RESEARCH PAPER | Botany | Volume : 4 | Issue : 12 | Dec 2014 | ISSN - 2249-555X

Genetically Modified Crops and Criticisms

KEYWORDS: Genetically modified Crops.

Dr. Parveen Garg

Department of Botany,Swami Shradhanand College, University of Delhi,Alipur, Delhi- 110036

ABSTRACT *Traditional methods of gene exchange are limited to crosses between the same or very closely related species, a footing which modern biotechnology (genetic engineering or genetic modification) departs from by facilitating gene transfer between species irrespective of taxonomic positioning. An organism that has been modified or transformed using such latest techniques of molecular biology is commonly referred to as a genetically modified organism (GMO).*

Unlike conventional breeding, genetic engineering has been and continues to be received with mixed reactions amongst nations, regions, civil society groups and the academic community. Genetic modification is a subject of great controversy in its own right as some see the science itself as intolerable meddling with natural order, which needs to be banned. The other front presents views in support of genetic engineering hailing it as a promising response to many problems facing mankind in many sectors including agriculture, health and industry.

Criticisms against GM foods

Environmental activists, religious organizations, public interest groups, professional associations and other scientists and government officials have all raised concern about GM foods, and criticized agribusiness for pursuing profit without concern for potential hazards, and the government for failing to exercise adequate regulatory oversight. It seems that everyone has a strong opinion about GM foods. Even the Vatican (1) and the Prince of Wales (2) have expressed their opinions.

Most concerns about GM foods fall into three categories: environmental hazards, human health risks, and economic concerns.

Environmental hazards

Unintended harm to other organisms

Last year a laboratory study was published in Nature (3) showing that pollen from B.t. corn caused high mortality rates in monarch butterfly caterpillars. Monarch caterpillars consume milkweed plants, not corn, but the fear is that if pollen from B.t. corn is blown by the wind onto milkweed plants in neighboring fields, the caterpillars could eat the pollen and perish. Although the nature study was not conducted under natural field conditions, the results seemed to support this viewpoint. Unfortunately, B.t. toxins kill many species of insect larvae indiscriminately; it is not possible to design a B.t. toxin that would only kill crop – damaging pests and remain harmless to all other insects. This study is being reexamined by the USDA, the U.S. Environmental Protection Agency (EPA) and other nongovernmental research groups, and preliminary data from new studies suggests that the original study is been flawed (4 and 5). This topic is the subject of acrimonious debate, and both sides of the argument are defending their data vigorously. Currently, there is no agreement about the results of these studies and the potential risk of harm to non - target organisms will need to be evaluated further.

Reduced effectiveness of pesticides

Just as some populations of mosquitoes developed resistance to the now-banned pesticide DDT, many people are concerned that insects will become resistant to B.t. 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 "superweeds" would then be herbicide tolerant as well. Other introduced genes can cross over into non – modified crops planted next to GM crops. The possibility of interbreeding is shown by the defense of farmers against lawsuits filed by Monsanto. The company has filed patent infringement lawsuits against farmers who may have harvested GM crops. Monsanto claims that the farmers obtained Monsanto – licensed GM seeds from an unknown source and did not pay royalties to Monsanto. The farmers claim that their unmodified crops were cross – pollinated someone else's GM crops planted a field or two away.

SOLUTIONS TO ABOVE PROBLEMS

There are several possible solutions to the three problems mentioned above. Genes are exchanged between plants via pollen. Two ways to ensure that non – target species will not receive introduced genes from GM plants are to create GM plants that are male sterile (do not produce pollen) or to modify the GM plant so that the pollen does not contain the introduced Gene (6, 7 and 8). Cross – pollination would not occur, and if harmless insects such as monarch caterpillars were to eat pollen from GM plants, the caterpillars would survive. Another possible solution is to create buffer zones around fields of GM crops (9). For example, non – GM corn would be planted to surround a field of B.t. GM corn, and the non – GM corn would not be harvested. Beneficial or harmless insects would have a refuge in the non – GM corn, and insect pests could be allowed to destroy the non – GM corn and would not develop resistance to B.t. pesticides. Gene transfer to weeds and other crops would not occur because the wind – blown pollen would not travel beyond the buffer zone. Estimate of the necessary width of buffer zones range from 6 meters to 30 meters or more. 30 this planting method may not be feasible if too much acreage is required for the buffer zones.

Volume : 4 | Issue : 12 | Dec 2014 | ISSN - 2249-555X

HUMAN HEALTH RISKS

Allergenicity

Many children in the US and Europe have developed life – threatening allergies to peanuts 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. A proposal to incorporate a gene from Brazil nuts into soybeans was abandoned because of the fear of causing unexpected allergic reaction. Extensive testing of GM foods is required to avoid the possibility of harm to consumers with food allergies.

Unknown effects 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 article published in Lancet examined the effects of GM potatoes on the digestive tract in rats (10). This study claimed that there were appreciable differences in the intestines of rats fed with GM potatoes and rats fed with unmodified potatoes. Yet critics say that this paper, like the monarch butterfly data, is flawed and does not hold up to scientific scrutiny 11. Moreover, the gene introduced into the potatoes was a snowdrop flower lectin, a substance known to be toxic to mammals. The scientists who created this variety of potato chose to use the lection gene simply to test the methodology, and these potatoes were never intended for human or animal consumption. On the whole, with the exception of possible allergenicity, scientists believe that GM foods do not present a risk to human health.

ECONOMIC CONCERNS

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 patented, and patent infringement is a big concern of agribusiness. Yet consumer advocates are worried that patenting these new plant varieties raises the price of seeds so high that small farmers and third world countries are not able to afford seeds for GM crops, thus widening the gap between the wealthy and the poor. It is hoped that in a humanitarian gesture, more companies and non – profits follow the lead of the Rockefeller foundation and offer their products at reduced cost to impoverished nations.

Patent enforcement may also be difficult, as the contention of the farmers that they involuntarily grew Monsanto – engineered strains when their crops were cross – pollinated shows. One way to combat possible patent infringement is to introduce a "suicide gene" into GM plants. These plants would be viable for only one growing season need to buy a fresh supply of seeds each year. However, this would be financially disastrous for farmers in third world countries who cannot afford to buy seed each year and traditionally set aside a portion of their harvest to plant in next growing season. In an open letter to the public, Monsanto has pledged to abandon all research using this suicide gene technology (12).

REFERENCE 1. TypeII fish antifreeze protein accumulation in transgenic tobacco does not confer frost resistance (Transgenic Research, Vol 8, No 2, pp 105-117,Apr 1999) | 2. Transgenic salt-tolerance tomato plants accumulate salt in foliage but not in fruit (Nature Biotechnology, Vol 19, No 8,pp 765-768, aud 2001) | 3. Peroxidase activity of desiccation-tolerant loblolly pine somatic embryos (In Vitro Cellular & Devopment Biology Plant,Vol 36, No 6,pp. 488-491, Dec 2000) | 4. GM corn poses little threat to monarch (Nature Biotechnology, Vol 17, p 1154, Dec 1999) | 5. Bt and the Monarch Butterfly: Update by Dr. Douglas Powell (AGCare Update Magazine) | 6. New tools for chloroplast genetic engineering (Nature Biotechnology, Vol 17, No 9,pp 855-856, Sep 1999) | 7. Tandem constructs: preventing the rise of superweeds (Trends in Biotechnology, Vol 17,No 9,pp 361-366,Sep 1999) | 8. Containment of herbicide resistance through genetic engineering of the chloroplast genome (Nature Biotechnology, Vol 16, No 4, pp345-348,Apr 1998) | 9. Efforts of bioengineer intrinsic resistance to insect pests into crop plants have made use of a natural bacterial toxin ,Bt, from Bacillus thuringiensis Berliner (Science, Vol 284, No 5416, p 873, May 1999) | 10. Effect of diets containing genetically modified potatoes expressing Galanthus nivalis lectin on rat small intestine (Lancet,Vol 354, No 9187,pp 1353-1354,Oct 1999) | 11. The Lancet scolded over pusztai paper (Science ,Vol 286,p656, Oct 1999) | 12. In an open letter from Monsanto CEO Robert B. Shapiro to Rockfeller Foundation President Gordon Conway,Monsanto announced it will not pursue technologies that rendor seed sterile. |