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Awareness of Health Impacts of Genetically Modified Foods in India

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Abstract

Genetically modified foods (GM foods) are foods derived from genetically modified organisms (GMOs). GMOs have had specific changes introduced into their DNA by genetic engineering techniques. Countries like India that have food security concerns and have small and marginal farmers practicing an integrated type of agriculture have specific problems for which they seek solutions. Crisis for genetically modified foods is an unsolved poblem till date in India as there is no step taken by the government. The GM crops currently on the market are mainly aimed at an increased level of crop protection through the introduction of resistance against plant diseases caused by insects or viruses or through increased tolerance towards herbicides. Insect resistance is achieved by incorporating into the food plant the gene for toxin production from the bacterium Bacillus thuringiensis (BT). Many alarming health risk such as infertility, allergy, metabolic syndrome, cancer etc are been caused by consuming GM foods by the toxin produced by it. There is a great need to create awareness among the public on health effects of GM foods to avoid future health risk. Measure to be taken by the government to eradicate the GM foods from the market.

Keywords: Genetically modified foods; *Bacillus thuringingenesis; C*ancer; Allergy; Infertility

Introduction

Genetically modified foods (GM foods) are foods derived from genetically modified organisms (GMOs). World Health Organisation (WHO) defines Genetically modified organisms (GMOs) as organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally. The technology is often called "modern biotechnology" or "gene technology", sometimes also "recombinant DNA technology" or "genetic engineering". It allows selected individual genes to be transferred from one organism into another, also between non-related species.Such methods are used to create GM plants – which are then used to grow GM food crops. GMOs have had specific changes introduced into their DNA by genetic engineering techniques. For centuries, food crops and animals have been altered through selective breeding. While genes can be transferred during selective breeding, the scope for exchanging genetic material is much wider using genetic engineering. In theory, genetic engineering allows genetic material to be transferred between any organism, including between plants and animals.

Origin of GM foods

First commercially grown genetically modified whole food crop was the tomato (called Flavr Savr), which was made more resistant to rotting by Californian company Calgene. The tomatoes were released into the market in 1994 without any special labelling. The initial objective for developing plants based on GM organisms was to improve crop protection. The GM crops currently on the market are mainly aimed at an increased level of crop protection through the introduction of resistance against plant diseases caused by insects or viruses or through increased tolerance towards herbicides. Insect resistance is achieved by incorporating into the food plant the gene for toxin production from the bacterium Bacillus thuringiensis (BT). This toxin is currently used as a conventional insecticide in agriculture and is safe for human consumption. GM crops that permanently produce this toxin have been shown to require lower quantities of insecticides in specific situations, e.g. where pest pressure is high.

Certain number of techniques exists for the production of GM plants. The two most commonly employed are the bacterium *Agrobacterium tumefaciens*, which is naturally able to transfer DNA to plants, and the 'gene gun', which shoots microscopic particles coated with DNA into the plant cell. Generally, individual plant cells are targeted and these are regenerated into whole GM plants using tissue culture techniques. Three aspects of this procedure have raised debate with regard to human health. The transformation is facilitated by a selected marker gene conferring which will be resistance to antibiotic (e.g. kanamycin, which kills normal non-GM plant cell) is co-transferred with the gene of interest to allow discrimination of GM tissue and regeneration of GM plants. This method of transferring has a risk of spreading of antibiotic resistance to the bacterial population either in the soil or in the human gut after consuming GM food (Suzie key et al, 2008).

Production of GM foods across the world

The cultivation of genetically modified plants increased globally in 2009 as well. In comparison to 2008, field area rose by nine million hectares to total of 134 million. This growth totalled three percent in industrialised nations (two million hectares) and 13 percent in developing nations (seven million hectares). Above averaged field increases were noted in Brazil and Burkina. In the case of soy, approximately 77 percent of global production is achievedn with GM soy beans and this figures is 49 percent in the case of cotton. The annual report on the worldwide commercial use of GM plants is published by the agro-biotechnology agency ISAAA (International Service for the Acquisition of Agri-Biotech Applications). According to the report, crop areas increased once more in 2009 in countries in which GM plants already have been cultivated on a large scale for the number of years.

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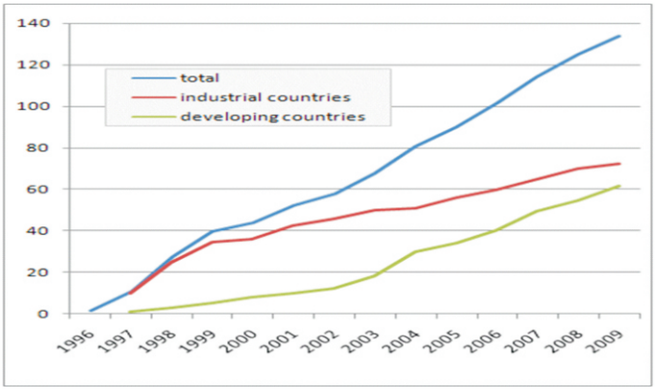

Figure 1. Cultivation of GM plants 1999-2009(Source- International Service of Acquisition of Agri-Biotech Applications (ISAAA, 2009)

Countries	Area of cultivation (millions of hectares)	Crops cultivated
USA	64	Soyabeans, Maize, Cotton, Rape seed, Sugar Beet, Squash and papaya
Brazil	21.4	Soya bean, Maize, Cotton
Argentina	21.3	Soyabean, Maize, Cotton
India	8.4	Cotton
Canada	8.2	Rape seed, Maize, Soya bean, Sugar beet
China	3.7	Cotton, papaya, tomatoes, sweet pepper

Table 1. Field areas of GM plants according to country in 2009 (field are in millions of hectares)(Source- International Service of Acquisition of Agri-Biotech Applications (ISAAA, 2009)

The field area of GM cotton increased in 2009 by cotton increases in 2009 by 3.2 percent to a total of 16 million hectares. Costa Rica planted GM cotton first time in 2009, followed by it eleven other countries cultivated. The leaders in GM cotton cultivation are USA, India and China. In India, field area rose from 7.6 percent to 8.4 million hectares. In 2009, 87% of Indian cotton production was based on GM. Without any proper test, Bt.brinjals is commercialized in Indian markts.

Ill effects GM cotton and GM Brinjal – Indian scenario

In the thirty seventh report given by Committee on Agriculture (Ministry of Agriculture, India) with respect to "Cultivation of Genetically Modified Foods- Prospects and effects (2011-2012)" held in Lok shabha, New Delhi discussed the current perpectives in GM foods especially in Bt Cotton and Bt.Brinjal. The committee consists of Members from various organisations, Universities, National and International testing forum, Departmant of Biotechnology (DBT), Department of Science and Technology (DST), Genetic Engineering Appraisal Committee (GEAC), Mosanto etc.

a) With respect to Environment and Livestock

Laboratory study was published in Journal Nature (1999) revealed 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.

Figure 2. Bt.Brinjal

Crops	Area	Area (GM)	Proportion of GM
Soyabean	90	69	77%
Maize	158	42	26%
Cotton	33	16	49%
Rape seed	31	6.4	21%
Sugar beet	4.4	0.5	9%

Table 2. Cultivation worldwide in millions of hectares. Source-Inter national Service of Acquisition of Agri-Biotech Applications (ISAAA, 2009)

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 cropdamaging 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 nongovernment research groups, and preliminary data from new studies suggests that the original study may have been flawed (Douglous,1999). 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.

In India, Thousands of cattle in Andra Pradesh died after consuming the remnents of Bt. Cotton. Now the Andhra Government has issued a dictum that farmers should not allow their cattle to be fed on the remnants of these plants which could be toxic. In Gujarat, there is also a report that the soil after it has been used for Bt. Cotton for several years becomes incapable of sustaining any other crop possibly because of dehydration and loss of micro-nutrients.

b) With respect to human health

It was often suggested by the advocates of GM crops that there should be no concerns about this issue because GM crop material is degraded during processing into feed and during digestion. There are, for instance, significant secretions of nucleases, enzymes which break down DNA, along the gut (David Beever and Richard Phipps, 2003). Until a couple of years ago, none of the published studies had detected transgenic (GM) DNA in the milk, eggs or meat of GM-fed animals (Phipps et al, 2003, Chowdhury et al, 2004, Einspanier et al, 2001 and Phillips et al, 2002). Nevertheless, several of these studies found that plant chloroplast DNA from animal feed is present in milk, eggs and meat (Phipps et al, 2003, Chowdhury et al, 2004 and Einspanier et al, 2001).

All over the world many testing laboratries were set up to analyse the risk of GM foods. But in our country, though we have all technological advancments to set up the labotaries to test our own GM crops, due to political crisis it has been not created. It has been stated out clearly in the thirty seventh report given by the ministries in the meeting conducted by Committee on Agriculture held in Lok sabha (2012) describing on the topic "Cultivation of Genetically Modified Foods-

Prospectrs and Effects" chronic toxicity on GM crops has been refused. If the chronic toxicity tests done, B.t cotton will not be marketed. In case of B.t Brinjal, Genetic Engineering Approval Committee hurridely approved it on October 14th, 2009 even though the reports concerning the ill effects submitted earlier to the committee. Followed by the approval the group of scientific committee framed a false report indicating the B.t Brinjal is safe for human consumption in the year 2010.

Monsanto-Mahyco, 2009 in its report stated that the release of Bt brinjal into the environment for food, feed and cultivation may present a serious risk for human and animal health; the GM aubergine is unfit for consumption. That's the verdict of French scientist Professor Gilles-Eric Seralini of the Committee for Independent Research and Information on Genetic Engineering (CRIIGEN), who carried out the first ever independent assessment of Monsanto-Mahyco's dossier on toxicity tests submitted to the Indian regulatory authorities. Professor Seralini, commissioned by Greenpeace India to undertake the assessment, said his key findings were statistically significant differences between groups of animals fed GM and non-GM brinjal in the raw data, which were discounted rather than used to raise food safety concerns and to call for further investigation. Mosanto in its report indicated that brinjals contain alkaloids in it- two major and two minor. Alkaloids are generally toxic. The two major alkaloids' level in brinjal is just about what man can tolerate. In Bt. brinjal, one of these alkaloids increases by 30 per cent. This is the primary data of Monsanto which available on the net. But Expert Committee-II Report, on the basis of which Bt. brinjal was cleared by GEAC on 14.10.2099, says that there is no difference. Now this difference of 30 per cent is a lot of difference. Then, it has two minor alkaloids which are highly toxic. There, even if there is an increase of 20 per cent, it would mean that brinjal becomes toxic.

An article published in India Today (Jan, 2011) reported the analysis done by Dr.Lou Gallagher, an epidemiologist from New Zealand that rats fed on B.t Brinjal experienced organ and system damage and had ovaries at half their mormal weight, enlarged spleen with white blood cell count at 35-40% higher than normal with elevated eosinophils indicating immune function changes. Moreover toxic effects to the liver were seen in the form of elevated bilirubin. This is a ninety days rat study which is the longest study done to find the health effect of GM crops.

India is the home of brinjal, where it has been cultivated for four thousand years without the help of fertilizers or pesticides. When there are so many indigenous varieties of brinjal in each region of India, where is there a need to borrow this Bt brinjal from other countries? So far, over 70 000 Indians have signed the "I am No Lab Rat" anti-GM protest in India that is also battling large scale cultivation of Bt cotton (Kurunganthi, 2008).

Conclusion

Nature journal (1999) has published an article stating that India's government has not yet announced a policy on GM foods because no GM crops are grown in India and no products are commercially available in supermarkets yet. India is, however, very supportive of transgenic plant research. It is highly likely that India will decide that the benefits of GM foods outweigh the risks because Indian agriculture will need to adopt drastic new measures to counteract the country's endemic poverty and feed its exploding population. Even though GM foods have some advantages, it has serious health effects so it is necessary for the Indian Government to set up the proper well equiped laboratories to test the GM food for chronic toxicity before commercialization. This will pave the way for healthy India.

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