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Writing for the Sciences

Research Paper

***Genetically Modified Organisms against world hunger***

 Genetically modified organisms or GMOs represent one of the most controversial topics in the world of science. Many scientists point to GMOs as the solution to many of our world's problems including climate change, and world hunger. Others argue that the environmental effect that these modified organisms can pose to our world if set free can be devastating. These arguments lead us to a fork in the road to the future of humanity. Are GMOs a viable solution to solving world hunger, or are the side effects of spreading GMOs around the world too dire for humanity to endure?

 According to the World Health Organization (WHO, n.d.), world hunger has been on the steady rise since 2015, with an estimated 820 million people not having enough food to eat. This stat includes children of all ages who have their growth and development stunted by lack of proper nutrition. Among the countries most affected by the rise of lack of sustenance are those in the continents of Africa and Asia. The steady rise in underfed population of Africa is alarming. Countries in Eastern Africa report that over 30% of the population is underfed. (WHO, n.d.)

 In addition to military conflict and a struggling economy, the increasingly inclement weather of the African continent has worsened the access to food for the population of countries of East Africa. The population of developing countries in this area of the world, heavily rely on their own land for sustenance. According to the Environmental and Energy Study Institute (EESI, n.d.)  “70 percent of inhabitants still directly rely on the land for their livelihoods”. As the population increases, landowners are overusing the land, exhausting its nutrients and rendering it unfit for the growth of crops. Combine this with the harsh climate of the area and worsening weather conditions and its obvious why the population of this area is mostly malnourished. (EESI, n.d.)

 The increasingly harsh weather changes have brought forth devastating floods, long droughts, shifts in rain patters and high temperatures. The direct effect these have on the lands can render lands unfit for crops and livestock on their own .However, the indirect effects of soil erosion caused by storms,  pests and diseases put on the crops and livestock by the warmer weather can make it almost impossible to make use of the lands. The deteriorating weather also “impairs transportation for access to food. Food spoilage as well as pest and pathogen damage become more likely when food deliveries are delayed or blocked”. (EESI, n.d.)

 Enter Genetically Modified Organisms. Humans have been utilizing genetics to modify the traits of other organisms like crops and animals for millennia. Many even suggest that the modification of animals is one of the most important tools for the success of our species. By mating organisms with desirable traits, through artificial selection, we ensure we will get more desirable traits in organisms. However, the term GMO is more accurately used to describe organisms produced by “the production of heritable improvements in plants or animals for specific uses, via either genetic engineering.” (USDA, n.d.) Genetic engineering, is the key word here, as it employs the “manipulation of an organism's genes by introducing, eliminating or rearranging specific genes using the methods of modern molecular biology” (USDA, n.d.)

  With genetic engineering (GE), modifications to the genome are virtually infinite. With these techniques we can suppress phenotypes or increase others in organisms.  By splicing genes from other organisms and isolating them one could even add new genes to any other underlying organism’s genetic code. Genetic engineering has already come to produce species of crops that produce proteins that can work as pesticides called Bt plants. These plants have been added a gene from a bacterium called *Bacillus thuringiensis* (*Bt*), which produce a protein lethal to common pests that attack crops. These are commonly called insecticidal plants and can reduce the usage of expensive and sometimes climate damaging pesticides. (Micheal, 2015)

 So why is it that GMOs have such a bad perception in the food industry. Why is it that, many food companies, spend millions on their public relations and advertisement teams to market their products as GMO-free? Is consuming GMOs detrimental to our health? Genetic engineering has been a controversial topic since before humans started using it, as it is considered by many to be unnatural. When GMO food products were first introduced to the food industry, many theorized about its effect on consumers’ health. After many years of GMO products on the free market, the science is in. After more than 30 years since the discovery of GE crops, an overview of 10 years of scientific papers has concluded “the scientific research conducted so far has not detected any significant hazards directly connected with the use of GE crops”. (Carchedi, n.d.) A Committee on Genetically Engineered Crops held by the National Academies of Science, Engineering and Medicine has concluded that GMOs are safe to eat. (NAP, n.d.) More than 150 Nobel Laureates support GMOs as a safe option for consumption. (Precision, n.d.) Most experts around the world have concluded GMOs are safe to eat. Why shouldn't we embrace GMOs as the solution to end world hunger?

As with everything, the overuse of GMOs can pose a dangerous strategy. Ecologically, GMOs can disrupt the natural gene flow in our environment. Gene flow is the introduction of new alleles into a population of organisms. (Britannica, 2020) GMOs have unfair, unnatural advantages against non-GMOs which means they can unfairly compete with the genotypic composition of a population. In some cases, this can even render certain, otherwise favorable, alleles extinct or endangered. When there is a relatively low allele variation in a population, has proven detrimental in many populations of organisms. (Lamb, 2015) For example: the “potato famine that afflicted Ireland in the mid-1800s...they planted sections from a parent potato… [ so that] all potatoes were clones of their parents and contained identical genetic information… an invasive pathogen, *P. infestans*, wiped out the entire population”.(Lamb, 2015) A major disruption in gene flow can render our crops vulnerable against unforeseen changes on their environment. Natural selection wouldn't be able to counter the effects of nature by which life has adapted by over millions of years.

The risks of introducing GMOs into our environment can prove detrimental if left unchecked. However, population controls have been devised to counter the effects of unnatural competition. Methods like zone buffering and terminator seeds are considered viable options to prevent ecological irreversible damage that GMOs can cause.

GMOs and genetic engineering have virtually unlimited potential. With this technology, what we could achieve is only limited by our imagination. GE crops have been engineered to resist harsh droughts, like those preventing harvests in Tanzania. These maize seeds are “genetically engineered with a gene to help them tolerate water-stress during the all-important flowering and seed-filling stage is obvious to everyone”. (Cornell, n.d.)  These seeds could help restart plantation and crop harvesting in these developing hungry countries.

GMO crops can also be engineered to be more nutritionally significant food items. Crops can have additional vitamins and nutrients that can fulfill nutritional needs with less food content. This is the idea behind the Golden Rice initiative. Golden Rice has been specifically engineered to be a rich source of important micronutrients that are deficient in the diets of poorly fed countries. The goal of the engineers behind the Golden Rice project is to tackle the “The most damaging micronutrient deficiencies in the world [which are] are the consequence of low dietary intake of iron, vitamin A, iodine and zinc”. (Mayer, n.d.) This is perhaps one of the most promising uses of GE. This is a viable, sustainable solution to feeding many in these countries where food is scarce.

World hunger is one of the most pressing issues or society faces. Food insecurity, especially in countries of Eastern Africa, has been on a steady rise for the last couple of years. As the population keeps growing, statistical analysis suggests that the problem will only get worse if nothing changes. GMOs are perhaps one of the most misunderstood topics in the scientific media. A topic that was first expected to have negative effects on the health of those who consume them. These misconceptions are founded in merely incorrect assumptions of the past. After 30 years science has spoken, and GMOs are considered safe to eat. The environmental effects of GMOs can now be contained by applying strategies like zone buffering and terminator seeds.

GMOs are the viable solution to solving world hunger. They are the best tool we have against world hunger and as such we should start changing our perception of it and embracing its responsible use around the world.

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