

Genetically Modified Organisms: Risks, Benefits and Moral Obligation

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Genetically modified (GM) crops on one side have been hailed as the solution to world hunger and have been criticized as environmentally dangerous, playing God and “illegitimately crossing species boundaries.” (Comstock 2008, p. 752) There are legitimate arguments as well as flawed arguments on both sides. One of the major difficulties with the debate on GM crops is that empirical data can only answer so many questions about the consequences of GM technologies. Furthermore, when a normative claim is made to justify or condemn something it must extend across all related parties or else it becomes somewhat arbitrary. That is why my intentions are not to directly refute the arguments against GM crops, but rather to present the reasons they should be employed. Therefore, I would like to assert that the social implications, the history of agriculture, and recent genetic successes all point to the ethical permissibility of pursuing GM foods as aids to the problem of world hunger.

First, a brief introduction to how GM technologies function is necessary to make distinctions among the historical methods of breeding plants. GM crops are organisms engineered on a molecular level. Scientists determine a specific gene from a foreign gene pool and insert it into an alternate genetic code. “Foreign genes are genes taken from sources other than the organism’s natural parents.” This type of gene selection is different than the traditional methods of cross breeding in a few ways. (Comstock 2008, p. 752) Traditionally changes in plant genetics were results from the natural reproductive process of two plants sharing DNA. As a result of this reproductive process the DNA exchanged stayed within the same species. Traditional methods of breeding, such as the methods Gregor Mendel used, did not select genes singularly but instead transferred genes in groups. The traditional methods of selecting for genes are not much different than the more specific selections made through GM technologies.

To begin, the history of agricultural and other sciences are inextricably linked to risk. For this reason, the risks of GM foods must be weighed against benefits in determining whether or not it is ethical to pursue them. From the beginning of civilization nearly every advance holds some degree of risk. Trial and error and now the more sophisticated scientific methods have posed danger in some form. Airplanes, medical research, exploration and pesticides all had their risks, but the foreseen benefits led the researchers and scientists on towards their interests. There is a wide range of risks associated with pesticides; however, we find pesticides beneficial despite poisonings from pesticides reaching nearly 45,000 with around 200 of these being fatalities. (Ebenreck 1991, p. 435) It is interesting that we don't normally consider the risks of driving an automobile when the fatality rate is near 43,000 a year with the total injuries reaching 2.9 million. (car-accidents.com) The history of agriculture extends from the beginning of civilization, and the risks taken historically do not seem to be any less severe than the potential risks that biotechnology affords. The risks of agriculture therefore must be explored.

Some of the earliest examples of agricultural risk come from the California Indians who lived on the west coast of North America an estimated 4,000 years ago (Steinber, et al, 2000, p. 136). While we would not consider the practice of collecting and cooking acorns a modern form of agriculture, they hold the same objectives as agriculture. These objectives could be described as the provision of food through the engine of human ingenuity. A tribal expert gave some statistics about the nutritional value of acorns commenting on how they "are extremely nutritious, containing up to 18 percent fat, 6 percent protein, and 68 percent carbohydrate as well as vitamins A and C and many amino acids" (Steinber, et al, 2000, p. 136). These nutritional benefits make the acorn as an agricultural pursuit very sensible. To the best of my knowledge it is tremendously risky to eat poisonous food. Ironically, acorns are lethally poisonous if not treated properly. Who was it that first tried acorns? (Thornton 2008) Perhaps he did it on accident. Or maybe the chief picked him out of a crowd around the cooking fire and said, "test this nut out." Either way, there was risk involved. It could even be the case that someone thought to boil the acorn first in the hope that it would make it safer. That clever Indian still runs the risk of not neutralizing the poison.

This is one example of how risk plays a role in agriculture. However, it points out the link between risk and benefit: the benefit of a common nut that is highly nutritional over the risk of picking the wrong type of acorn at the wrong time. One of the key elements in deciding whether the risks outweigh the benefits is need. When

need persists, the amount of risk a community is willing to take also increases. It is apparent that we could do without GM crops in America. However, the need in third world countries is more persistent than that of the developed countries. So again that prompts the question of whose need is more important. Is it just to neglect need of other groups?

An opponent of GM crops might argue that for both the old Indian communities and the GM crop consuming society the risk of death is present but not equal. A common fear among opponents of GM technologies is that the gene pool could be harmed by reducing genetic diversity. (Resnick 2008, p. 270) Essentially the fear is that if there is only one type of crop because all the others have been replaced by a "superior" GM type then one effective disease or virus could wipe out all of the food everywhere. This is an unrealistic fear in that the threats to a crop extend beyond insect predators and plant diseases. A crop's success is determined by climate, availability of water, the health of the soil along with the economic forces of supply and demand. While placing a gene that protects against cotton devouring ladybugs is beneficial to a crop of cotton, it does not defend against drought, disease, a lack of nitrogen in the soil or a diminishing demand for jeans. Even if a wide margin of crops were destroyed in a country it would take a great deal to make the problem of food supply worse than it is now with 1 in every 5 people in the developing world being undernourished. (fao.org) The fear for the Indian was that the acorn would be of the poisonous variety while our fear today is that the GM crop will not be resilient enough. The Indian might die of poison or for our modern world some people might starve as a result. Starvation is already happening, so, if we feed people for awhile and find later that it doesn't work the end is the same while our efforts to aid at least were not.

Among other things, the history of agriculture points to our need to pursue GM technologies. Both because need has always dictated what agricultural pursuits were attempted and because in reality the risk is still the same.

Moving on, cases of genetic selection in the past can be compared with prospects for the more selective biotechnology. While these examples do not use the same methods of selecting genes they still hold the same risks. I would like to treat this example in the same manner a lawyer might use a past case to interpret the law. That is, by juxtaposing different cases against each other, interpretations and claims can be more easily justified.

Norman E. Borlaug's work with wheat is one example of a scenario of genetic selection from the past. This wheat was not necessarily genetically engineered on the molecular level; however,

it used similar methods. He collected hundreds of varieties of plants and used "shuttle breeding" to genetically select for preferable genes. "Shuttle breeding" involved growing the varieties of plants in mass quantities in economically viable locations. If the plant showed promise he would then transfer them to a better climate and breed them under those conditions. Essentially, Borlaug more crudely chose what genes his plants were going to have, but he still did it at a much faster rate than evolution would ever have allowed. (Pollock 2008, p. 75) Also, this method holds some of the same risks as the engineering of plants on the molecular level. For instance, both hold the risk of lowering genetic diversity and exposing a crop to a *super virus*. Sharing this risk is central because it is one of the most viable arguments against GM crops. Having similar benefits is another useful element to the parallel. Both methods are aimed at increasing yield by protecting against disease, viruses and predators.

Concerns began to arise between 1939 and 1941 when Mexico's wheat harvest was cut in half by a fungus called stem rust. The fungus was carried as an airborne spore and spread quickly "wiping out 75% of the durum wheat crop" which is located in the United States. (Pollock 2008, p. 74) There were fears that the stem rust fungus would destroy the entirety of the North American wheat crop. The wheat crop was not overrun by the stem rust fungus in America. However it spurred on a scientist named Norman E. Borlaug to develop rust-resistant varieties of wheat. In 1970 Borlaug took his wheat to India, which had similar problems with the fungus, and in doing so was reported to feed 6.2 billion people. (Pollock 2008, p. 75) Titled "the man who fed the world" as he waited to accept the Congressional Gold Medal for his work in the third world, Borlaug became the fifth individual in history to be awarded the Medal of Freedom, the Congressional Gold Medal and a Nobel Peace Prize, among figures such as Martin Luther King Jr., Nelson Mandela and Mother Teresa. (Bush 2007, p. 969) Feeding a starving nation was enough to win Borlaug some of the greatest honors in recent history. It seems likely that doing the same for other nations would be viewed in the same manner. This is the side of benefit. Over 6 billion people fed and an example of the potential of agricultural selective breeding.

On the other side the fear that a new strain or variety of fungus would emerge became a reality recently. A new form of stem rust called Ug99 by scientists was found in Uganda, Kenya and Ethiopia in 2006. The problem was nearly as bad as the destruction of the crops in the 1940's and 50's. Rick Ward, a wheat breeder, was quoted saying "[we came] incredibly close... to not being prepared to deal with this crisis." (Comis 2007, p. 4) Now the proposed solution to the

reappearance of stem rust is again to “find resistant varieties” of the wheat. (Pollack 2008, p. 76) Finding new resistances in plants is one of the main goals of GM technologies. It is not clear that Ward is a proponent for GM foods but it seems a viable solution to use GM crops to that end.

If this success story shares the same risks and benefits with GM crops, and also shares a similar method, then we can expect similar results with the use of GM crops. Yes, there will be drawbacks to GM technology; however, this case study shows that the agricultural risks that are present can be overcome. Borlaug and his wheat shed light on the use of the precautionary principle to argue against GM crops. Engelhardt and Jotterand take an interestingly different approach to the precautionary principle, commenting that, “the precautionary principle requires considering the untoward consequences of not supporting technological innovation” (2008, p. 762). They assert that there are developmental dangers that we must consider and take action against through technological development and innovation. The precautionary principles use in this manner simply states that there is risk in inaction just as there is risk in action. The example of Borlaug’s wheat suggests that science can deal with the consequences of implementing advances in GM crops while there will be no way to tell if science can deal with the consequences of inaction, or in other words, not implementing biotechnologies like GM crops.

Thirdly, the social implications of GM foods for our society and the potentialities they create across the globe cannot be ignored. Our interactions with foreign countries could prove how just our culture truly is as easily as the interactions that take place domestically can. The issue of world hunger becomes increasingly significant because it sheds light on the legitimacy of the moral basis of the laws our country employs. In the United States we hold moral values and uphold them through the legal system, law and government regulation. As a society we seek to be just economically, socially, politically and morally. We hold justice to be one of the foundations of our civilization, viewing it as the defense of equality. One principle that is found in almost all theories of justice asserts that “like cases should be treated alike, or to use the language of equality, equals ought to be treated like equals and unequals unequally” (Beauchamp, p. 26). This principle is applied across the United States in lawsuits to justify ourselves as liberators and to defend our rights of property. Rawls states that “laws and institutions no matter how efficient and well-arranged must be reformed or abolished if they are unjust.” (Rawls 1971, p. 3) Because the principles of justice assert equality for equals and injustices among equals demands reform or

abolishment of that system. We as a country either have to be just towards people as our equals or define them as unequals. Removing our obligation to meet basic needs of children living in third world countries is unjust, because they are our equals.

Discussing the issue of starvation in relation to the two opposing social groups shows how morality must act; that is in an all-encompassing manner. To assert that the United States has no obligation to help end starvation is not only founded without a shred of empathy for humanity, but is also neglecting the moral basis for our established laws and government programs that deal with hunger in America. Welfare programs in the United States can give financial aid to American citizens for health insurance, heating bills, weatherization assistance, and the purchase of food. For instance, food stamp programs can provide a family in poverty with food. (govbenefits.gov) There is no state obligation to provide welfare for other countries. However, feeding people is not an issue of national interest but rather an interest of humanity. Why is it that we find cases about the neglect of children so horrific? Why do we prosecute parents who do not feed their children? We prosecute individuals for acts of neglect because socially we find it immoral to watch a helpless individual starve when there is a means to feed that person – means such as welfare or perhaps GM foods. For this reason, the justice system has established laws that protect children. Is a child's life protected by the American legal system because of their citizenship? No, they are protected by the American legal system because as a society we find it immoral to let innocent children starve. If the legal system was the only protection for starving children in the United States then perhaps children of illegal immigrants should be allowed to starve. For this reason, protections starving children must be applied across the globe when it is possible because morality extends beyond borders.

Astonishingly, 55% of the 12 million child deaths each year are results of malnutrition. (fao.org) Continuing with the principles of justice, if it is just to prevent a child from starving when there is a means, and this is founded on moral principle, then all cases of starvation should be prevented when there is a means or else not all children are equal. In Zambia's Luapula Valley "nearly 60% of children under five were stunted" do to a lack of calorie intake. (fao.org) There are two reasons that I have identified that would allow this malnutrition to continue without it being unjust. The first reason could be that the children facing starvation in Zambia are not equal to the children facing starvation in the United States. This is not an adequate reason because there is nothing to suggest that either group of children has any control of where they were born.

The second reason would be that there is not a means to feed this population of children. The question of whether GM crops can be a means to prevent the starvation of children is evident. In this instance the Zambian Government purchased the region's farmers "higher-yielding" varieties of seed which in turn provides families with enough food to eat along with a small surplus to sell. (fao.org) With GM foods' ultimate benefit being higher crop yields, it is at the very least botanically viable to say that they could be a solution to the starvation of children.

If we are to base large portions of our legal system on moral principles such as non-malevolence or defending innocent individuals then those moral portions of the justice system must extend to all equal parties of the categories involved. To do the contrary is to debase the justifications for those laws. Socially we have an obligation not only to innocent individuals, such as starving populations in developing worlds, but also to the foundation of our own justice system.

The history of risk, agricultural technologies similar to GM crops and the social implications of justice all display why genetic technologies should be implemented as a solution to world hunger and agricultural shortages. First, need was established as influential in deciding which risks are worth pursuing both because the benefit increases with need and as need persists desperation leads to a willingness to pursue a solution. Secondly, the example of Borlaug and his wheat suggests that science can solve the problems caused by biotechnology. Also, it asserts that there is no way of knowing whether the problems that result naturally will be able to be resolved without biotechnology as a potential solution. Thirdly, disallowing or withholding GM crops in other countries is a violation of the moral foundations of laws that protect Americans rights and liberties. Perhaps all of these arguments alone are not sufficient to justify risking the impacts of genetically modified technologies; however, when considering the moral implications along side the history of agriculture, some risks, specifically GM crops, are necessary.

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