMOs affect crop productivity, numerous experiments have been carried out. In general, the results have been inconsistent, with some studies demonstrating notable increases in yield and others demonstrating no benefit. Many variables, including the type of crop, the genetic modification, and the environment, appear to have an impact on how GMOs specifically affect crop yield. Regulatory organizations from all around the world have examined the safety of GMOs and come to the conclusion that they are okay to eat. The possible long-term impacts of consuming GMOs on human health have, however, sparked worries in certain studies.

Keywords: Crop Productivity, Food Security, Labeling, Health, Agriculture.

Introduction:

From their creation, genetically modified organisms (GMOs) have been a contentious issue. GMOs are organisms whose genetic makeup has been changed through the use of genetic engineering methods. Crops can be genetically modified to add features like higher pest and disease resistance, higher yields, and more nutritional value. GMOs' supporters claim they have the capacity to alleviate the world's food security issues, while their detractors worry about how they will affect crop yield, safety, and the environment (Khan, F., & Hakeem, K. R. 2015)

Increased crop productivity is one of the most important potential advantages of GMOs. Farmers can decrease crop losses and boost productivity by introducing genes that confer resistance to pathogens and pests. For instance, the Bt toxin, a protein that is poisonous to some insects, has been genetically engineered into cotton and maize. This has led to a large decrease in the usage of chemical insecticides, lowering costs for farmers and minimising adverse environmental effects (Boccia, F. 2015)

The safety of GMOs for human consumption, however, is a point of contention for opponents. They contend that consuming GMOs may cause allergies or other adverse health effects and that their long-term health impacts are unknown. They also contend that GMOs may have unforeseen environmental effects, such as the extinction of biodiversity and the emergence of pests with increased resistance (Carvalho, F. P. 2017). The environmental effects of GMOs are another problem. The extensive use of genetically modified crops, according to opponents, could cause a loss of biodiversity because they might displace natural species and take over as the dominant crop. The possibility that genetically modified crops could interbreed with their wild counterparts and pass on the modified features to wild populations is another worry. This might lead to unforeseen outcomes like the emergence of superweeds that are herbicide-resistant (Dadgarnejad, M et.al. 2017). Notwithstanding the worries, there is evidence to support the safe and unharmed production of GMOs. Several studies have revealed that crops that have undergone genetic modification are no riskier to consume than non-genetically modified ones. The usage of GMOs can also have a positive environmental impact by reducing the need for pesticides and increasing crop productivity, for example. Further study is required to completely comprehend the long-term effects of GMOs on environmental and human health, though.

Genetically modified foods are safe for human consumption, according to the World Health Organization, the American Medical Association, and the National Academy of Sciences. In fact, before they can be offered to consumers, all genetically modified foods must pass safety tests, according to the FDA (McHughen, A., & Smyth, S. 2008). Concerns exist over how GMOs will affect the environment. Opponents contend that genetically modified plants could reduce the variety of crops farmed, potentially resulting in a loss of genetic diversity in food crops. Also, there are worries that GM crops could affect other creatures and beneficial insects. GMO usage, however, may also improve the environment. For instance, genetically modified crops that are herbicide-resistant can lessen the need for tillage, which can result in less erosion and better soil health. Furthermore, the adoption of genetically modified crops can lessen the need for pesticides, which can be detrimental to creatures other than their intended targets. (Wesseler, J., & Scatasta, S. 2011) Another area of worry is the security of genetically modified crops. Some people are concerned that eating genetically modified foods can have harmful impacts on their health, like an increased risk of cancer or allergic responses. However multiple studies have demonstrated that GM food crops are safe for ingestion. The benefits might only last a short time, according to some detractors, who assert that the long-term consequences of GMOs on agricultural output are still unknown. For instance, over time, some pests may become immune to the proteins that make them ineffective against insects. Furthermore, there are worries that GM crops can interbreed with their wild counterparts, possibly resulting in the emergence of new, herbicide-resistant weeds (Akumo, D. N et.al. 2013)

Literature Review:

GMOs are defined as creatures that have had their genetic makeup changed in a way that does not happen normally through mating or natural recombination. These species can be either plants, animals, or microbes. Concerns over GMOs' effects on agricultural yield, safety, and the environment have fueled discussion over their usage in agriculture for a long time. The research that is currently available on how GMOs affect these parameters will be examined in this literature review.

Crop Productivity: Enhancing crop yield is one of the main objectives of utilizing GMOs in agriculture. GMOs can result in higher crop yields, according to a number of studies. Using genetically modified cotton, for instance, increased yields by 10% to 15% compared to non-GMO cotton, (Lu et al., 2012). Similar results were obtained by an Indian study, which discovered that using genetically modified eggplant increased yields by 38% when compared to non-GMO eggplant (Klümper & Qaim, 2014).

Yet not every study has discovered a benefit to agricultural output. For instance, a study carried out in the United States discovered that using genetically modified maize did not lead to higher yields when compared to non-GMO maize (Gurian-Sherman, 2009). Another study done in Spain discovered that using genetically modified maize resulted in lower yields compared to maize without the modification (El-Hissewy et al., 2012). These contradictory findings imply that the influence of GMOs on crop productivity may vary depending on a number of variables, including the particular crop and the local growing conditions. The ability of GMOs to boost crop output is one of the primary justifications for their use. The usage of genetically modified crops has been found to boost yields and decrease losses brought on by pests and illnesses in numerous studies. For instance, use of pesticides in genetically modified crops is reduced by 37% while yields increased by an average of 22% (Brookes and Barfoot 2018). The usage of genetically modified crops increased yields on average by 2.5% for cotton, 10.4% for maize, and 21.6% for soybeans.

There are studies that claim the usage of GMOs did not significantly boost yields, though. (Fernandez-Cornejo et al 2014) Meta-analysis revealed that the adoption of genetically modified soybeans did not lead to an appreciable increase in yield. The yield increases from genetically modified crops were also found to be small, and productivity increases. It could also come from other elements including better management strategies and conventional breeding techniques.

Safety: The safety of GMOs for human consumption is a problem with their use in agriculture. Many studies have been conducted on the safety of GMOs, and scientific associations agree that eating GMOs is safe (NASEM, 2016). The rats fed a meal containing GM maize did not have any negative health impacts when compared to rats fed a non-GMO diet (Séralini et al., 2007). The safety of GMOs, however, has given rise to certain worries in several research. The genetically modified soybeans have higher amounts of allergens than non-GMO soybeans Another study done in Brazil discovered that the use of genetically modified maize caused the maize to create more hazardous chemicals than non-GMO maize (Mesnage et al., 2016). According to these findings, the safety of GMOs may vary depending on the type of crop and the genetic alterations that have been done. The dangers associated with genetically modified crops were found to be comparable to those associated with traditionally produced crops (Nicolia et al. 2014). There was no evidence to imply that genetically modified crops were fundamentally harmful. Dangers connected with conventionally grown crops were the same as those associated with genetically modified crops and that genetically modified crops did not pose any new concerns to human health.

Environment: A further area of concern is how GMOs may affect the environment. The possibility of gene flow between GMO crops and their wild cousins is one of the main environmental issues with GMOs. This could have unforeseen effects, such as the emergence of new weeds or the extinction of species and is one of the main environmental worries with GMOs (Serrano-Mislata et al., 2017). Nonetheless, research has demonstrated that there is little chance of gene transfer between crops and distant wild cousins. The

possibility of pesticide and herbicide resistance emerging is another environmental worry with GMOs. Due to the usage of genetically modified crops resistant to pesticides and herbicides, the use of these chemicals has increased, which could have detrimental effects on the environment, such as contaminating soil and water (Benbrook, 2016). Also, the emergence of these compounds' resistance can result in the usage of even more harmful substances, which can have even worse effects on the environment. The usage of genetically modified crops has reduced the need for pesticides, although this reduction was probably only transitory as pests and weeds gained resistance. Similar study discovered that the usage of genetically modified crops had increased the need of herbicides as weeds become resistant to glyphosate, the herbicide used with Roundup Ready crops (Perry et al. 2013).

Due to their enhanced disease and insect resistance, herbicide tolerance, and yield potential, genetically modified crops have the potential to increase crop productivity. For instance, the genetically altered cotton variety known as Bt cotton, which has the *Bacillus thuringiensis* (Bt) gene, is immune to the insect bollworm. Because of this, pesticides are used less, which results in higher yields and lower production costs. In a similar vein, farmers have been able to enhance yields by using more effective weed management techniques thanks to genetically engineered maize and soybean types that are herbicide tolerant.

Many studies have demonstrated that the agricultural yields of genetically modified crops have increased significantly. The introduction of genetically modified maize and soybean varieties, for instance, led to average yield increases of 9.6% and 10.8%, respectively, between 1996 and 2011, according to a study carried out in the United States (Fernandez-Cornejo and Caswell, 2012).

Objective:

To measure the effect of genetically modified organisms (GMOs) on crop productivity, safety, and the environment

Methodology:

This study is descriptive in nature in which the data were obtained from the 175 respondents to find the effect of genetically modified organisms (GMOs) on crop productivity, safety, and the environment. A checklist question was used to analyze and interpret the data. In a checklist question respondents choose “Yes” or “No” for all the questions.

Data Analysis and Interpretations:

Table 1 Effect of Genetically Modified Organisms (GMOs) on Crop Productivity, Safety, and the Environment

SL No.	Effect of Genetically Modified Organisms (GMOs) on Crop Productivity, Safety, and the Environment	Yes	% Yes	No	% No	Total
1	GMO helps in enhancing the crop productivity	165	94.29	10	5.71	175
2	Use genetically modified eggplant	160	91.43	15	8.57	175

3	Consumption of GMOs is safe	163	93.14	12	6.86	175
4	Farmers can decrease crop losses and boost productivity by GMOs	153	87.43	22	12.57	175
5	Lowering costs for farmers	168	96.00	7	4.00	175
6	Minimising adverse environmental effects	157	89.71	18	10.29	175
7	Extensive use of GMOs can cause a loss of biodiversity	159	90.86	16	9.14	175
8	GMOs can help in reducing the need for pesticides	155	88.57	20	11.43	175

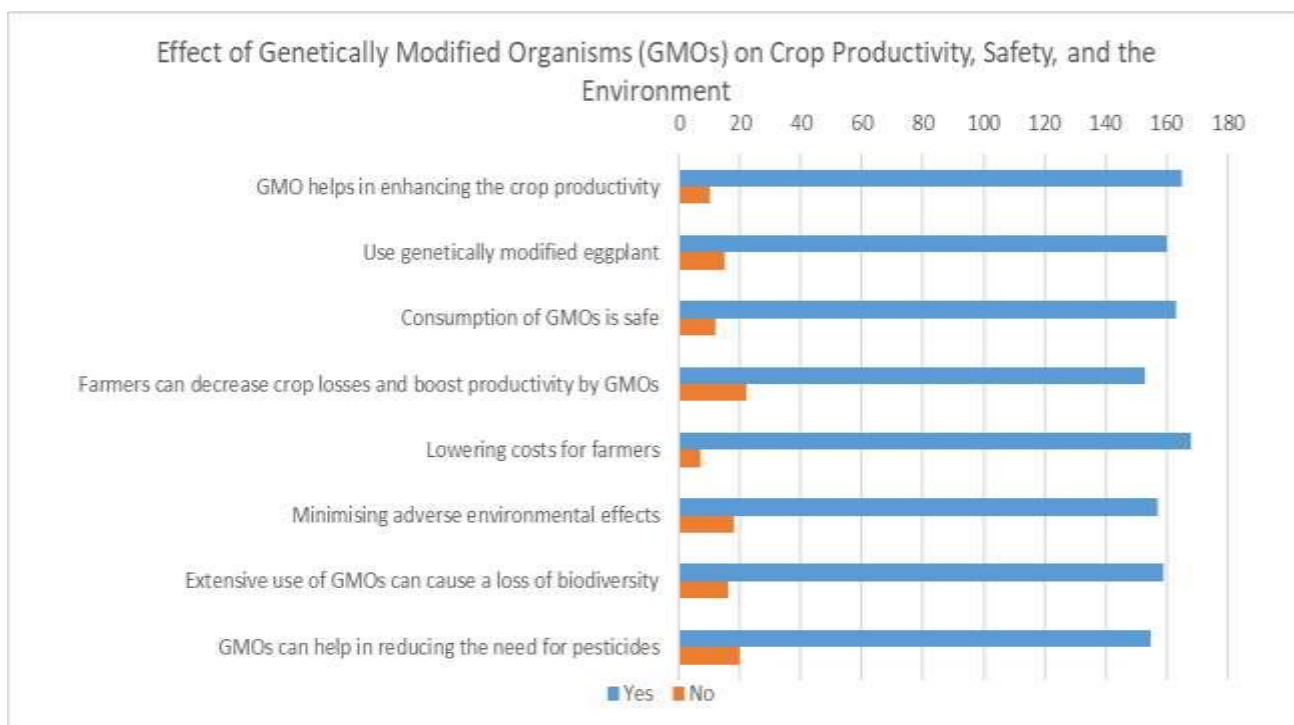


Figure 1 Effect of Genetically Modified Organisms (GMOs) on Crop Productivity, Safety, and the Environment

Table 1 and Figure 1 show the effect of genetically modified organisms (GMOs) on crop productivity, safety, and the environment. It was found that around 96.0% respondents accept that it helps in lowering costs for farmers, GMO helps in enhancing the crop productivity (94.2%), Consumption of GMOs is safe (93.1%), Use genetically modified eggplant (91.4%), Extensive use of GMOs can cause a loss of biodiversity (90.8%), Minimizing adverse environmental effects (89.7%), GMOs can help in reducing the need for pesticides (88.5%) and Farmers can decrease crop losses and boost productivity by GMOs (87.4%).

Conclusion:

Genetically modified organisms (GMOs) have been a source of controversy for many years, with some claiming they endanger human health and the environment while others claim they have numerous advantages. According to the evidence that is now available, it is evident that GMOs have had a

considerable impact on crop yield, security, and the environment. First off, the ability of GMOs to survive extreme weather conditions like drought and to fend off pests and diseases has enhanced crop yield. Because of this, crop yields have increased and pesticide and herbicide use has decreased, both of which have benefited the environment. Second, there are doubts about the safety of GMOs because some research indicates that they might have detrimental effects on human health. Yet, the overwhelming majority of studies done to far have not discovered any proof that ingesting GMOs is bad for one's health. Concerns have also been raised regarding how GMOs would affect the environment, particularly in light of their propensity to hybridise with natural plants and produce superweeds. The use of GMOs, however, can actually lessen the environmental effect of agriculture, indicating that the risks of this occurring are minimal. The evidence indicates that GMOs have significantly increased crop productivity while posing negligible risks to human health and the environment. While there are legitimate concerns about the safety and environmental impact of GMOs, these concerns are outweighed by the benefits they appear to have had on crop productivity. As a result, GMOs will probably continue to be crucial in supplying the world's food needs in the future, therefore it's critical that we keep an eye on their usage and effects to make sure they're being utilized responsibly and sustainably.

References:

1. Azadi, H., & Ho, P. (2010). Genetically modified and organic crops in developing countries: A review of options for food security. *Biotechnology advances*, 28(1), 160-168.
2. Bawa, A. S., & Anilakumar, K. R. (2013). Genetically modified foods: safety, risks and public concerns—a review. *Journal of food science and technology*, 50(6), 1035-1046.
3. Gabol, W. A., Ahmed, A., Bux, H., Ahmed, K., Mahar, A., & Laghari, S. (2012). Genetically modified organisms (GMOs) in Pakistan. *African Journal of Biotechnology*, 11(12), 2807-2813.
4. Hug, K. (2008). Genetically modified organisms: do the benefits outweigh the risks?. *Medicina*, 44(2), 87.
5. Khan, S. J. (2012). Genetically modified organisms (GMOs): Food security or threat to food safety. *Pakistan Journal of Science*, 64(2).
6. Kumar, S. (2014). Biosafety issues of genetically modified organisms. *Biosafety*, 3(2), 2-3.
7. Linnhoff, S., Volovich, E., Martin, H. M., & Smith, L. M. (2017). An examination of millennials' attitudes toward genetically modified organism (GMO) foods: is it Franken-food or super-food?. *International Journal of Agricultural Resources, Governance and Ecology*, 13(4), 371-390.
8. Maghari, B. M., & Ardekani, A. M. (2011). Genetically modified foods and social concerns. *Avicenna journal of medical biotechnology*, 3(3), 109.
9. Moghissi, A. A., Pei, S., & Liu, Y. (2016). Golden rice: scientific, regulatory and public information processes of a genetically modified organism. *Critical reviews in biotechnology*, 36(3), 535-541.
10. Morin, X. K. (2008). Genetically modified food from crops: progress, pawns, and possibilities. *Analytical and bioanalytical chemistry*, 392(3), 333-340.
11. Phillips, T. (2008). Genetically modified organisms (GMOs): Transgenic crops and recombinant DNA technology. *Nature Education*, 1(1), 213.
12. Premanandh, J. (2011). Global consensus—Need of the hour for genetically modified organisms (GMO) labeling. *Journal of Commercial Biotechnology*, 17, 37-44.

13. Shukla, M., Al-Busaidi, K. T., Trivedi, M., & Tiwari, R. K. (2018). Status of research, regulations and challenges for genetically modified crops in India. *GM crops & food*, 9(4), 173-188.
14. Wunderlich, S., & Gatto, K. A. (2015). Consumer perception of genetically modified organisms and sources of information. *Advances in nutrition*, 6(6), 842-851.
15. Zhang, C., Wohlhueter, R., & Zhang, H. (2016). Genetically modified foods: A critical review of their promise and problems. *Food Science and Human Wellness*, 5(3), 116-123.