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GMOs and their Environmental Impact

Genetically Modified Organisms are organisms that are in some way the result of biotechnology. In recent years, the term has become synonymous with organisms that are genetically manipulated in a laboratory for improved nutrition, resilience, size, or whatever else the organism is being shaped to be. The practice of genetically controlling crops is nothing new, and human beings have always put in efforts to make plants more suited to their needs and desires. It is the technology that has evolved, and it should be noted that this evolution is an extension of practices from the Green Revolution. People needed more productive crops, and certain tactics were developed to enrich soil and improve crops. These practices were a drain on their respective ecosystems, but energy must come from and go to somewhere; with the intention to reform the process for improved production and often sustainability, the private sector made unprecedented advances in farming practices. Recently, the most prevalent and controversial method on the ears and minds of people is the manufacture of GMOs and accompanying technology. There is never any reason to throw away technology though, and so long as identifying GMOs does not turn into a witch-hunt, the traditional and modern technologies of several agricultural fields have the potential to be combined and achieve maintainable agricultural prosperity that the world has yet to witness.

Traditional and more recent developments of crop growth have been combined with new technology to create crops that can feed the world and make obscene profits in the process. As with any new technology there are drawbacks, and as with any

perceived flaw, many people will point to those drawbacks and denounce the entire technological method. Before we go too far in either direction, it would be wise to look at the scope of the agricultural technologies that we have today and the impact that GMOs have on human beings in a number of respects. Although the United States government and citizens are constantly reevaluating GMOs, and though there have been many proposed changes in recent years around the country, the United States has a fairly straightforward acceptance of GMOs. The official position presented by the USDA is as follows:

"The United States government, which does not require mandatory biotechnology-specific labeling for transgenic products, has argued in numerous international fora, especially the Committee on Food Labeling under the Codex Alimentarius, that there is no scientific justification for the imposition of mandatory labeling requirements based solely on the process by which the product was produced. At the same time, however, USDA has attempted to help markets meet customer demands around biotechnology content through the provision of tools and services relating to product testing and evaluation of testing services, process verification, and technical information for grain and seeds."(pg. 7,Economic Research Service/USDA).

The U.S. is clearly very confident on their position and want other countries to follow suit. Th U.S.'s approach is not the international practice, as there are many different countries with many different practices and interpretations of the safety of these products. The European Union, for example, mandates the labeling and full traceability of all GMOs. There is no common universal policy when it comes to these organisms, so it is important that instead of allowing the government to have all of the

say and interpret everything that individual citizens do their part and educate themselves on the basics of GMOs, because there will always be parties with varying interests when it comes to the dissemination of information.

Because of differences in labeling as well as many other issues, many people wonder if GMO's are safe, and it is a tough question to answer. GMO is an umbrella term that encompasses many different products and technologies. GMOs include "medicines and vaccines, foods and food ingredients, feeds, and fibers," so it is difficult to consider them as purely negative, or even as falling under one category.(Human Genome Project). Even considering only the most common and contemporary definition, there is an incredible amount of variability in different organisms, so to ask if GMO's are safe is akin to asking if dogs are safe: Some will be great friends and assist you, whereas some are just as likely to bite you in an uncomfortable way. Generally speaking, the GMO's that are unsafe don't make it to the market, and there are some GMO's with no clear danger whatsoever, just as there are some exceptions in the form of risky products that are introduced to the market. Unfortunately, there is an incredible amount of misinformation and pseudoscientific justification for the fact that GMO's should be off the market, but generally those who introduce these products take the risks as seriously as consumers demand them to.

Even when it does not go so far as misinformation, some information can be misleading because of the way that it is phrased or because of ambiguity of circumstance and data. The Institute for responsible technology references what appears to be a medical organization; when answering the question as to whether or not GMO's are safe, they provide this: "**The American Academy of Environmental**

Medicine (AAEM) doesn’t think so. This Academy reported that “Several animal studies indicate serious health risks associated with GM food,” including infertility, immune problems, accelerated aging, faulty insulin regulation, and changes in major organs and the gastrointestinal system". This seems very convincing, and it appears to be true with some light fact-checking. The only issue is that, when we look at the source, it turns out that the AAEM is an unregulated organization made up of clinical ecologists, who are any people who claim the title for themselves since the title has no legal implications. There are many physicians and concerned professionals in agricultural fields in the organization though, so it is important to take into account their concerns, but their opinions do not necessarily constitute facts or even necessarily scientific observation, so some caution is necessary, especially because of the scope of their influence.

Some of the most common misconceptions really have no basis in fact whatsoever. Often, a person learns something from a source that is unreliable such as a friend or coworker, and they assume that since that person may not be what they'd consider a liar that the truth is being told. Misinformation often has its roots in misunderstanding, and some misconceptions accompany political affiliations or lifestyles. There are people who believe that companies are using animal DNA in vegetation and genetically manipulating animals' DNA, but this is simply not the case. It could be that the misunderstanding's stem from misconceptions of the meaning of organic in certain contexts, or even of the process of genetic modification entirely; not only that, but some organizations believe that the ends justify the means and exist solely to misinform! Having a keen eye to spot faulty truths can be difficult, but drawing conclusions without knowing the facts is a damaging albeit prevalent practice.

Ambiguous wording is often used; for example, a previously addressed organization states that "Genetically modified foods have been linked to toxic and allergic reactions, sick, sterile, and dead livestock, and damage to virtually every organ studied in lab animals. The effects on humans of consuming these new combinations of proteins produced in GMOs are unknown and have not been studied."(GMO Education. The issue here is the highly ambiguous wording; although genetically modified foods have been linked to all of these health problems addressed, so have organic foods, and for that matter, breathing as well. It is also highly misleading to say that these protein combinations have not been studied as to their effects on humans. That even seems counterintuitive; these products are manipulated and created in laboratories by people who know exactly what they're working with so much so that they are manipulating genes, and the products themselves are overseen by several federal organizations in their production as well as their release. Furthermore, to say that GMOs do anything is an incredible oversimplification. This particular organization also states, "Herbicide tolerance lets the farmer spray weed-killer *directly* on the crop without killing it. Comparative studies on the toxic residues in foods from such crops have not yet been done."(GMO Education) This seems to suggest that GMOs that take advantage of tolerance have not been studied in comparison to other crops that do not use this method, and this is obviously not the case. Organic food growth and alternate forms of GMOs are grown and researched in comparison to other methods constantly. If it seems unfair to pick on this particular group, keep in mind that at this moment, their website is the fourth result under the search term *GMO* on Google.com

Moving on from common misconceptions; it's important to consider that although

GMO is an umbrella term that applies to a wide amount of crops, there are some negatives to GMO crop production and use. For one, GMO crops are primarily developed by independent companies and contractors, so the business sector dominates the production of these crops. This can be an issue considering intellectual property laws that keep the profits for that technology in the hands of the business that develops it, or even by the simple nature of food production being controlled; businesses and individuals who have the money to develop certain technologies also have the potential to indenture the populace of entire countries to said businesses and individuals; "most of this research is being done by the private sector, which patents its inventions, agricultural policy makers must face up to potentially serious problems.[. . .]The high cost of biotechnology research is leading to a rapid consolidation in the ownership of agricultural life science companies"(17, The Green Revolution Revisited and The Road Ahead). This can also widen the gap between big and small businesses, which can all but remove entrepreneurship and prevent improved and different technology from being developed. To say that this technology can contribute to the income gap is really quite an understatement. Controlling food is controlling a living necessity, so the implications are far-reaching and very intimidating. Many of these crops are genetically superior to other crops as well, so they can replace natural foliage and alter an environment, "Producing crops, by its very nature, means getting rid of wild plants on the farm."(Genetically Modified Plants and the Environment).

Specific GMOs can also be an issue. Because of the factors that encourage the development of these technologies, which are usually profit-based, but extend to other intentions and needs; these technologies are rarely designed with the improvement of

people's lives and environment in mind. Profits are not acquired by giving people what they need, rather they're acquired by a company getting back more than they put in. This can have many implications to the environment as well as to individuals' health and living quality. These technologies are associated with the Green Revolution, and many of the issues that caused some critics to consider the Green Revolution a failure are still present and abused by those who manufacture GMOs. Mechanization becomes increasingly more prevalent, wasting resources and disemploying workers. Chemicals and genetic manipulation are often overused in that they solve problems that could be solved by less pervasive or environmentally damaging methods. There have been some incredibly dangerous results due to the combination of chemicals and genetic manipulation, and on rare occasions, these products have made it to market. Greater efforts should be made by companies and government to prevent these occurrences, and consumers should do their part in supporting only companies that release safe products.

Pollution has long been considered a chief offender in the Green Revolution's evolutive agricultural possibilities, and some companies rely so heavily on genetic modification that they coat plants in toxic material that they developed specifically for their genetically modified crops. Many times, this toxic material sticks around and/or gets around into the air, water, and other crops. GMOs are also utilized to make the lives of animals more miserable, because certain crops give different nutrition to make animals have characteristics that are more desirable for consumption but poor for health and mobility; often though, animals have poorer nutrition simply because of careless and lazy nitrogen replacement in the soil, leading to forage of poor quality. The greatest

dangers of GMOs are, of course, the unknown dangers, but those can hardly be guarded against and should not influence the development of new technology.

So could organic be the answer? It has been stated that organic technology was never really given a fair shake; it has also been stated that organic technology could not feed the amount of people that are currently alive on earth. It should be noted that there is an incredible amount of wasted energy in feeding animals for the purpose of slaughter and byproducts, as well as much fertile land being used to supply us with a constant supply of material that becomes waste as trends or the disposable nature of certain products take over. Incredible amounts of cotton are wasted on clothing that sits in basements, and incredible amounts of food are wasted by supermarkets and restaurants. We should be cautious when saying that we lack enough of anything when so much is wasted everyday. Organic technology basically amounts to good farming practice, and its established practices as well as modern innovations should not be ignored by anyone who has an interest in sustainable and traditional agriculture.

The issue with organic agriculture is not what it is, because what it *is* is fantastic. What organic agriculture *is not* is the problem, and because of the way that organic farming is defined as well as what it is generally thought of as being, it excludes many quality innovations and techniques that could otherwise assist in producing quality products. It is a great positive to have organic agriculture as an alternative to the status quo now, because many modern manufacturers of common products take advantage of innovations with such fervor that they do not make use of natural resources and go wild with profit-making, ignoring sustainability and environmental damage. Many practices of non-organic agriculture are simply very damaging to the environment, and they don't

make use of anything that already exists in nature to solve problems, rather they treat these organic life-forms as if they were machines that must be assembled, made attractive, and sold. Organic agriculture's stringent allowances of non-organic co-mingling and chemical contamination provide a perfect environment for innovation that is outside of the realm of genetic modification, which can later be applied to other technologies if such applications are so desired. This means that we have some people who are trying new things with a focus being on sustainability and natural solutions, so even if we go entirely in the other direction for mass production, there may be something to fall back on if we have issues. At the moment though, pure organic practices are characterized by their limitations.

GMOs are the status quo and with good reason. If organic agriculture exists as the foil to the pitfalls of technology, modern methods exist for the exploitation of technology. Foods that are genetically modified can have greater yield, can be easier to grow, and can bring forth incredible profits. In addition, the pitfalls of abuses of modern technology are not essential in GMO production of all and even most types. GMOs are usually just crops that have the edge over nature in some very interesting ways, often being resilient not to chemicals, but instead to the elements, pests, and disease. GMOs are typically nutritionally superior and are constantly being experimented with to create new and exciting crops. As to the future of this technology, "There is growing evidence that genetic variation exists within most cereal crop species for developing genotypes that are more efficient in the use of nitrogen, phosphorus, and other plant nutrients than are currently available in the best varieties and hybrids. In addition, there is good evidence that further heat and drought tolerance can be built into high-yielding

germplasm."(14, The Green Revolution Revisited and The Road Ahead). GMOs, such as Golden Rice, have the potential to save the lives of people with no other options, and crops that are altered to grow in more challenging environments can do just the same. Citizens have recently shown their support for technological innovation for GMOs, with GMO labeling laws being struck down in several states, and new ways of manipulating genes in crops are constantly being researched.

The specifics of GMO improvements over naturally occurring organisms can be stated in as simple a way as saying that they are just that: Improvements. All ways in which a crop can be improved can at least be attempted, and that is what makes genetic modification of organisms such a tempting technology. Specific ways in which crops have already been improved to the desires and needs of human beings include "enhanced taste and quality; reduced maturation time; increased nutrients, yields, and stress tolerance; improved resistance to disease, pests, and herbicides; new products and growing techniques"(Human Genome Project). They can also be used to the benefit of the environment; however, unless the technology can turn a profit, such innovations will be the exception rather than the general practice. The primary positive that can be taken from GMOs above all other positives is the success and yield of crop production, which has implications such as the feeding of the world and high efficiency as to input. Combined with sustainability, GMO production can be a large part of the solution to the hunger problem that has plagued mankind since its inception.

It is likely that if GMO technology can be combined with the naturalistic mindset that is making organic growth such a popular alternative in many environments that can support it, we can achieve some incredible results. At the moment, we are still in a place

where the innovations of genetic modification and of the Green Revolution are still too fresh for us to be completely objective; and because most people are in a constant state of struggling due to their socio-economic concerns, people are generally more concerned with their immediate ability to maintain or improve their current position in life than to fix the underlying issues that hold them back. People need to demand sustainability and quality in their products by supporting those companies that are willing to provide it to them or demanding improvements with their wallets. Political involvement can only do so much when it comes to the products that people put into themselves, and generally, a company will not have the ability to influence politicians with a flat wallet. If the current trends continue and consumers continue to support those companies that don't have sustainability at heart, then they will find that they've supported an unsustainable system.

GMOs are not evil, and in fact, they are one of the most positive innovations that have ever come to humanity, but it is important not to forget the roots of the organic movement when it comes to technology in and of the Green Revolution (and make no mistake, GMOs and their current uses are extensions of the agricultural practices of the Green Revolution). Organic farming methods were developed as alternatives to the Green Revolution even before it occurred, because Albert Howard "pointed to emerging problems of animal and plant disease, soil erosion, and similar conditions. He laid the blame for these on mismanagement of soil. Howard specifically cited the failure of modern civilizations to properly return wastes from cities and industries to the farms. Sustainability issues were at the top of the list for this man, now considered the “father of organic agriculture.”(4, Organic Crop Production Overview). These issues were seen

coming, but they were not considered a major enough issue for the profit-driven companies that supported Green Revolution technologies to consider.

Unfortunately, what goes around comes around, and now we are seeing issues such as pollution, obesity, and other issues related to abuse of Agrotechnologies. Fortunately though, we now have the internet and with a small amount of research we can learn almost everything about anything. This allows consumers to make more educated decisions, correct their misconceptions, and learn what products to support. It also allows producers an insight into the mind of the consumer as well as an incredible amount of information so as to adjust to those conceptions. People are finally beginning to vote with their wallets, and while reactions like not supporting certain companies because of their practices may hurt their employees, this can easily be offset by supporting other businesses with better practices. If humans want to continue living on Earth, we certainly have the capability, even with rapidly expanding overpopulation (although that will eventually become too much if unchecked). All people have to do is consider sustainability and improvement for themselves and their surroundings, and they can likely make decisions that will do just that. After all, nobody wants to poison everything; at some point people and their environment won't be able to take another hit in the interest of convenience or immediate pleasure. GMOs can poison just as they can cure. It is people that design GMOs and people that make decisions as to what they put in and around themselves.

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