

MITIGATING THE IMPACT OF GLOBAL FOOD CRISIS THROUGH MASSIVE CULTIVATION OF GENETICALLY MODIFIED FOODS

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Abstract

Genetically Modified Foods (GMFs) are food products developed from genetically modified organisms. With an ever growing population and the problems of world hunger, there has been a high demand for an increased food supply. Studies indicate that transgenic plants have advantages over wild type species as the recombinant DNA may come from other species or even lab-synthesized genes; and not always limited to related wild plants. These confer on GMFs certain desirable characteristics including disease resistance and herbicide/drought tolerance. There are, however, concerns about the risks involved with GMFs and the recombinant technology, touching on environmental as well as health risks. This paper provides an understanding into GMF technology, highlighting the benefits derivable as well as controversies trailing the application. It is expected that, if properly applied, GMFs would be the panacea for world food crisis.

Genetically modified foods (GMFs) are food products developed from genetically modified organisms. Genetic modification is a special set of technologies that alter the genetic makeup of such living organisms as animals, plants, or bacteria (Wong, 1997). Combining genes from different organisms is known as recombinant DNA technology, and the resulting organism is said to be a 'genetically modified organism (GMO)'. GM products (current or in the pipeline) include medicines and vaccines, foods and food ingredients, feeds and fibers (Conner and Jacobs, 1999).

Snow and Palma (1997) stated that in 2003, about 67.7 million hectares grown by 7 million farmers in 18 countries were planted with transgenic crops, the principal ones being herbicide- and insecticide-resistant soybeans, corn, cotton, and canola. Other crops grown commercially or field-tested were a sweet potato resistant to a virus that could decimate most of the African harvest, rice with increased iron and vitamins that may alleviate chronic malnutrition in Asian countries, and a variety of plants able to survive weather extremes. On the horizon are bananas that produce human vaccines against infectious diseases such as hepatitis B, fish that mature more quickly; fruit and nut trees that yield years earlier, and plants that produce new plastics with unique properties (Ferber, 2000).

Technologies for GMFs offer dramatic promise for meeting some areas of greatest challenge for the 21st century. Like all new technologies, they pose some risks, both known and unknown (Mitten *et al.*, 1999). Controversies surrounding GM products commonly focus on human and environmental safety, labeling/consumer choice, intellectual property rights, food security, poverty reduction, and environmental conservation. This paper thus provides an understanding into GMF technology, highlighting the benefits derivable as well as controversies trailing the application.

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Advantages of Genetically Modified Foods

The world population has topped 6 billion people and is predicted to double in the next 50 years (Ferbe, 2000). Ensuring an adequate food supply for this booming population is going to be a major challenge in the years to come. Brown (1999) outlined major advantages of GM foods as highlighted below:

- **Pest Resistance** Crop losses from insect pests can be staggering, resulting in devastating financial loss for farmers and starvation in developing countries. Farmers 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 GM foods such as *Bt* 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 (weed-killers) to destroy weeds: a time-consuming and expensive process that requires care so that the herbicide does not harm the crop plant or the environment. Crop plants genetically engineered to be resistant to one very powerful herbicide could help prevent environmental damage by reducing the amount of herbicides needed.
- **Disease Resistance** There are many viruses, fungi and bacteria that cause plant diseases. Plant biologists are working to create transgenic plants resistant 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/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 locations previously unsuitable for plant cultivation. Creating plants that can withstand long periods of drought or high salinity in soil and groundwater will help people to grow crops in previously inhospitable places.
- **Nutrition** Malnutrition is common in Third World countries where impoverished people rely on a single crop such as rice as main staple food. 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.
- **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.

Controversies over Safety of GM Foods

Environmental activists, and other scientists and government officials have all raised concerns about GM foods, and criticized Agri-biotech companies for pursuing profit without concern for potential hazards, and the government for failing to exercise adequate regulatory oversight (Golden,

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1999). It seems that everyone has a strong opinion about GM foods. Mitten *et al.* (1999) categorized most concerns about GM foods into three categories (environmental hazards, human health risks, and economic concerns) as enunciated below:

Environmental Hazards

- **Unintended Harm to Other Organisms** In 2006, a laboratory study was published in *Nature* showing that pollen from *Bt* corn caused high mortality rates in monarch butterfly caterpillars. Monarch caterpillars consume milkweed plants, not corn, but fear is that if pollen from *Bt* corn is blown by the wind onto milkweed plants in neighboring fields; the caterpillars could eat the pollen and perish.
- **Reduced Effectiveness of Pesticides** Just as some populations of mosquitoes developed resistance to the pesticide DDT, many people are concerned that insects will become resistant to *Bt* or other crops that have been genetically modified to produce their own pesticides.
- **Gene Transfer to Non-Target Species** Another concern is that crop plants engineered for herbicide tolerance and weeds will crossbreed, resulting in the transfer of the herbicide resistance genes from the crops into the weeds. These 'super weeds' would then be herbicide tolerant as well. Other introduced genes may cross over into non-modified crops planted next to GM crops.

Economic and Political Considerations

Bringing a GM food to market is a lengthy and costly process, and of course, Agri-biotech companies wish to ensure a profitable return on their investment. Many new plant genetic engineering technologies and GM plants have been planted and patent infringement is a big concern of agri-business. Yet consumer advocates are worried that patenting these new plant varieties will raise the price of seeds so high that small farmers and Third World countries will not be able to afford seeds for GM crops. It is hoped that, in a humanitarian gesture, more companies will offer their products at reduced cost to impoverished nations

- Many opponents of current genetic engineering believe the increasing use of GM in major crops has caused a power shift in agriculture towards Biotechnology companies, which are gaining excessive control over the production chain of crops and food, and over the farmers that use their products, as well.
- Studies have shown that genetic modification could lower pesticide usage, and bring about higher yields and profitability to many farmers including those in developing nations. A few genetic engineering licenses allow farmers in less economically developed countries to save seed for their next year's planting.
- In August 2002, Zambia cut off the flow of genetically modified food (mostly maize) from UN's World Food Programme. Although there were claims that this left a famine-stricken population without food aid, the UN programme succeeded in replacing the rejected grain with other sources, including some foods purchased locally with European cash donations. In rejecting the maize, Zambia cited "precautionary principle" and also the desire to protect future possibilities of grain export to Europe.
- In December 2005, the Zambian government changed its mind in the face of further famine and allowed the importation of GM maize. However, the Zambian Minister for Agriculture Munda

Sikatana has insisted that the ban on genetically modified maize remains, saying “we do not want GM (genetically modified) foods and our hope is that all of us can continue to produce non-GM foods.

- In April 2004 Hugo Chavez announced a total ban on genetically modified seeds in Venezuela.
- In January 2005, the Hungarian government announced a ban on importing and planting of a genetic modified maize seeds, although these were authorized by EU.

Possible Human Health Risks

- 1) **Allergenicity** Many children in the U.S and Europe have developed life threatening allergies to peanut and other foods. There is a possibility that introducing a gene into a plant can create a new allergen or cause an allergic reaction in susceptible individuals.
- 2) **Unknown Effect on Human Health** There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health. A recent study which examined the effect of GM potatoes on the digestive tract in rats claimed that there were appreciable differences in the intestine of rats fed GM potatoes and rat fed unmodified potatoes. Yet some critics say that the study is flawed and does not hold up to scientific scrutiny. On the whole, with the exception of possible allergenicity, scientists believe that GM foods do not present a risk to human health.

Conclusion

Genetically modified foods have the potential to solve many of the world hunger and malnutrition problems, and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides. Yet there are many challenges ahead for governments, especially in the areas of safety testing, regulations, international policy and food labeling. Many people feel that genetic engineering is the inevitable wave of the future and that we cannot afford to ignore a technology that has such enormous potential benefits. However, we must proceed with caution to avoid causing unintended harm to human health and the environment as a result of our enthusiasm for this powerful technology.

Recommendations

1. Nigerian Government should sponsor indigenous scientists to USA and Britain to study the dynamics of GMF technology with a view to fully domesticating it.
2. GM crops/seedlings should be provided for farmers at subsidized rates to encourage them to embrace this novel technology.
3. The National Agency for Food, Drug Administration & Control (NAFDAC) should scrutinize all GM products to ascertain their safety for consumption.
4. In view of the environmental concerns, there is need for scientists to investigate these claims in respect of GM crops so as to advise government appropriately.
5. International bodies like UNDP, World Bank, and UNESCO, should provide grants for large-scale production of GM products in developing countries.
6. Finally, since certain objections to GMFs have political undertones, the science of genetic engineering should be divested of the intrigues and vagaries of international politics and allowed to flourish.

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