Possibility of GMOs in Solving World Hunger

In this article of Food Technology Magazine– we look at the facts, examples, ethics, social implications and research into genetically modified crops to help solve world hunger – Anjali Grillo states multiple examples of how GMO foods can help solve world hunger and examines the social and ethical advantages and disadvantages surrounding GM foods.

Part 1:

Rice naturally photosynthesizes through the C3 pathway which is less efficient than the C4 pathway utilized primarily by grass crops such as maize and sugarcane. Converting the cellular structure of rice from C3 to C4 will grant support more people than is currently possible. While a single hectare of land in Asia produces enough rice to feed 27 people, the International Rice Research Institute has estimated that by 2050, using GMOs, that same hectare will require to produce enough rice to feed 43 people, addressing world hunger.

The original advancement in the development of Golden Rice was the result of a collaboration between Peter Beyer and Ingo Potrykus, and was acquired around Easter 1999. This new grain, commonly known as the “grain of hope” around that time, announced the development of a genetically modified “golden rice.” This new strain of GM rice has genes from viruses and daffodils interwoven into its genetic instructions.

The result is a form of rice that is a golden-yellow color (similar to daffodil flowers), and also produces beta-carotene, which the human body usually transforms into Vitamin A. Virtually a million children die every year because they are enfeebled by Vitamin A deficiencies and an additional 350,000 go blind. Golden rice, said Time, will be a godsend for the half of humanity that depends on rice for its major staple. Merely eating this rice could prevent blindness and death as well as world hunger for many people. It is at a very early stage to develop GM crops that can produce biopharmaceuticals. Cornell University researchers are currently working on modified tomatoes as a vaccine for the Norwalk virus, which causes severe diarrhoea. Mice experiments have displayed an improved immune response. There have also been experiments with GM potatoes aiming to develop a vaccine against rotavirus and against the bacteria commonly known as E.coli which is the cause of diarrhea. Feeding studies involving mice have already shown valid responses.

In Kenya, as well as in many other developing African countries, sweet potato is a high-maintenance crop grown typically by small-scale farmers. Sweet potatoes can adapt to a wide range of environmental conditions and grow in both fertile and marginal regions. It is the second most important subsistence crop after maize in Africa. However, yields are low. The typical African yield of six tons per hectare is less than half of the global average. Viruses and weevils (a type of beetle belonging to the superfamily Curculionoidea) frequently reduce yields by as much as 80%. Effective controls for these pathogens are not available, and the crop has generally been neglected in international agricultural research. Since 1991 the Kenya Agricultural Research Institute (KARI), has come up with GM sweet potato strains that are repellent to the feathery mottle virus (sweet potato virus.)

The genetic trait which has a tolerance to a herbicide that can allow farmers to control a variety of weeds while not affecting the modified crop. Herbicide-resistant crops are mainly grown in developed countries. However, more recently, they have also been harvested in some developing countries. In Argentina, more than 90% of the local soybean harvest in 2002 was produced from GM varieties, making it the world's second-largest producer of GM soybeans. The multinational company Nidera, supplies the majority of commercially marketed soybean seeds (70%). The remainder is sold by six other companies, including Monsanto which originated GM soybeans resistant to the herbicide “glyphosate”, marketed as Roundup Ready soybeans.

Part 2:

Ethically, the benefits of GM crops are linked to the ideals of beneficence and equality in the expectation that GMO engineering will help us enhance food safety and reduce health inequalities as the possibilities of producing foods of higher nutritional content and overall quality. A benefit of them which has been clearly displayed is that when GM crops were introduced, they were adopted more quickly than any other advances in agriculture; with the world's population rising at an alarming rate, particularly in developing countries, there is a significant threat to food security. The scale of the introduction of GM crops will therefore have a huge positive impact as it relates to the moral guiding principle of justice where an equitable supply of food is preserved. Another benefit gained through the use of GM technologies was the weather-tolerant and the maturation of new crops that can withstand inhospitable habitats. The antifreeze gene from cold-water fish that was launched in plants such as tobacco, potatoes and tomatoes can be seen as a clear example of rising climate sensitivity.

Following the ethical advantages of GMOs, food production has stayed ahead of population growth in the developing world over the past 60 years. This was also the case in many parts of Asia and Latin America where the Green Revolution's benefits are felt. Nevertheless, there was little benefit in agricultural productivity in Africa and some parts of Asia, and famine persisted. In fact, the Green Revolution's initial rate of improvement was not sustained between 1985 and 1990. Even in countries such as India, where there are plenty of grocery stores, inequality also causes large numbers of access problems. There is strong case for focusing on agricultural development, particularly as improvements in agricultural productivity contribute to the development of agriculture employment thus raising incomes.

On the other hand, when examining the ethical disadvantages of GMOs one major factor comes into concern. Before being sold to the public as meat, any new organism that has been designed or altered should be tested for safety. The current testing of traditional and modified foods is the same, notwithstanding the fact that about 80% of the food contains some type of adjustment. The likelihood of these engineered foods to produce an allergic response, effect gene expression, or modify the nutritional value of the end product are some of the concerns that should be studied.

Another ethical disadvantage of GMOs is that if GM crops are developed to benefit less developed areas, they will affect the type of farming that is being practiced. Many of those in LEDCs are farmers and rely on agriculture for their income, in the less developed world should practice viable farming methods because disruption would be unethical. If the effect was negative, the problem would be asked whether the income of potential producers and

consumers are simply compensation for any uncertainty that may occur.

Correspondingly, the' unnaturally of genetic modification must be accepted as a justification for disapproving GM crops, because health and environmental threats have been removed, the system must breach some essential boundaries. A professional example of this is found in Ecuador’s Constitution (Art. 71,) this states that nature has the right to: their existence being fully accepted, to maintain and regenerate its vital cycles, structure and functions, and finally, evolutionary processes. Therefore, GMOs go against this along with many people's beliefs of nature.

Moving onto the political aspects, developing countries are slowly opening the door to GMO crops research and marketing. Some see a solution in genetically engineered crops as these countries seek to expand their export markets, boost domestic living conditions, and tackle food insecurity. However, only four African nations — Burkina Faso, Egypt, Sudan, and South Africa — approved the use of GMOs in commercial agricultural output until recently; and the only crop permitted to be planted for all but South Africa is Bt cotton, which is an agricultural crop, not a food crop, so it won't do much for addressing famine. A reason for this disapproval of GMOs is most likely because Africa follows Europe’s lead in its regulatory approach to technology. African countries sell to Europe a lot of agricultural products, and they believe that if European buyers do not want to buy these products, it is better not to grow them at all.

Next, in regions facing environmental challenges, the GMO controversy is also prevalent. It includes the Asia Pacific, where fertile land is changing rapidly due to rising natural disasters and rising sea levels. Countries such as Cambodia, China, Indonesia, Thailand, and the Philippines cover the spectrum of attitudes towards GM crops. Regions like Latin America, which, according to the ?International Service for the Acquisition of Agri-Biotech Applications?, accounted for approximately 45 percent of biotech crops worldwide in 2016, are already planning for the effect that climate change will have on their ability to grow food in the future. However, the United States of America, a highly developed country made a law, commonly known as the “Farmer Assurance Provision,” was terminated in 2013. The law stated that if the USDA had already authorized (or deregulated) a biotech crop and a court overturned that approval, the law ordered the Secretary of Agriculture to grant a temporary status of legalization at the request of a grower or seed producer in order to allow farmers to continue the production of the plant with the catch that legal challenges for that crop would still be in place which came with conflict, therefore, the law was terminated. Which makes it yet another highly developed country which does not support the GMO market.

Finally, GMOs have provided a financial benefit to farmers in Brazil, according to a recent study on the economic impact of GM crops. GMO soybean varieties have lowered product costs with a $34 per hectare average farm income gain. With an average farm income gain of $58 per hectare, GMO maize has reduced output costs and increased yield. And cotton has reduced the cost of output and increased yield with $91 per hectare average farm income value. Countering this, as Maria Ishii-Eisemann, a senior scientist at the Pesticide Action Network, explained at an anti-GMO conference, food independence is 'our right to save, plant, and produce seeds and crops as we want. The skills needed to genetically modify seeds are so advanced (that only a handful of large companies can take it on. Compare that to the thousands — or, globally, the millions — of seed dealers and seed savers using conventional plant breeding techniques.

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