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THE USE OF GENETICALLY MODIFIED ORGANISMS (GMOS) IN MODERN AGRICULTURE

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Abstract
In this study, we discuss every environmental concern raised by the widespread use of GMOs in modern farming. More than 80 times as much land (122 million hectares) is now devoted to growing genetically modified crops for commercial purposes as it was from 1996 to 2007. The number of nations that produce doubles. Rapid growth is anticipated in the next years for the area of genetically modified crops, particularly in underdeveloped nations. When GMO crops are grown, farmers may reduce the number of pesticides they spray. The study included 100 participants who filled out questionnaires. The poll asked respondents about their familiarity with GMOs and their thoughts on the dangers such organisms pose to ecosystems and human health. As a result, both money and chemicals are spared by farmers. Creating a GMO plant requires inserting new DNA into plant cells and combining existing DNA into the plant's genome. Genetically modified organisms (GMOs) are a kind of industrial farming in which chemicals are put into plants to increase yield and product size. Based on the findings of the study, it was concluded that using goods containing GMOs poses potential health concerns.
Keywords: Genetically Modified Organisms (GMOS), Modern, Agriculture, plant, Engineer

INTRODUCTION

Creating an outcome that will help others is the goal. Common reasons for altering them include improving research outcomes and adjusting agricultural yields. Animal and plant cloning, the administration of growth hormones, the introduction of antibiotic-resistant plant varieties, the introduction of genes that confer greater size or resistance to environmental stresses, and the creation of novel foods by the manipulation of existing genes are all examples of common genetic modification. For various reasons, GMOs have many supporters. The primary motive is the need to provide sustenance for an expanding human population. The 2015 study from the United Nations Department of Economics and Social Affairs estimated that the global population was 8.5 billion in 2015, and predicted that it will increase to 9.7 billion by 2050 and 11.2 billion by 2100. The United Nations' Food and Agriculture Organization (FAO) concluded in its report titled "How to Feed the World in 2050" that a 70% increase in agricultural output would be required to meet global food demand in that year. Moreover, the FAO predicted that increases in yields and cropping intensity would account for 80% of this increase, with the remaining 20% coming from the expansion of arable land. Furthermore, it is quite evident that using the conventional method to accomplish such a massive goal is next to impossible. Among the many instances of GMOs, modified agricultural plants are often given. Increased crop yields, lower costs for food or drug production, reduced need for pesticides, improved nutrient composition and food quality, resistance to pests and disease, increased food security, and medical benefits for the world's expanding population are just some of the advantages of genetic engineering in agriculture. Crops that reach maturity earlier and are resistant to environmental stresses including aluminum, boron, salt, drought, and cold have also been developed thanks to scientific progress. Producing non-protein (bioplastic) or non-industrial (ornamental plant) products is another use. Several species of animals have been genetically modified to improve productivity and reduce illness vulnerability. More study on GMOs might be beneficial for a wide range of sectors. For instance, some bacteria are being studied for their potential as biodegraders and clean fuel generators in the future. Furthermore, recombinant vaccines might potentially be manufactured from genetically engineered plants. As a matter of fact, the idea of an oral vaccine expressed in plants (fruits and vegetables) for direct consumption by individuals is being explored as a potential solution to the spread of disease in underdeveloped countries, one that would significantly reduce the costs associated with conducting large-scale vaccination campaigns. Potatoes and lettuce are being studied

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as potential vaccine candidates against Norwalk virus, Hepatitis-B virus, and Enterotoxigenic Escherichia coli.

Other economically useful proteins are being investigated for plant synthesis as well, including spider silk protein and polymers used in surgery or tissue replacement. Xenotransplantation refers to the practice of using tissues and organs grown in genetically modified animals in human transplants. Humans benefit greatly from the wide range of GMO applications, yet many are concerned about the hazards involved. When GMO crops are grown, farmers may reduce the number of pesticides they spray. As a result, both money and chemicals are spared by farmers. Farmers who plant herbicide-tolerant crops spend less time tilling the soil and more time harvesting crops. Planting with no till helps to increase soil health, decrease soil erosion, lessen the need for fuel and labor, and reduce greenhouse gas emissions.

Genetically modified organisms (GMOs) are living things whose DNA has been manipulated in a manner that renders them incapable of reproducing in nature. The term "genetic alteration" is used to describe the practice of modifying an organism's DNA in order to produce desirable results. A genetically modified organism (GMO) is a living being whose DNA has been transformed using genetic engineering methods. Individuals, creatures, and viral genomes may all be modified in novel ways using genetic engineering procedures, which are often grounded on insights from microbiological research or genetics. “Different people agree on what constitutes genetic engineering, but most agree that a genetically modified organism is one that "does not originate spontaneously through mating and/or natural recombination." Everything from animals to flowers to bacteria is fair game when it comes to GM organisms. Species, all species, and even species within the same kingdom have genetic programming that allows for the creation of mutations. Amplification, alteration, deletion, or insertion of an endogenous gene into a new gene are all possible.

A section of DNA that indicates the presence or absence of a certain characteristic gene. All organisms have DNA in the form of genes. Genes are located on chromosomes. Genes provide instructions for how an organism is supposed to look, develop, and operate, and they may be handed down from generation to generation. Genetically modified crops, also known as transgenic plants or genetically engineered (GE) vegetation, are plants whose genetic material has been modified in a laboratory. When an organism is altered by methods that permit direct mutation or removal of genes, this is known as genetic engineering. Recombinant DNA methods are the same as rDNA strategies.

LITERATURE REVIEW

Zhang, Hongzhou (2019) China's agricultural and food security policies have always placed a strong emphasis on agricultural research and technology despite the country's severe resource restrictions. Developing innovative yield-enhancing methods, especially the use of Genetically Modified Organisms (GMOs), is seen by most policymakers and grain specialists as the primary means by which China may overcome its agricultural resources restriction. Public skepticism regarding the advantages of GM crops has increased in China, despite the central government's strong backing of GM technology and GM food. In an effort to clarify the contentious debate over genetically modified (GM) food in China, this chapter provides some first thoughts on the trajectory of GM crops in China and their possible domestic and international repercussions.

Babar, Usman & Xu, Ruqiang (2022) China, home to the world's biggest population, relies on just a small fraction of the world's arable land and freshwater resources. Therefore, China imports a great deal of food commodities to guarantee its food security policy. Under the present conditions of climate change and global warming, the import of GM crops seems obligatory; nonetheless, authorisation prior to import is the most critical stage. The ramifications for China's efforts to ensure food security are on display in the length of the licensing procedure and other variations. In addition, these factors may have an impact on the novel food items obtained using NPBTs. In addition to price and quality, the nutritional value of food makes its safety a top priority. Despite the fact that genetically modified (GM) foods were first made available to the public in 1994, the issues of openness and traceability surrounding them continue to spark heated controversy. There's no denying the allure and size of the market for these GM foods. Commercialization and development of food items in China are heavily influenced by the country's regulatory framework and genetically modified food technologies. Genetically modified organisms (GMOs) were first approved for human consumption in 2015, and since then both animals and people have been known to consume them. With this landmark clearance, there has been a growing public demand for more information on and

evaluation of genetically modified (GM) foods. It took almost a decade to design and commercialize the FlavrSavr tomato, but after that, the market for genetically modified (GM) crops exploded. GM foods were made possible by breakthroughs in rDNA technology in the 1980s.

Waris, et al (2012) Biotechnology has become more important in recent years as a tool for advancing society and the economy. The field of biotechnology is rapidly expanding. One area where biotechnology has been useful is in the development of GM crops and livestock. Organisms whose DNA has been artificially altered are known as genetically modified organisms (GMOs). Common terms for this field of study include "gene technology," "recombinant DNA technology," and "genetic engineering." Selected genes have been moved from one creature to another using this method. Many nations have utilized this method to develop genetically modified crops. Such progress, however, has raised a number of ethical, legal, and health concerns, as highlighted in the review. These concerns must be taken into account while working with such species. While weighing the benefits, it's important to remember that there are drawbacks as well. The use of the GMO has been fraught with difficulties in a number of nations. While the European Union has expressed less concerns about the use of genetically modified organisms (GMOs), the United States is now the largest producer and consumer of GMOs. Bacillus thuringiensis (Bt) cotton is a popular kind of genetically modified organism (GMO). Pakistan has only released Bt Cotton as a commercial GM crop. Some of the minor conflicts that have arisen around the cultivation of genetically modified organisms in Pakistan are explored. This analysis primarily focuses on how genetically modified organisms (GMOs) have affected agricultural output throughout the globe and in Pakistan, providing both positive and negative perspectives. This overview not only discusses the history and present state of GMOs in Pakistan, but also emphasizes synthetic biology as a potential replacement for GMOs by allowing for the creation of new genes without the need for a donor organism. Synthetic biology, Pakistan, GMOs in Pakistan, GMOs, pros and downsides of GM, reservations about using GMOs are some of the key terms in this article.

Gupta, Rasna & Singh, Ram (2017) Genetically modified organisms (GMOs), sometimes known as transgenic organisms, are living things whose DNA has been transformed in laboratories. Genetically modified organisms (GMOs) are the most studied, commercialized, adopted, and regulated use of contemporary biotechnology. The medical, agricultural, environmental, and, more recently, industrial uses of genetically modified plants, animals, and microbes have prompted the development of a wide range of transformation techniques. When it comes to the release of GMOs into the environment for the purpose of food and feed production, genetically modified (GM) plants dominate as the biggest class. The theory is that by reducing the need for chemicals and machinery during planting, maintaining, and harvesting, these will lower production costs. A portion of the cost savings could be passed on to the customer. The nutritional effects may also be advantageous to customers. Foods with increased nutritional density are possible thanks to genetically modified organism technology. The entire potential of GMOs has not been uncovered, despite the fact that it has many more uses. In order to ensure the long-term viability of GMOs in the sectors of medicine, agriculture, ecology, and industry, research capacity must be expanded so that more data can be generated to normalize their advantages. The many forms of GMOs, their respective labels, their uses, and potential effects on human health are all briefly discussed in this chapter.

Das, Sagarika &Bhartia, Sourabh. (2020) Poor agricultural yields due to unfavorable weather circumstances (climate change) and pests have contributed to the expanding global population's impact on food supply. Increased food production may be possible with the use of genetic engineering, thanks to the development of drought- and pest-resistant modified seeds (crops). Growing GM crops on millions of acres of land and then introducing them into our food supply is a massive genetic experiment that affects every living thing on Earth. The rapid changes in genetically modified crop production make it difficult for consumers, farmers, and legislators throughout the globe to agree on a common strategy for the future of food production. Some people believe genetically modified foods are unsafe to eat, even though they have been promoted as a way to save millions of lives from famine. Genetically modified foods have been given a number of negative labels, including the potential to increase antibiotic resistance, changes to the food's natural quality, toxicity, and allergenicity.

RESEARCH METHODOLOGY

Research design

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Students were chosen at random from those enrolled in Environmental Protection, Landscape and Garden Agriculture, Milk Technologies, and Livestock Farming, all of which are known to contain students with varying degrees of knowledge and interest in biotechnology within their student bodies. In order to better enlighten the participants about GMOs, a short definition was added in the questionnaire. Information about the respondent's demographics (age, employment, level of education) was also requested. The study included 100 participants who all filled out questionnaires.

Materials and Methods

Despite the presence of health and social dangers significant no less than the environmental risks, this research attempts to concentrate on the consequences and genetic risks of genetically modified organisms on the environment. Table 1 shows clearly that despite differences in educational attainment, a considerable proportion of individuals still lack information regarding the environmental concerns posed by genetically modified organisms. It is clear from the table that the respondents' knowledge and attitudes varied widely; yet, a majority (59.4%) of those polled was concerned that GM crops might "have negative effects on the environment." This perspective shifts as one acquires more information. In addition, roughly 28.7% of them either do not know or do not have access to information regarding the environmental risks posed by GMOs. Among them, just a tiny fraction held the notion that GMOs pose no danger to the natural world.

Table 1. GMOs could have negative effects on the environment

Level of knowledge	Inclined to agree	Inclined not to agree	Don't know
0 to 4	47.7	9.4	43
5 to 6	57.1	11.9	28.1
7 to 8	60.3	11.6	28.1
9 to 10	61.1	13.2	25.6
11 to 13	66	11.9	22.1
Total	59.4	11.9	28.7

DATA ANALYSIS

The potential risks associated with GMOs on the environment

A. Potential gene escape and super weeds

Concerns have been raised about the possibility of cross-pollination between genetically modified crops and weeds, leading to "super weeds" that are very difficult to eradicate once they get established in a given area. The transfer of pollen from glyphosate-resistant crops to related weeds can confer resistance to glyphosate, which is a cause for concern. Furthermore, the area of genetically modified plants continues to increase at an alarming rate, with an estimate of 102 million hectares in 2006. There are still around 70 million hectares available for the HT (Herbicide Tolerant) variety. Even if the likelihood of this occurring is low, let's pretend it happens. Just because a plant has developed resistance to one herbicide doesn't indicate it has developed resistance to all herbicides. Some are concerned that the plant's propensity to "escape" into the wild and cause imbalances or environmental calamity may be enhanced via genetic engineering. Most agricultural plants have stringent limitations placed on their development and seed dissemination, making their survival in the wild and among weeds almost unlikely.

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Table 2: Potential gene escape and super weeds

Trait	HT	IR(Bt)	IR/HT	VR/Others	Total
1996	0.6	1.1	--	<0.1	1.7
1997	6.9	0.4	<0.1	<0.1	11
1998	19.8	7.7	0.3	<0.1	27.8
1999	28.1	8.9	2.9	<0.1	39.9
2000	32.7	8.3	3.2	<0.1	44.2
2001	40.6	7.8	4.2	<0.1	52.6
2002	44.2	10.1	4.4	<0.1	58.7
2003	49.7	12.2	5.8	<0.1	67.7
2004	58.6	15.6	6.8	<0.1	81
2005	63.7	16.2	10	<0.1	90
2006	69.9	19	13.1	<0.1	102

Source: ISAAA, Clive James, 2006. HT (Herbicide Tolerance), IR (Insect Resistance), VR (Resistance to Virus Diseases)

B. Impacts on "non target" species

Some environmentalists worry that even while GM crops have been tested extensively before widespread commercial distribution, their discharge into the environment might still have unintended consequences. Potential effects are often unexpected. To illustrate, take Bt corn, which is cultivated by experts and treated with a highly targeted insecticide to eradicate a specific kind of bug that feeds on it. A paper published in the magazine "Nature" in 1999, however, stoked the flames of controversy. A team of scientists led by "Cornell" University's "Lucy John" discovered that a strain of genetically modified maize designed to repel insects also has the potential to eliminate helpful insects like the queen butterfly's larvae. High capacity of insects to adapt to selection pressures and that may acquire new recipes and difficult to regulate is another cause of worry for the possible consequences of GMOs on the environment. It has been noticed in the United States that a genetically engineered potato (the Colorado potato) designed to ward against bugs also kills the beneficial insect, the ladybird beetle, due to its toxicity.

C. Loss of biodiversity

The loss of biodiversity in our natural environment is of particular concern to those who care deeply about the environment, including farmers. Because of these concerns, breeders and farmers in the United States and certain European nations have worked tirelessly over the last century to collect and preserve seeds from all types of main crops. Furthermore, the amount of knowledge about genetically modified goods is likely to have a negative impact on biodiversity if it is used in agricultural production.

The amount of knowledge about genetically modified products

Questions about the knowledge of genetically modified foods were included in the survey. Table 3 displays the percentage of respondents who said various things about genetically engineered foods, including whether or not they include gene additions (61%). About a quarter of respondents (23%) felt they had a sufficient degree of knowledge about genetically modified foods, whereas about half (44.0%) felt they had an overall level of understanding (Table 4).

Table 3: measuring the information level regarding the genetically modified products

Questions	**Frequency**	**Percentage**	**P value***	**t-statistics**
GM products are hormonal products	12	12.0	<0.001	2.024
GM products are naturally modified products	61	61	<0.001	0.035
GM products contain gene	23	23	<0.001	-0.058
GM products are natural	4	4	<0.001	0.151
total	100	100.0	0.012	-0.002

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Table 4: the information level about the genetically modified products

Questions	N	%
I have sufficient information	23	23.0
I have a general information	44	44.0
I have very little information	29	29.0
I have no information	4	4

CONCLUSION

Since genetic engineering may transfer a gene from any kind of animal, plant, or bacterium to another kind of creature, regardless of their connection to one another, it is difficult to bring attention to the threats that may be generated by genetically modified crops on the environment. In addition to the destructive effect of this modern technology on the environment, many scientists and environmental protection organizations worry that it could lead to the emergence of organisms with entirely new synthetic qualities that are often harmful in their entirety. To mitigate the environmental concerns posed by transgenic plants, we must devote substantial resources to research across a wide range of fields. There is a growing movement throughout the world to ban genetically modified organisms. This is particularly true in Europe. The decline in biological diversity has been linked to a number of problems, including the spread of invasive species, the development of superweeds, damage to "non target" species, insecticide resistance, and threats to human health. It is well-established that as people's understanding of GMOs has grown, they have become more wary of purchasing GM foods and other items that might have negative effects on human health, genetic variety, and the environment. Based on the findings of the study, it was concluded that using goods containing GMOs poses potential health concerns.

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