

**GMOs In Our World**

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Most of the produce eaten in America has come from plants that have been genetically modified; these produce items are labelled as GMO by American legislation. GMOs were created with the intention of producing a higher crop yield and creating more nutritious foods. Through misunderstanding, media coverage, and faulty scientific studies, the general population has a negative connotation associated with genetically modified organisms. Many believe that GMOs can cause health problems or that they contain unnecessary chemicals and pesticides based solely on what the media has spread. By spreading awareness about the creation, purpose, and governmental agencies associated with the making of genetically modified organisms, the stigma surrounding GMOs can be lifted. GMO products should be widely accepted and utilized throughout the world; GMOs have proven benefits, but the media coverage surrounding GMOs has created a negative connotation in public perception and has impacted GMO legislation.

### **Media Coverage of GMOs**

Over time, the media has spread misinformation surrounding GMOs to the public. On numerous occasions the media has told their audience about possible health risks associated with GMOs, but the truth is, these media companies use “scientifically flawed” evidence and studies to convey their message (Adenle, 2011, p. 2). There are no recognized, peer reviewed works that support the hypothesis that GMOs cause health problems (Helmann, 2020). This phenomena causes the public to question their food security, giving rise to public concern and protesting; even affecting GMO legislation (Adenle, 2011). In all reality, GMOs were meant to “meet the needs of industrialized farming” (Waltz, 2019, p. 573) and not necessarily to meet the ethical inquiries of consumers. For example, some GMO tomatoes are given their signature red color by being placed under ripening lights, and some apples are designed to keep from browning. Many

of these practices go misunderstood, and therefore, fail to “resonate with consumers” (Waltz, 2019, p. 573).

When GMO species are produced in labs, a segment of DNA foreign to the original plant is introduced into the plant’s cells. When the plant’s cells incorporate the DNA segment into its own genome, tissues are taken from it that will culture a new plant. The new genetically modified plant will make seeds that encompass the new genetically modified species. The claim that GMO crops cause health problems is impossible. The only new thing being introduced into the parent species is DNA; all DNA is made of the same components and therefore digested the same by the human body. In fact, close to 70 percent of the food eaten in America is sourced from genetically modified crops, yet there are no cases of death or sickness related to the consumption of GMOs (Adenle, 2011). There was a scientific study done comparing the composition of fatty acids of lambs who ate GMOs to lambs who ate non-GMO crops. The scientists found that the contents of the fatty acids of the two groups of lambs were not significantly different, concluding that GMOs do not have any significant effects on bodily tissues (Siminska, et. al., 2013). In America, the U.S. government, or more specifically, the FDA Center for Veterinary Medicine, ensures that all GMO products fed to livestock perform the same as non-GMO products (“GMO Crops,” 2020). Many media outlets claim that genetically modified organisms contain chemicals that can harm the human body. This claim has no basis when the creation of GMOs is explored, and the accusation that GMOs cause health problems is unreasonable, especially when the making of genetically modified plants is regulated and has been shown to be non-problematic. The way that the media selectively covers stories based on their ability to make the public react is detrimental to GMO product reputation.

Many recent food biotechnology companies pride themselves on health. Even Impossible Foods, a well known brand that revolves around making a healthier vegan alternative to meat, utilizes GMOs within their practices. “Company scientists modified *Pichia pastoris* yeast with a gene encoding soy leghemoglobin, along with other genetic modifications related to the yeast’s metabolic pathways” (Waltz, 2019, p. 574). These genetically modified yeasts can now create protein structures that the company uses to make their vegan meat. Even though these genetically modified yeast microorganisms are the driving force of Impossible Foods’ product creation, the company can escape the GMO labelling by the U.S. government. Impossible Foods is only one example of this phenomenon, and it leads to a misunderstanding in consumers minds. One would assume that products labeled GMO would include everything made of or from genetically modified products, but that is not the case. Consumers are often left in the dark about where their foods come from, and the fear that arises creates false suspicions about the unknown. Impossible Foods does make a healthier alternative to meat using environmentally friendly practices (Waltz, 2019); their use of genetically modified yeast points to the fact that GMOs can create new, innovative practices within the food industry.

### **GMO Benefits**

The negative media coverage surrounding genetically modified organisms drastically fails to fairly represent the benefits of GMOs. Genetically modified organisms were first introduced into agriculture to increase crop yield and prevent crop loss. The way this is accomplished is by bioengineering modified plant species that are resistant to certain viruses, pesticides, and types of insect damage (“GMO Crops,” 2020). Corn, soybeans, cotton, potatoes, papayas, summer squash, canola, alfalfa, apples, and sugar beets are some of the most common genetically modified crops. Among them, up to 94 to 99.9 percent of the total harvested crop is

made of the genetically modified species (“GMO Crops,” 2020). Many consumers fail to realize that so much of their food is made from genetically modified crops in the modern day. If the media accurately represented genetically modified organisms, the public would already be well aware of all the benefits that come with them.

“Some GMO crops were developed specifically to benefit consumers” (“How GMO Crops,” 2020, para. 5). In many cases, GMOs prevent food waste; for example, some genetically modified potatoes resist bruising and result in fewer being thrown out (Waltz, 2019). Genetically modified plants could be modified in a way that affects the produce itself, like the potato example, but some plants are modified in order to create more produce in general. Another praised modification made to some plants is that they are made more nutritious for the consumer (“How GMO Crops,” 2020); one of the best examples of this trait is Golden Rice that was modified to include more Vitamin A. This crop was spread throughout developing countries and helped children facing Vitamin A deficiencies, who without the crop faced blindness and death. Because of the stigma around the GMO, anti-GMO attacks kept Golden Rice from nearly half a million children, depriving them of the Vitamin A they needed to survive (Helmann, 2020). The rainbow papaya provides another heroic GMO story: papaya farming on the Hawaiian Islands was threatened when ringspot virus disease wiped out nearly all of the papayas found there. The rainbow papaya was modified in order to be resistant to the ringspot virus disease that was so detrimental to the Hawaiian papayas; because of this, the rainbow papaya had “saved papaya farming on the Hawaiian Islands” (“How GMO Crops,” 2020, para. 11).

With the higher crop yield that genetically modified organisms bring to the table, the food becomes more affordable and accessible to the consumers. With more food to come by, the food becomes less costly and more attainable across income levels. Because there is a higher

amount of food, farmers are able to lower costs of individual foods, while still increasing their incomes. This process makes a nation's food security higher, and therefore increases the quality of life among their people (Adenle, 2011). Statistics show that GMOs significantly improve the economies of those countries in which they are used (Adenle, 2011); they help countries improve their gross domestic product and trade, create jobs, and are heavily involved in increasing the industrial development of undeveloped countries (Adenle, 2011). Many speculate that the legislative dealings that keep GMOs from undeveloped landlocked countries are unjust because of all the economic growth GMOs would bring to them.

Genetically modified organisms provide numerous solutions and benefits that are often looked past. So many crops are now made to be healthier, economically beneficial, and even more environmentally efficient. Many GMOs enable farmers to produce more on less land. When crops are able to avoid sickness and insect damage, and are designed to produce more units per plant, the process increases farmer's net production. Making the change to genetically modified crops becomes a more environmentally sustainable option when thought about in this light. The farms that primarily use genetically modified crops ultimately use less resources to produce more which becomes the ideal situation in the eyes of both those who economically benefit and those who are activists for the planet.

### **GMO Legislation**

Governments around the world take into account the benefits and social stigma around GMOs while crafting the legislations surrounding them. In the United States, the Food and Drug Administration, the Environmental Protection Agency, and the Department of Agriculture all work together to monitor and regulate genetically modified organisms. The Coordinated Framework for the Regulation of Biotechnology, made in 1986, describes the way the three

agencies work together, and how they ensure that all GMOs under the GMO label are completely safe. The Coordinated Framework for the Regulation of Biotechnology also makes it mandatory that all GMO developers take a safety assessment, which in most cases leads to a conversation with the Food and Drug Administration until safety of the GMO is assured (“How GMOs Are Regulated,” 2020). According to the Center for Food Safety and Applied Nutrition (2020), the United States Government has passed the National Bioengineered Food Disclosure Standard which enforces that by January of 2022 all bioengineered food be labeled. The legislation describes bioengineered food as “those that contain detectable genetic material that has been modified through certain lab techniques and cannot be created through conventional breeding or found in nature,” (“How GMOs Are Regulated,” 2020).

The new labelling mandatory by January 2022:



Center for Food Safety and Applied Nutrition. 2020. *How Can I Tell If I'm Eating GMOs?*

[Bioengineered Food Label] fda.gov. <https://www.fda.gov/food/agricultural-biotechnology/how-gmos-are-regulated-food-and-plant-safety-united-states>

The new American legislation describes exactly what their terminology means and the directive food producers need to follow in order to make their products legal and safe. It is also

important to note that the term “GMO” or “genetically modified organism” is nowhere to be found on any United States Government website, or in the new legislation effective in January 2022. It was these terms that were targeted by media companies and strike up negative thoughts in public minds. The choice to move to terms like “bioengineered” matches the choices of new biotech companies, such as the Impossible Foods example discussed previously. This active choice to avoid certain terminology shows the damage that the media has done to the GMO industry, and how legislative governments have to make an effort to change because of it.

The European Union was also challenged by the movement and media coverage surrounding GMOs. In the 2000s, the European Union had great economic power over poor landlocked African countries, often trapping them in trading agreements (Adenle, 2011). At the time, the European Union was not accepting GMOs, the union was too cautionary because of negative media coverage. This lack of awareness surrounding genetically modified organisms made nations cautionary, especially undeveloped ones that could benefit the most from incorporating GMOs into their agriculture (Adenle, 2011). During this period, the landlocked African countries involved with the EU had varying levels of trust in GMOs, but even the countries that were interested in adopting GMOs were not able to, fearing that they would lose vital trade agreements with the EU (Adenle, 2011). This whole situation demonstrates lack of cooperation between countries involved in the European Union, spread of misinformation, lack of access to GMO products, and unequal levels of trust in GMO products. In this situation, the European Union was abusing its power over the poor African countries who would benefit economically from bringing GMOs into their countries, most likely wanting to prolong their economic and trade control over the people. During this period of back and forth, “Southern African countries were faced with a food crisis due to drought, the food aid provided by the USA



was rejected by Zimbabwe and Zambia simply because the maize was GM,” (Adenle, 2011, p. 3). While these countries faced starvation, Zambia banned GM maize and protested based on illegitimate ideas (Adenle, 2011). These poor African countries relied on the information given to them by developed countries, but the information was based on what the media had spread. The fact that the GMO misinformation had an impact at this level is outrageous; people starved because of economic oppression and lack of education, even when food was readily available to them. The fear of genetically modified organisms had no grounds, but still outweighed the need for food in these people’s minds.

Even when the European Union did implement regulation to be more accepting of genetically modified food sources, they did so in a way that hardly applied to genetic engineering at all. The EU legislation describes that ““foods containing material which contains, consists of or is produced from GMOs in a proportion no higher than 0.9%”” (Weighardt, 2006, para. 2), should be labelled as GMO. Assuming that the European Union was referring to a GMO as a whole good, as in, a genetically modified tomato, the legislation holds unreasonable. Imagine tomato sauce made from 0.9% tomatoes; or wheat products made from only 0.9% wheat flour. Because the legislation does not necessarily state that, we can explore other options that fit the rule. Weighardt (2006), an author published in *Nature Biotechnology*, explains that it only makes sense that the ingredient is measured according to the quantity of genetically engineered DNA existing in the ingredient. But then, there arises a new problem. The modern process for measuring DNA is called PCR, or polymerase chain reaction. In this process, a select piece of DNA is found in a genome of an organism, extracted, and copied millions upon millions of times until there is an adequate amount of DNA to be analyzed. This amount is usually recorded in micro or nano grams, in other words, about 0.00000001 or 0.000000001 of one gram. Even if

scientists were to come up with a ratio of modified DNA to plant matter, it would yield inaccurate results for many reasons (Weighardt, 2006). There is no accurate way to come up with a standard weighing ratio of modified DNA to plant matter. Based on how the crops are treated, or the weather conditions, the DNA ratios can drastically change (Weighardt, 2006). Even Monsanto, a trusted company in the United States, is quoted saying, “the ratio GMO-DNA/non-GMO-DNA reference materials may significantly deviate from the certified powder mass ratio values,” (Weighardt, 2006, para. 7). The European Union disregarded this known fact within their own legislation; but on top of that, they have also disregarded plant biology all together. Even the same species of plant experience genetic variation through the reproductive process, and may experience different ploidy (Weighardt, 2006). When large multicellular organisms reproduce, genetically modified or not, the two parent genomes go through recombination in which their genes are mixed to create an offspring genome. It is very likely that the modified genetic code could be changed through this process, while the expression of the gene stays the same. The European Union legislation does not account for this in any way, even though it is a well known concept in biology. Another key concept when talking about plant biology is the concept of ploidy, in which plants of the same species can possess multiple genomes in each of their cells, making it impossible to have a set ratio of modified DNA to plant matter. Even when the European Union allows GMOs to be governed within their system, the group makes the legislation non applicable to the subject matter. It is evident that the legislators took no effort to educate themselves on the concept of genetic engineering or plant biology when crafting the 0.9% concept of their legislation. Unlike the United States law, which is straightforward and applicable even for those who do not have a science background, the European Union creates laws that are confusing for even the scientists who specialize in the subject.

The poorly constructed legislation is challenging enough for GMO circulation, but on top of that, a common thought is that GMOs should be removed from the European Union. Helmann (2020), a former diplomat and author, suspects “that doubts among the general public about GMOs have less to do with safety concerns and more do with protecting non-GM producers and defending the questionable claims of ‘organic’ marketers against competition” (Helmann, 2020, p. 92). She explains that “organic” lobbies abuse their economic power to influence agriculture legislation, and that anti-GMO groups hold subsidies over farmer’s heads to ensure that genetically modified crops stay out of the European Union (Helmann, 2020). Ulterior motives hinder all the positive things genetically modified organisms could accomplish for the planet. Media companies and legislative bodies continue to be motivated by economic gain rather than the betterment of society.

### **The Negative Aspects of GMOs**

Ultimately, there are no accepted peer reviewed studies that point to GMOs having any negative health effects (Helmann, 2020), meaning that most of the criticism brought to the argument against GMOs do not have any valid scientific basis to ground upon. However, Babcock and Francis (2000) describe GMO issues that arise outside of the GMO science. They explain that after GMO crops are introduced into a nation’s agriculture, not all farms will see “equitable benefit” (Babcock & Francis, 2000, p. 1309). Large corporations would have the first access to the profitable GMO species and would have economic control over the genetically modified produce before smaller scale farmers would; saying that the smaller farms would be “least likely to benefit from new and costly technologies” (Babcock & Francis, 2000 p. 1309). This methodology behind the spread of GMOs reinforces an already existing economic hierarchy that would then also include GMOs. Babcock and Francis (2000) describe an issue that is not

exclusive to GMOs, but about farming technology in general. They talk about farmers “producing food for local markets” (Babcock & Francis, 2000, p. 1309), which are often owned by families that work for themselves. When compared to large industrialized farming corporations, these small family owned businesses do not have the funding to compete by any means. This argument could also be made about machinery, pesticides, or labor practices; in all cases, larger corporations will have the funds necessary to invest in new technologies that they can readily implement. To say that this issue is exclusive to GMOs is not a fair assessment of the agriculture industry.

Babcock and Francis (2000) make another argument against GMOs, saying that the produce would hurt local culture and tradition (Babcock & Francis, 2000). They quote an African delegate from a 1998 Ford and Agriculture Organization meeting, in which the delegate is quoted, ““We think it will destroy the diversity, the local knowledge and the sustainable agriculture systems that our farmers have developed for millennia and that will thus undermine our capability to feed ourselves”” (Babcock & Francis, 2000, p. 1309). Some of the most common alterations made from original crop species are herbicide tolerance and insect/pathogen resistance; in all other aspects, the original and genetically modified species of plant are identical and can be treated as such in agriculture systems. Therefore, the African delegate’s people could keep their vital agriculture practices. With the GMO crops treated the exact same way as the original crop species, the crop yields will be higher because of the genetic alterations, and crop prices will be made cheaper because of the crop abundance. This way, the country's poor will have an easier time affording fresh food, and the country will have lower rates of starvation and malnutrition. With the introduction of GMOs into the African country, the people can keep their agriculture traditions and lower their rates of starvation and malnutrition within their poor

communities, improving the well being of their country. Instead of hurting the culture and local practices, GMOs would enable traditional practices and improve health among the people.

### **GMOs In Our World**

Genetically modified organisms have the power to greatly improve the quality of life of people who utilize them for good. They provide so many solutions that are searched for in today's society: people want to eat healthier, support local communities, and solve world hunger. All of these things can be accomplished using genetically modified organisms. Through the years, the media has tarnished the term "GMO" in consumers' minds, so much so that the toxicity surrounding the subject affects governing bodies and fuels economic greed. This cycle of abuse is very harmful, especially for the people who need GMOs the most. Denying healthy food to people who do not know any better is a crime disguised in misinformation and legislative ties. The only way to improve upon past misfortune is to open up and promote insightful conversations about science and educate those who rely on the media for the truth. By doing this, the world will see great biotechnology innovation.

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