GM No

Abstract: This paper, written for Introduction to Composition, ENGL 1010, examines the effects genetically modified organisms (GMOs) can pose on human health and the environment. After researching the field and reading scientific studies and other journal articles, I took the stance of opposing GMOs. The research I conducted during the course led me to believe that GMOs are inherently harmful. For example, there are undesirable effects on human health due to the consumption of GMOs, as well as harmful effects on the environment in which they are grown. I concluded that these negative outcomes of utilizing GMOs outweigh the possible benefits, which include efficient agriculture practices and a promise to end world hunger. Through this writing it is made evident that these encouraging benefits aren't possible or they fall short when compared to the negative effects.

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Percy Schmeiser grew canola on his farm in Saskatchewan, Canada, for 40 years. Each year he would save seeds at the end of the harvest to sow crops for the next year. However, in 1998, his farming routine was interrupted when Monsanto, a multinational agricultural biotechnology corporation, took him to court. The corporation sent investigators, who found samples of its genetically modified (GM) canola among Schmeiser's stock. Monsanto alleged that he violated its patent held on the GM seeds and accused him of obtaining the seeds illegally, even suggesting that he had stolen them from a seed house. The GM canola plants likely appeared on Schmeiser's land as a result of cross-pollination or seed movement caused by the wind, which is the main reason for contamination involving GM crops. This, however, seemed irrelevant as the judge ruled in favor of Monsanto and told Schmeiser that all his seeds, which he had developed over nearly half a century, now belonged to the corporation. As Schmeiser put it, this allowed Monsanto to "make [him] burn them, or destroy them by any other means . . . or harvest them, in which case [he would have to] give it all the seeds from [his] plants as well as [his] profits." (Goldsmith).

At the point where an extremely wealthy corporation is going out of its way to ensure it gets every last cent out of every genetically modified seed it creates, we are left to wonder if the direction genetic modification is going, as well as the other risks associated with it, are worth the positive benefits it can bring to fruition.

The answer to this is no. While the potential of GMOs is promising from a theoretical perspective, such as producing crops that are resistant to pests and drought, the negative impacts on health and the environment outweigh the possible

benefits. It can be argued that the benefits of genetic modification, specifically in food crops, can allow surpluses of food to be produced. This, as is claimed, can help the malnutrition and starvation problem taxing the world. However, the harmful effects associated with GMOs outweigh the potential advantages they may produce.

Genetically Modified Organisms are "plants [or other organisms, such as animals]… whose genetic makeup (DNA) has been directly modified using genetic engineering techniques" (Commission of the European Communities). According to Andrew Curry, a foreign correspondent and journalist for *Discover*, the inception of genetically modified crops began in the 1970s, when scientist Norman Borlaug crossed short, sturdy dwarf wheat varieties with high crop-yielding varieties to produce a hybrid wheat crop that could produce significant amounts of wheat and be sturdy enough to support it. After this breakthrough, another occurred in Belgium at Ghent University, where biologists Marc van Montagu and Jeff Schell discovered that the bacterium Agrobacterium tumefaciens caused plants to develop tumors by altering the plants' genetic code through a process of lending its own genes. Thus, the field was truly opened for altering an organism's genetics. If a bacterium and a plant could exchange genes, then other organisms had this same potential (Curry). This discovery created a hopeful outlook for the uses of GMOs– one that had the potential to better agricultural practices and go further to create surpluses of food to help contest hunger and malnutrition problems globally.

Genetically Modified Organisms do have very promising potential from a theoretical standpoint. One main objective in the development of GMOs is to produce more sustainable crops. One method by which crops can be fabricated to be more sustainable is by "insert[ing] an insect's genes into a plant" to create a pest-resistant crop (Demenet).

One example of this occurred when van Montagu used Bacillus thuringensis (Bt), a bacterium used in a common organic pesticide, which produces a protein deadly to certain pests. The biologist isolated DNA from Bt and inserted it into the genetic code of a tobacco plant, which then could manufacture its own pesticides (Curry). The same has been done with Monsanto's Roundup Ready line of crops that are designed to be resistant to its Roundup chemical herbicide. This way, fields can be sprayed with the herbicide to kill any weeds inhabiting the field without harming crops.

Food sources can also be altered to include other positive benefits, including "insert[ing]…vaccines into bananas or potatoes" (Demenet). This could provide nutrient-rich food that also assists in providing immunity to certain diseases. Also, plants can be manufactured to need less water, as well as be "enrich[ed] with vitamins and minerals . . . that revitalize acidic soil devastated by over-farming. . . . The aim is to make [crops] naturally resistant to drought, soil salinity, viruses, blights, and other scourges," which can allow harvests in dire circumstances, such as in an arid climate (Demenet). This creates the potential to "guarantee 'food security' in the short term for the world's 826 million undernourished individuals" (Demenet). The burden of producing sufficient food supplies could be alleviated if food can be grown in unfertile climates, which could help combat the increasing hunger problem the world is experiencing. This is possibly one of the most promising ambitions of genetic modification.

Because of these positive outcomes, GMOs have had "a 9,000 percent increase [in agriculture] in 15 years" (Curry). However, even when persuasive arguments can be made in favor of GMOs and their potential benefits, more compelling arguments come from the opposition. While it is advantageous for crops to be produced that resist

herbicides and repel pests, produce higher yields in arid climates, and have the potential to help eliminate malnutrition and starvation problems, the research done by those opposing GMOs concludes that the risks involving health and the environment, as well as the fact there is no solution to reducing global hunger, make it evident that GMOs are not a beneficial resource.

One main reason genetically modified organisms have no place in providing nutrients to humans is the negative health impacts that accompany GM crops. "80% of all processed foods in the U.S. are made with GMOs," which is extremely unsettling because of the health concerns genetic modification poses to humans (Belli). This isn't surprising, considering, "[s]ix companies–Monsanto, Syngenta, DuPont, Mitsui, Aventis, and Dow–now control 98 percent of the world's seed sales," and all of these companies invest in genetic modification technology (Kingsolver 51). According to the American Academy of Environmental Medicine, "There are serious health risks associated with eating GM foods, including infertility, immune system problems, accelerated aging, disruption of insulin and cholesterol regulation, gastrointestinal problems, and organ damage" (Smith). The research conducted by the AAEM, as well as reports by farmers worldwide, have shown that GM foods caused numerous sick, sterile, and dead livestock, toxic and allergenic reactions in humans, and damage to nearly every organ that was studied (Smith). GM food can also have adverse allergenic effects. According to Behrokh Mohajer Maghari and Ali M. Ardekani, of the Biotechnology Department, Iranian Research for Science and Technology and the Reproductive Biotechnology Research Center of the Avicenna Research Institute, "Foodborne diseases such as soya allergies have increased . . .

[as] recent studies have revealed that *Bacillus thuringiensis* corn expresses an allergenic protein which alters overall immunological reactions in the body." Frighteningly, the United States Food and Drug Administration has allowed GM foods to enter the market with no regard to labeling or safety testing even though its own scientists warned otherwise (Smith).

One study done by French scientists ascertained the negative health effects of GMOs by testing a group of rats over a two-year period. Each test group of rats was fed varying amounts GM crops, specifically herbicide-resistant corn, over a period of time equivalent to their lifespan. The study proved that Monsanto's Roundup Ready corn causes severe health effects, including tumors and kidney and liver damage, resulting in premature death (Philpott). The results of this study confirm that GM foods have negative impacts on health in rats, which may be paralleled in the health of humans.

Research has also proven that the threat of GM food goes past simply eating it. Herbicide-resistant genes found in GM soy have the potential to transfer into the bacteria that occupy the intestines and can further function there, which "means that long after we stop eating GMOs, we may still have potentially dangerous GM proteins continually produced inside us" (Smith). With this information in mind, it is difficult to justify the positive benefits GMOs can have when weighed against such detrimental health issues.

Genetically modified organisms also pose a threat to the environment. One modification made to the genetics of food crops is a resistance to herbicides. When glyphosate is added to the genes of plants, the plant becomes immune to the

herbicide. In turn, farmers can spray their fields with glyphosate, also called Roundup, and kill weeds without harming the crops. This eliminates the need for till farming and manual labor to rid fields of weeds. Unfortunately, weeds such as "ragweed and horseweed [have] developed herbicide tolerance as well" (Imhoff). As this happened, farmers had to spray multiple applications throughout the season instead of one annual application. This just further developed the weeds' resistance, and forced farmers to use 'cocktails of multiple chemicals.' The more time weeds were exposed to chemical applications, the stronger resistant traits were expressed (Imhoff). According to Penn State University weed scientist David Mortensen, this process has created herbicide-tolerant "super weeds" that have affected between 70 and 80 million acres of cropland (Imhoff). This has led to a shift in creating GM crops that are tolerant of more potent chemical herbicides. A study cited by Imhoff done by Charles Benbrook from the Center for Sustaining Agriculture and Natural Resources at Washington State University, concluded:

> [H]erbicide use [has] increased over the 16-year period [since GMOs have been introduced] by 527 million pounds. . . . Introducing a new generation of crops tolerant to a different herbicide is predicted to significantly increase the amount of chemicals sprayed across the fields of rural America. Just as alarming, dicamba and 2,4-D [a chemical used in Agent Orange which has been linked to forms of cancer, Parkinson's Disease, nerve damage, hormone disruption, and birth defects] are known to volatize more easily than most herbicides.

> They can travel for miles, impacting non-target crops, human communities and wildlife long after application. (Imhoff)

This shows a trend in increased herbicide use as a result of genetic modification. Instead of creating crops that require less herbicide use, the tolerance weeds are building have led to an increase in the use of more harmful herbicides. These herbicides, dicamba and 2,4-D, are harmful not only to the environment, but also to the health of humans who consume the crops that have been sprayed.

Another problem with herbicide-resistant crops concerns crop rotation. Farmers rotate crops in their fields to avoid soil depletion. This "will inevitably occur . . . when maize is rotated with other transgenic crops that are resistant to herbicides" (Devos, Cougnon, Vergucht, Bulcke, Haesaert, Steurbaut, and Reheul) and, in turn, previous crops that shouldn't grow in the next rotation will not be affected by herbicides. Now farmers will have to manually rid their fields of the unwanted crops. This defeats the purpose of herbicide-resistant crops.

Another environmental concern arises with pollinators, such as bees, that assist in pollinating plants. The behavior of pollinators determines how and which plants are pollinated. This means they may impact transgene movement into wild plant populations. If transgenic crops are close enough in range with native wild relatives, wild populations may be negatively affected when they come into contact with transgenic pollen carried by pollinators (Prendeville and Pilson). This introgression would mean the negative effects occurring in cultivated populations would happen in the wild, affecting wildlife that would consume the affected plants.

If these health and environmental concerns weren't bad enough, the corporations that produce GMOs are beginning to abuse their technology. These "food-marketing machine[s] that thrive on change for [their] own sake" have surpassed altering genes to benefit farmers and have begun to modify genes for their own profit (Pollan, 4). Monsanto, the seed giant that sued Percy Schmeiser, has been forcing "[f]armers [to] pay a premium for [its] seeds, and to make sure they keep paying, the company [has] require[d] them to sign an agreement promising not to plant seeds their crops produce" (Kluger, Bjerklie, Ganguly, and Thompson). Since this is hard to police, the corporation is now producing and selling seeds to farmers that yield only a crop harvest, but no next-generation seed, "hop[ing] to enforce biologically what it can't enforce contractually" (Kluger, Bjerklie, Ganguly, and Thompson). Using the same process van Montagu did when inserting bacterium DNA into tobacco plants, Monsanto's scientists have modified the reproductive gene in their crops to produce sterile seeds. This has two major concerns. One is that the technology behind genetic modification is now being abused so that a multibillion-dollar corporation can make even more money than it already does. The second is direr:

> Worse still, some doomsday scenarios suggest, pollen from Terminator plants could drift with the wind like a toxic cloud, cross with ordinary crops or wild plants, and spread from species to species until flora all around the world had been suddenly and irreversibly sterilized. (Kluger, Bjerklie, Ganguly, and Thompson)

Beside the startling plant-eradicating potential of Terminator crops, this further proves that the GMO campaign has shifted from focusing on producing sustainable crops to help the hunger and malnutrition problem taxing the world to making higher profits for the corporations creating the GMOs. The investments of corporations, such as Monsanto, that are making the GMO push, are no longer concerned with creating resistant, high-yielding crops, but instead in their own profits. It is one thing to modify a crop's genetics to allow it to grow in an arid climate, but when a company specifically modifies genetics to prohibit seed production so a farmer has to continue to purchase seeds, it has gone too far.

One last position condemning the use of genetically modified organisms is the lack of solvency for the claims of ending world hunger and malnutrition. First, the problem with lack of food is a perpetuating cycle. If a population can be supported with adequate amounts of food, soon that population will grow, and food becomes scarce. More food can be produced to compensate for the larger population, but then the population will grow again. In this case, the hunger problem can never be solved. As Demenet reported, "In 50 years, the Earth's population will have soared to nine billion . . . and most of the newcomers will increase the already overwhelming pressure on . . . much depleted soil" and this process will continue as the food demand is met and a larger population ensues. Demenet also argues, "[L]ow food production is not what causes malnutrition. There is enough to eat in the southern countries . . . but the world's poorest people . . . simply have no access to food." The problem is not producing enough food; it's making that food available to those suffering from malnutrition and starvation. The

fact that the corporations who create GM crops sell their seeds at such burdening costs prohibits the small-scale farmers in poor nations from reaping the benefits of growing GM crops (Demenet).

Percy Schmeiser, the farmer from Canada, appealed his case against Monsanto twice, eventually leading to a hearing in the Canadian Supreme Court. Schmeiser lost both appeals, and the court ruled in favor of the giant biotech corporation. Just as Monsanto held no regard for the financial wellbeing of Schmeiser in its quest for money, it and the rest of the genetically modified food industry hold no concern for the rest of the human population. While Schmeiser experienced harmful financial effects, our health is what is at jeopardy in the case of GMOs. In theory, it seems very wise to claim the profits of a crop that resists herbicides, creates its own pesticides, produces high yields, can thrive in arid climates, or can incorporate vaccines. The promise of ending world hunger using the practice of genetically modified organisms is also a compelling reason to favor them, theoretically. However, when informed of the problems associated with human health–such as increased cancer risks, hormone imbalances, and liver and kidney damage– as well as the environmental risks posed, it is clear that GMOs aren't as promising as they appear in theory. When factoring in that technological practices of creating GMOs are now being used to create higher profit margins for corporations such as Monsanto through terminator seeds, the practicality of GMOs decreases. Then, when it is made clear that the promise of eliminating hunger and malnutrition problems globally can't be solved, there really seems no strong claim to affirm the

practice of genetic modification. It is evident that the negative impacts of GMOs outweigh the possible benefits.

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