Is gene modification a panacea for the world hunger?

The growth of the world population at the rate of 78 million people a year would need 640 square miles of farmland for their food needs, according to an estimate made by Lester Brown, Earth Policy Institute, Washington. India will add another 500 million people[1], reaching the 1.6 billion mark by 2012. The tropical forests in the Amazon region, Congo and Indonesia are already bearing the brunt of deforestation, to give way to new farmland and timber for the growing human population. The recent surge in production of biofuels from food crops in addition to the export bans and excess levies the world over, has heightened the food crisis.

To resolve the food security problem for the population of 9 billion in the coming 50 years, it has been realized that agricultural research and genetic modification could provide the key to the situation. The International Assessment of Agricultural Science and Technology for Development (IAASTD) was formed in 2002, as a result of a conjuncture between biotech companies and the World Bank, to ascertain the status of genetically modified (GM) crops for the developing nations. In 2005, the IAASTD had widened its interests from food production to encompass social justice and the environment[2]. The assessment led to a contention as to whether GM crops are to be favoured or not. Controversies surrounding GM foods and crops mainly emphasize on human and environmental safety, intellectual property rights, ethics and environmental conservation among others. Opponents of genetic engineering fear that the use of this technology outside laboratory environs carries potential threats to both farmed and wild ecosystems[3].

GM foods are produced from genetically modified organisms (GMO) that have had their DNA altered through genetic engineering. GM foods were first put on the market in the early 1990s. The most common modified foods are derived from plants: soybean, corn, canola and cotton-seed oil[4]. Other GM crops include insect-protected maize and herbicide-tolerant maize, cotton and rapeseed varieties[3]. GM crops have been extensively cultivated in the United States as well as agronomical countries such as Argentina, Brazil, South Africa, India and China. Biotechnological science has already established itself in developing countries. With the development of a new strain of GM rice, China is emerging as one of the major centres for R&D in biotechnology[5]. There has been a progressive expansion of GM crops[3] in India since 2002. In Africa, the Gates Foundation has invested millions of dollars for a genetic engineering project that will add the essential nutrients, vitamins A and E, iron, zinc and improved protein to various food crops[5].

However, NGOs, public interest groups as well as religious organizations have expressed concern about GM foods and their effect on the environment as well as human health. In the UK, food manufacturers and supermarkets have renounced GM ingredients. Synthetic farming has driven 40 species of weeds into the endangered category. This has led to scepticism over cultivation of pesticide-resistant GM crops which would further claim the remaining species of wildlife[6]. Studies have shown that GM crops can cause unintended harm to other organisms. The Botanical and Rotational Implications of Genetically Modified Herbicide Tolerance (Bright) Link Project undertaken in the UK states that GM crops pose no harm to the environment than conventional plant varieties. But the same was criticized by English Nature, the UK government's independent wildlife advisor, as it presented a threat to wildlife as well as weeds[7]. There are possibilities of cross-breeding among genetically engineered crop plants and weeds, leading to development of 'superweeds'. This may have a huge impact on biodiversity if herbicide-tolerant crops are sprayed with herbicide to the extent that no wild plants are able to survive. Plants toxic to insects may result in a decline of birds and insects which feed on wild seeds or food. Reports of GM foods misplacing the bee populations in Germany as well as the US are plenty, thereby risking agriculture as well as economy[8]. Cultivation as well as consumption of GM food may also pose health risk to human beings in the form of allergies and anaphylaxis[9].

In GM crops genes are incorporated into the crop's genome using a vector containing several other genes, including viral promoters, transcription terminators, antibiotic resistance marker genes and reporter genes. There is little information on the safety of these genes. DNA does not always fully break down in the alimentary tract[10]. Gut bacteria can take up genes and GM plasmids[11] and this opens up the possibility of the spread of antibiotic resistance. Consumption of components with high biological activity may have major effects on the body's metabolism, which can be screened only by novel toxicological methods. The present methods used for testing toxicity in food are confined to chemical analysis of nutrients and known toxins. Hence better diagnostic methods such as mRNA fingerprinting, proteomics and secondary metabolite profiling are required to be performed before sanctioning a GM crop into the food chain[12].

GM crops have been portrayed as a succour for the world's food needs in the impending future, by delivering increased yields and disease-resistant crops. Dick Taverne, author of *The March of Unreason: Science, Democracy and the New Fundamentalism*, extols that 'the anti-GM lobbies have exacted a heavy price on the agro-business in Europe', further adding that 'the delay in cultivation has led to loss of millions of lives in developing countries'[5]. However, the correlation between unavailability of food and malnutrition drawn by the GM campaigners does not seem to be true. Analysts blame the starvation among the poor to the unaffordable food costs and ill-managed stretches of fertile land. Judicious utilization of huge fertile tracts of East Africa and Central America along with implementation of irrigation systems like the drip systems which the Israelis developed to make the Negev Desert bloom, could help solve the world's hunger problem. The global food crisis can be solved with intelligent land management[13]. It is the socio-political design which affects people and their lives. The Friends of Earth, an NGO in the UK, believes that the future of farming does not lie with the hi-tech GM crops, but with traditional practices that develops safe and wholesome food, thereby protecting rural livelihoods as well as the environment[6].

While the Greenpeace opposes GM organisms in the environment, biotech companies do not consider ecologically sustainable agriculture such as organic farming to be a feasible option for optimizing the world's agricultural output.

As the world stands divided on GM foods, the IAASTD emphasizes on 'agro-ecological' strategies to address environmental issues, integrate traditional, community-based knowledge, create opportunities for the poor farmers and include social scientists in the policy-making process[2]. Genetic engineering seems to be a promising technology for fulfilling the larger needs of the coming generation. However, it is imperative to take safety measures in order to guard biodiversity at large.

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Neelam Pereira (*S. Ramaseshan Fellow*), W/o Dr Abhijit Mazumder, National Centre for Antarctic and Ocean Research, Headland Sada, Goa 403 804, India.
e-mail: neelam.pereira@gmail.com

Scopus awards to young Indian scientists

Scopus®, the largest abstract and citation database of peer-reviewed research literature and quality web sources, announced on 8 December 2007, the Second Young Indian Scientist awards. The awards, instituted by Elsevier, a well-known publisher of scientific, technical and medical information products and services, were given away to nine young researchers in the presence of Theo Groothuizen, S&T Counsellor, Royal Dutch Embassy. The researchers had been selected by a jury that included subject experts, senior academicians and Scientometricians.

The awardees included: Bakhtisaran Raman – Biological Sciences, Centre for Cellular and Molecular Biology, Hyderabad; Anil Kumar – Chemistry, Indian Institute of Technology, Bombay; S. K. Satheesh – Earth Sciences, Indian Institute of Science, Bangalore; Sanjay Mittal – Engineering, Indian Institute of Technology, Kanpur; Dinesh Mohan – Environmental Sciences, Industrial Toxicology Research Centre, Lucknow; Upadrastha Ramamurthy – Material Sciences, Indian Institute of Science, Bangalore; Nimish A. Shah – Mathematics, Tata Institute of Fundamental Research, Mumbai; Sushil Kumar Jha – Medicine, Jawaharlal Nehru University, New Delhi, and Vinod Kumar Aswal – Physics, Bhabha Atomic Research Centre, Mumbai. The awards were for young scientists not more than 40 years old. The award carried a citation, a crystal plaque and a cash award of Rs 50,000.

MEETING REPORT

Sea faring traditions of the Indian west coast*

The Third S. Ramaseshan Memorial Public Lecture was delivered by the noted historian, Lotika Varadarajan during the 73rd Annual Meeting of the Indian Academy of Sciences (IASc), Bangalore held at Thiruvananthapuram. D. Balasubramaniam, President of the Academy, in his introduction stated that the lecture series was conceived to honour S. Ramaseshan, who he described as a 'doer of science'. Ramaseshan's greatness lay in the manner in which he blended his quest of science with societal commitments. Hence, it is no surprise that Ramaseshan's contribution to science is multifold, illustrated to some extent by the journals of the Academy, notably *Resonance* and *Current Science*. The IASc has an established tradition of inviting experts from other fields to its Annual Meetings, primarily to underpin the regard that it accords to knowledge and learning. And keeping with the tradition, Lotika Varadarajan presented her work of a number of decades titled 'Sea faring traditions of the Indian west coast'.

Describing herself as a historian who rediscovered herself after working on cultural processes, Varadarajan set the tone of her talk by stating that she truly enjoyed working on seafaring traditions. The method used for the study was the analysis of a composite body of chronological, material and oral sources. That India has never been a seafaring nation is

*A report on the Third S. Ramaseshan Memorial Public Lecture delivered on 4 November 2007 during the 73rd Annual Meeting of the Indian Academy of Sciences, Bangalore, held at NIIST (formerly RRL), and SCTIMST, Thiruvananthapuram.