

Advantages and disadvantages of genetically modified organisms biology essay



The benefits and risks of any particular genetically modified crop depend on the interactions of its ecological functions and natural history with the agro-ecosystem and ecosystems within which it is embedded. These evolutionary and ecological factors must be considered when assessing genetically modified crops. We argue that the assessment of genetically modified crops should be broadened to include alternative agricultural practices, ecosystem management and agricultural policy. Such an assessment ecological services that support it. The benefits of genetically modified crops should be compared to those of other means of agricultural intensification such as organic farming, integrated pest management and agricultural policy reform. A gradual and cautions approach to the use of genetically modified crops that relies on a truly comprehensive risk assessment could allow people to reap substantial benefits from genetically modified crops while mitigating their serious risks.

INTRODUCTION

Genetically modified organisms (GMOs) is an organism whose genetic material has been altered using genetic engineering techniques. These techniques generally known as recombinant DNA technology, use DNA molecules from different sources which are combined into one molecule to create a new set of genes. This DNA is then transferred into an organism, giving it modified or novel genes.

Genetically Modified Organisms can be produced by gene cloning methods in which a non-native gene is introduced and expressed in a new organism.

Generally the new protein has also been somewhat modified or engineered

for proper expression in the new host. In particular, differences between microorganisms and eukaryotic cell must be overcome, such as the presence or absence of introns, occurrence of DNA methylation and certain post-translational modifications to the protein itself for proper transport within or between cells. The advent of PCR and gene sequencing methods have opened up the door to all sorts of manipulative techniques for changing the structure of protein through genetic alterations.

The introduction of bacterial genes into cash crops, to enhance their growth, nutritional value or resistance to pests, is becoming rather common place in plant technology.

One example that has made frequent headlines is the introduction of bacterial genes for natural pesticides into plants in order to eliminate the need for chemical pesticide use. The drawback to this technology is public concern over the consequences of ingesting these natural pesticides. Problems such as these might be alleviated by site-specific expression of the gene or control of expression throughout the lifecycle. For example, it might cause less concern if expression of a pesticide gene in the leaves of young plants could be used to prevent foliage from being destroyed early on without expression in the fruit later in the lifespan.

Advantages of Genetically Modified Organisms

The world population has topped 6 billion people and is predicted to double in the next 50 years. Ensuring an adequate food supply for this booming population is going to be a major challenge in the years to come. Genetically modified foods promise to meet this need in a number of ways:
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Pest resistance

Crop losses from insect pests can be staggering, resulting in devastating financial loss for farmers and starvation in developing countries. Farmer typically use many tons of chemical pesticides annually. Consumers do not wish to eat food that has been treated with pesticides because of potential health hazards and run-off of agricultural wastes from excessive use of pesticides and fertilizers can poison the water supply and cause harm to the environment. Growing genetically modified foods such as B. t. corn can help eliminate the application of chemical pesticides and reduce the cost of bringing a crop to market.

Herbicide tolerance

For some crops, it is not cost-effective to remove weeds by physical means such as tilling so farmers will often spray large quantities of different herbicides (weedkiller) to destroy weeds, a time-consuming and expensive process, that requires care so that the herbicide doesn't harm the crop plant or the environment. Crop plants genetically-engineered to be resistant to one very powerful herbicide could help prevent environment damage by reducing the amount of herbicides needed. For example, Monsanto has created a strain of soybeans genetically modified to be not affected by their herbicide product Roundup. A farmer grows these soybean which then only require one application of weed-killer instead of multiple applications, reducing production cost and limiting the dangers of agricultural waste run-off.

Disease resistance

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There are many viruses, fungi and bacteria that cause plant diseases. Plant biologists are working to create plants with genetically-engineered resistance to these diseases.

Cold tolerance

Unexpected frost can destroy sensitive seedlings. An antifreeze gene from cold water fish has been introduced into plants such as tobacco and potato. With this antifreeze gene, these plants are able to tolerate cold temperatures that normally would kill unmodified seedlings.

Drought tolerance/salinity tolerance

As the world population grows and more land is utilized for housing instead of food production, farmers will need to grow crops in location previously unsuited for plant cultivation. Creating plants that can withstand long period of drought or high salt content in soil and groundwater will help people to grow crops in formerly inhospitable places.

Nutrition

Malnutrition is common in third world countries where impoverished people rely on a

single crop such as rice for the main staple of their diet. However, rice does not contain adequate amounts of all necessary nutrients to prevent malnutrition. If rice could be genetically engineered to contain additional vitamins and minerals, nutrient deficiencies could be alleviated. For

example, blindness due to Vitamin A deficiency is a common problem in third world countries.

Pharmaceuticals

Medicines and vaccines often are costly to produce and sometimes require special storage conditions not readily available in third world countries.

Researchers are working to develop edible vaccines in tomatoes and potatoes. These vaccines will be much easier to ship, store and administer than traditional injectable vaccines.

Phytoremediation

Not all genetically modified plants are grown as crops. Soil and groundwater pollution continues to be a problem in all parts of the world. Plants such as poplar trees have been genetically engineered to clean up heavy metal pollution from contaminated soil.

Disadvantages of Genetically Modified Organisms

The pros and cons for using genetically modified organisms (GMOs) are vast and varied but there is little argument over the uncertain consequences of this relatively new science. The pace at which GMOs have found their way into the food supply is what frightens many opponents, as long-term risk assessments won't be available for many years.

Long-term health effects

The science of genetically modifying organisms is in its infancy, coming online in earnest in the mid-1990s. Pressure from agricultural interests and the scientific community eager to prove the viability of the process has led to what some would call an irresponsible rush to market of these products.

More than 60 percent of the products in most U. S. grocery stores are derived from sort of genetically altered plant or animal, notes Nina Fedoroff, a molecular biologist at Penn State University in the spring 2007 issue of Science Journal. There simply hasn't been enough time to study the long-term health effects on humans from eating genetically altered foods.

Gene spilling

Many of the arguments against bio-engineered food stuffs focus on the law of unintended consequences. It is unclear what effect, if any, genetic pollution from inadequately sequestered populations of genetically modified crops would have on the surrounding wild varieties. Releasing pollen from genetically altered plants into the wild via wind and insects could have dramatic effects on the surrounding ecosystem but there is no long-term research yet available to gauge the impact.

Reduced biodiversity

Biodiversity even within a species or genus, keeps plant and animal population viable. If a particular virus for example, affected corn in Northern Iowa but the slightly different variety of corn grown on an adjacent farm was immune, only the portion of the crop susceptible to the virus would be lost.

As genetically engineered crop consume more and more acreage, the

number and variety of wild species is reduced. Such as alignment threatens <https://assignbuster.com/advantages-and-disadvantages-of-genetically-modified-organisms-biology-essay/>

the entire supply as pests and diseases repelled by just one or a few genetically altered varieties develop resistance to those defenses.

In a doomsday scenario, a lone pathogen could wipe out an entire harvest nationwide

and spawn years of underproduction as the agriculture industry struggles to recover and combat the threat.

Cross-pollination

The potentially negative environmental impacts of GMOs are numerous, and many are as yet unknown and could be irreversible. These include the loss of flora and fauna biodiversity, unintended harm to other organisms and reduced effectiveness of pesticides. According to the Food and Agricultural Organization of the United Nations, one of the biggest concerns is the creation of “super weeds”: the unintentional transfer of herbicide resistance genes from desired crops to weeds. Some of these concerns, however, are the same concerns that could occur with breeding.

Genetic consequences

The artificial insertion of genes into organisms could destabilize that organism, encouraging genetic mutations that could be detrimental either to the environment, to humans or both. Insertion of the desired gene into a crop's genome could activate or deactivate other genes, causing unintentional consequences as well. For example, genes that orchestrate the precise development of tomatoes could be de-activated, leaving tomatoes

rotting on the vine before maturation. Long-lived organisms, such as trees,
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would be most at risk with consequences unknown for perhaps years. It's entirely possible they would no longer bear fruit, or they would have weak trunks. Characteristics of bark we may rely upon for paper products may disappear. The possibilities are essentially endless. Furthermore, changes in gene expression of genes that already exist in the organism may have negative consequences by interacting with the product of the inserted gene. For example, the gene coding for the red color of berries could interact with the inserted disease resistance gene creating an entirely new protein that perhaps would cause cancer after the berries were eaten by humans. As of 2010, many of the consequences are purely speculative and true issues would not be known for perhaps years.

Animals

GMOs pose a potential risk to insects, particularly those involved in pollination of GMO crops, as well as birds, insects, organisms in soils, and water. The impact of GMO pollen in bees' gut or ingestion by bacteria is not known. One fear is that the insects may develop resistance to the pesticides after ingesting GMO pollen, creating swarms of pesticide-resistant bugs.

Intellectual property

The risk of GMOs to the world economy may be significant. It is entirely possible that world food production would be dominated by a few companies, increasing the dependence of developing countries on industrialized nations.

Foreign exploitation of natural resources, labeling issues and scientific advances skewed to interests of richer countries are just a few of the

concerns. Although eventually more efficient and economical, initial research <https://assignbuster.com/advantages-and-disadvantages-of-genetically-modified-organisms-biology-essay/>

and development costs involved in bringing GMO products to market are substantial. To offset these costs, companies patent their products.

Infringement issues are a major issue.

Human health

Human health is also at stake. GMO plants may create new allergens or unintentionally confer antibiotic resistance in humans. As part of the technique, genes that confer antibiotic resistance are inserted into GMOs as “ markers” but they could confer resistance to these antibiotics when consumed by humans. However, the gene introduced into the potatoes was already known to be toxic to mammals. Researchers simply chose the gene to test the technique and it was never intended for human or animal consumption. As pollen spreads, pharmaceuticals derived from plants and fed to animals are then consumed by humans, also with unknown consequences.

Food supply at risk

Genetically modified seeds are a patented product, and in order to purchase the seeds customers must sign an agreement for use with the seed manufacturer. As the reliance on GM seeds expands world wide, concerns about food supply and safety continue to escalate. Genetically engineered seeds are identical in structure, and if a problem affects one particular crop a major crop failure can result.

Environmental destruction

Most GMO seeds are genetically engineered to be herbicide tolerant, resistant to insect infestation and disease. Environmentalists worry that the characteristics of GM crops may encourage farmers to increase their use of herbicides and pesticides, which will raise human consumption of dangerous toxins. GM crops also manufacture their own pesticides, which puts further poisons into humans and soil and may cause unforeseen changes in the environment. Another concern is that toxins contained in the GMO plants may harm other organisms, such as monarch caterpillars, bees and birds. The pesticide found in genetically modified cotton and corn is implicated in the deaths of poultry, cows, horses, sheep and buffalo worldwide.

Conclusion

As a nutshell, although Genetically Modified Organisms have a lot of advantages but still face many ethical issues related to the growing and consumption of genetically engineered crops. They hold potential to greatly increase the nutritional value of food as well as the productivity of crops, while at the same time provide many safety as well environmental concerns. These decisions need to be looked at by all of humanity since everyone is directly affected by the choices. While each person can read these details and come to different conclusion on the value of genetically engineered foods as well as the ethical choices being made by the companies in charge of producing these foods. The ultimate choice on genetically engineered foods should be placed onto a well informed consumer not held in the dark by those in power of the government and large corporations which may not have the general public's interests as their primary goal.