The Benefits and Risks of Using Genetically Modified Rice to Increase Food Production

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ABSTRACT

World hunger is a serious problem and genetically modified crops may be a solution. Since Gregor Mendel's work in the mid 1800s scientists have been studying how characteristics are passed from one generation to the next; consequently, we have developed genetic engineering which allows control of this process. In an attempt to help solve the hunger problem with the aid of genetic engineering, rice has been developed that grows with less water, makes its own pesticide and herbicide and produces vitamins; however, there are scientific and ethical problems with this process that have not been solved. This research document examines these issues and and offers suggestions for viable alternatives to using genetically modified rice.

Growing enough food to feed everyone in the world is becoming increasingly difficult as the population of the planet increases and resources such as water and fertile land become more scarce. Since all life is comprised of genetic material that determines its very nature(Ridley4-10), a possible solution to the problem of food shortage exists in the ability to manipulate food crops by influencing the genetic material that determines their growth patterns.

Because rice is a crop that feeds half of the world's population (The Asia Rice Foundation 2), answers to the problem of growing more of this crop are being offered by a number of large corporations and the world scientific community (Kuyek 5). By offering new forms of rice plants with the ability to resist disease and grow with reduced amounts of water, scientist

s and industry hope to make it possible to help considerably with the problem of world food shortage.

The nature of modern scientific research leads us to believe that any problem, even food shortage, can be solved with the right kind of science. Even though this may be true in many situations involving for example electronics, consumer products and transportation systems; the idea that agricultural problems can also be solved with the application of just the right scientific product should not be relied upon heavily. World hunger is such a huge problem with drastic consequences that it is understandable that society looks to scientists to supply the solution. When solving a problem such as world hunger, we must be absolutely certain the process we apply will solve the immediate problem while not subsequently creating another more serious problem. In the last century we did not have the ability to alter our environment, so the future was not as much of an issue as it is now. When Gregor Mendel did his study on pea plants in the mid 19th century, he made society aware that something in plants could be manipulated to influence what grew from each generation of seeds. He did this with only natural methods and the results were not influenced by chemically changing genes in the plants. This was a fairly safe experiment because Mendel was simply studying and keeping records of activities that have been going on for thousands of years. He put data together in a sensible logical way to demonstrate and explain what was happening. Inspired by his example, we have developed the ability to modify genetic material in living organisms so it is unlike any that has ever existed before (Steinbrecher 1-5). This adds a high risk factor to the use of genetically modified plants because we have no way of knowing for sure what will happen to them in future generations.

These advances in scientific research have made genetically modified rice available that is designed to supply more nutrition to help with the problem of world hunger(Science in Society). Do the benefits of using genetically engineered rice outweigh the possible risks with enough certainty to justify its use in helping to solve this urgent problem?

One of these types of rice is called Golden Rice. It was developed mainly to help with the problem of malnutrition due to lack of vitamin A, by genetically modifying the rice plant to produce different types of seed grain that contain the vitamin. The rice failed to help because the amount of vitamin A it provided made it such that people would have to eat huge amounts of the rice to get enough benefit from the small quantity of vitamin it supplied. A large number of the people with this vitamin deficiency were small children, and it turned out to be physically impossible for them to eat enough of the rice to get the necessary benefits from the vitamin in the rice ("Grains of delusion: Golden rice seen from the ground" 6-7). In this case genetic

engineering failed miserably because people are still hungry and undernourished. Even though they had good intentions, it is possible the corporation responsible for Golden Rice was so concerned with the financial aspects of research that they released the product before it was throughly tested. This is why we have government regulation although as we know, in some cases the government regulators just like the rice, fail to do the job they are supposed to do.

In the late 1970s the people in the U.S. Patent office refused to grant a patent to a scientist named Ananda Chakrabarty who had modified bacteria genetically so it would help clean up oil spills. They told him he could not patent a life form because they were trying to do their jobs as regulators. He filed a law suit against the patent office and had the case brought before the U. S. Supreme Court. The court disagreed with the patent office and granted Mr. Chakrabarty his patent in 1980 (Slater 2). This decision and Mr. Chakrabarty's product essentially marked the beginning of the biotech industry as we know it (Chakrabarty). Corporations and scientists are now regularly applying for and receiving patents on new life forms they design by altering genetic material and producing new unique forms of life (Kuyek 5).

The biotech industry has the possibility of making the future free from human suffering; however to keep this new industry from going too far with its potential to totally control the very essence of life, we must rely on the ethics of scientists and the good judgment of an informed public. Corporations continue scrambling to grasp the patent rights to control some new type of life form they have developed in their laboratories as they estimate the potential profits to be made by controlling and selling their particular type of genetic material which may include genetically modified plants used for food. People have to eat so there is a guaranteed market when it comes to food production. This would seem to be a perfect opportunity for corporations to show good intentions in the research and development of new types of crops such as Golden Rice.

Two large corporations, Monsanto and Syngenta, have offered to share their genetic research data on rice; however, there is a lot of skepticism about their true motives (Kuyek 5). This is an example of one tactic that large corporations are currently using by offering to share and exchange research data when there is a key piece of information they are missing. Once they have what they need, they quickly get patent rights before any one else can, because of their strategic connections and massive financial power.

A good example of this is a Texas company that calls itself RiceTec. They got involved in research dealing with basmati rice, which has been developed over a period of hundreds of

years in India using the idea of biodiversity by crossbreeding different kinds of rice. Once RiceTec figured out what they needed, they quickly obtained patents on the rice and started selling it under their own names of Texmati, Jasmati and Kasmati. When people in India found out they were furious, and many people there, and elsewhere in the world have been protesting this form of biopiracy (Afrol 1-2) (Basmati).

A large problem with crops like Golden Rice is that biodiversity is eliminated in the areas where they are planted and this is not a desirable situation for the best production of crops(Nelson 685). It has been shown that maintaining biodiversity by using different strains of the same type of plant can prevent devastating plant diseases like rice blast from destroying hundreds of acres of precious food (Yoon 1-2) (Mundt1-3). Another problem with Golden Rice is that it uses transgenic DNA which is unstable and carries with it the ability to be transferred between organisms (Science in Society 2). This is an issue that goes beyond the Golden Rice plant and calls into question anything done with DNA that could be harmful if not kept where it was designed to be used.

There is another type of rice being developed at Texas A & M University that uses transgenic DNA and produces its own poison to kill microbes that attack it during its early stage of growth. The explanation that comes out of the university from the scientists working on this rice is they are relatively certain the poison won't hurt people because it ceases to be effective after the rice is mature. The intent is to make the rice more resistant to disease. One of the key persons working on this plant, Timothy Hall, has stated: "We hope to be able to tell exactly where our genes are inserted and whether it really does make a difference where the transgene is inserted (AggieDaily 11/13/00)." This rice produces its own poison, but the scientists are not quite sure how it will work. It is possible this rice could subsequently become harmful to people or cross breed with other varieties of rice causing it to become poison also. There is also the possibility the transgenic material from the poison rice could enter some form of intrusive weed and make it noxious to all rice (Randerson 1). Or it could enter a disease causing organism and make that organism many times more lethal to the rice plants. This rice could prove to be a good solution, but if it is released before scientists have a chance to throughly test it, hunger problems and health problems could become many times worse than they have ever been.

Scientists absolutely must be able to govern themselves when it comes to research, which can be a problem because scientists have to make a living and they need to be paid for

their work. Research must be financed somehow, and this can be destructive if money becomes too important.

The Biosphere 2 project is a very good example of this type of situation where money becomes a driving force. Biosphere 2 is a 3.1 acre enclosed man made ecosystem designed to demonstrate that science, technology and industry could reproduce a fully functional model of the earth's environment in a huge sealed container. The project was financed by a Texas billionaire and millions of dollars were spent putting it together (Ogden). People with scientific backgrounds were hired to live in this huge enclosure and make it work. After a short while the system started to fail. The people inside running it became undernourished and lost weight, and the plants and ecosystems that were supposed to work in harmony started failing. Large swarms of ants started destroying plants and finally the experiment was stopped (Cohen and Tillman 1-6). Scientists from a local university took over the project and they still have not determined all of the things that went wrong (Veggeberg1-3). The Biosphere 2 project clearly demonstrates that the scientific community does not yet completely understand the way our environment works to keep us alive. Even though the project was not a success, the information it provided is very valuable and should be made common knowledge because it is proof that science needs powerful restraints to protect us all from overzealous research and development.

There is a new way of looking at science and society that more adequately describes the way nature and the earth's environment work. Part of this process comes from the theories that support quantum mechanics and quantum math and they involve taking a close look at how chaotic events work to shape our world. This new viewpoint essentially proposes the idea that from chaos comes what we call order and from order comes chaos; this being a cycle that is continuously evolving. This science acknowledges the very way we define our world as being insufficient to totally explain all that happens in it. Our current approach to science is through reductionism which takes a piece by piece approach to explaining and dealing with scientific problems. Reductionism does not work well with the environment, or with other science such as space travel and the nature of the universe (Wheatley 118). Accepting our environment here on earth and working with it in a symbiotic manner utilizing biodiversity (chaos) is a safe solution. It may be the best solution to our problem of world hunger until science has a chance to mature into the new way of thinking, when the best answer may be a combination of new theories and conventional scientific methods including genetic engineering.

There is evidence that genetically modified rice has helped to increase production per acre by providing the science to produce rice that will grow with a limited amount of water. This is a very important benefit and undoubtedly has helped to feed many people (Postel 4 Scientific American Feb 01). There is also evidence that was presented in the early 1970s that crops grown essentially in harmony with nature can do quite well. With the use of only minimal amounts of energy and organic fertilizers, the yield per acre of conventional methods requiring inorganic fertilizers, poisons, petrochemicals and huge amounts of energy to control undesirable plants and insects, can be more than doubled (Jeavons 113).

Genetically modified organisms can do miraculous things like eat up oil spills and turn the mess into a relatively harmless biodegradable substance. Genetically modified rice can produce its own pesticides and become resistant to attacks from harmful microorganisms. Genetically modified rice can be made to grow with reduced amounts of water and still produce large amounts of grain, and as far as we know the grain it produces is of good quality and not harmful.

Even though genetically modified rice has benefits, Golden Rice has failed the nutrition test. Some companies have abused their power and have actually managed to steal naturally produced enhanced strains of rice, obtain patents, and sell the material as their own. Our contemporary body of scientific knowledge is not able to completely explain how our environment functions, and there are scientists who admit they are not sure what can happen in some cases when it comes to dealing with genetically engineered food. Biodiversity is an absolute necessity if we are to survive because plants require it to survive (Muir 1998). Our science cannot fully explain why plants need this diversity and furthermore, genetic engineering does not particularly support this concept; in fact it often directly opposes it. The use of genetically engineered rice seems like a good idea because the solution is so clear cut and scientifically logical in that it seems like all that needs to be done is to make just the right pieces, put them together properly and our problem is solved. This would be correct if there were no unknowns, but there are too many unknown consequences, and scientists have admitted this. We have already seen some negative results and fortunately they were not disastrous.

Some people in corporations are easily corrupted and this is a very serious problem that has not been adequately addressed. Even if it is only one or two dishonest companies out of thousands of reputable firms, the results of careless handling of

genetic material for any reason could be many times worse than the current world food problem.

Our Supreme Court has shown its lack of technical knowledge by handing down a decision that people in the patent office knew how to handle. This should be a warning to all of us that the people in charge of making major decisions are not capable of staying in tune with scientific advances in such a way so as to be able to make intelligent decisions with the good of society in mind. This shows there is some question as to whether or not our government is capable of constructively dealing with something as powerful as genetic engineering. Scientists admit they do not know the full impact of many aspects of genetic engineering and there is limited success with genetically modified rice. Overwhelming evidence indicates the potential for disaster far outweighs any of the advantages of using genetically modified crops (including grain such as rice); therefore, genetically engineered rice should not be used in the production of food until genetic engineering can be totally understood by scientists and properly managed by government officials.

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