PAPER ON GM CROPS

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1. Preamble

1.1 Agriculture is the prime pivot of the Indian economy contributing 15 per cent of the Gross Domestic Product and more than 50% population directly dependent on it. India's food-grain production crossed the 240 million tonnes. However the rapid increase in the population level, expected to touch the 150 crore mark in the next two decades, needs an equally increased production of food grains. The scenario is very bleak and getting more bleak every year. We have a population which is nearly 17 per cent of the total human population of the world and the arable land mass is just 2.2 per of the arable land. The per capita arable land area was 0.48 ha in 1950 which has now gone down to 0.3 ha in 2009. We have to manage our production of grain and other agricultural produce within this limitation. Instead of a horizontal growth we have to plan a graph on the basis of innovations like shorter durations and diversifications.

The earlier experiments of optimum use of fertilizers and pesticides, which had ushered in the green revolution, have now started taking its toll. The soil has absorbed the maximum it could and the percentage of crops vis-à-vis chemicals used has started a steep decline. It has also resulted in toxic chemicals, via pesticides, polluting the crops, air and ground water. These are now finding its way into the human constitution creating further problems. Bio-degradation has been analyzed as the result of contamination due to heavy metals like mecury, lead and fertilizers. The unplanned discharge of sewage from industries is also finding its way to the soil and groundwater.

The latest researches in DNA technology has made it possible to select genes and introduce the produce the productive ones into hybrid seeds with better productivity and nutritional value. Tissue culture is now one of the most important researches in bio-technology and has helped in introducing genetically modified plants with immense commercial value. So, Genetically Modified (GM) Crops is seen as real option in modern agriculture. They offer advantages for agriculture production, but they also raise concerns about their ecological, economic and ethical impacts.

The objective of this paper is to take cognizance of the existing situation and to propose a framework for creation of an overarching system of laws and institutions and for a plan of action with a unified national perspective.

1.2 The present scenario of GM Crops has given rise to certain expectations as well as several concerns, important

amongst them are:

1.2.1 At present, the genetic engineering is allowed only for Cotton crops. Almost 90% of the cotton cultivation area is under Bt Cotton. The data, based on estimates for the year 2010-11, shows that out of total area of 111.42 lakh hectares under cotton cultivation, 98.54 lakh hectares are under Bt Cotton,

1.2.2 Bt Brinjal is next to come. The Genetic Engineering Approvals Committee (GEAC) report recommended commercial cultivation of Bt Brinjal but qualified it by stating that since the issue has important policy implications at the national level, the government should take a final view on the matter.

1.2.3 Most of the state governments have expressed concern and have sought to ban the use of Bt Brinjal, or all GM crops.

1.2.4 After the oppositions, the commercialisation of Bt Brinjal is being halted by the Union Government.

1.2.5 The claim about prospective rise in productivity is challenged. Its challenged on the basis of production graph of Bt Cotton.

1.2.6 Safety is a concern since the kind of tests that have been done is not specific or stringent enough to detect toxins.

1.2.7 There are apprehensions that there will be diversity loss in the variety of crops if genetically modified version of the crop is introduced, and this fear cannot be glossed over.

1.2.8 The regulatory and legal framework in India is still in developing stage.

1.2.9 The research in the field of genetic engineering is done mostly in private domain. The government funded research is nowhere to compete with global corporate giants.

2. Institutional / Legal Framework

2.1 India is having one of the toughest regulations for the GMO. The guide line prepared by RDAC (Recombinant DNA Advisory Committee) of DBT

2.2 The recombinant DNA safety guidelines are based on the 3tire system involving

2.2.1 **IBSC** – Institutional Bio-safety Committees are established at every institute engaged in research

2.2.2 **RCGM** - Review Committee on Genetic Manipulation is national committee functioning under DBT and has the function of reviewing the approval of of ongoing R&D project on GMO undertaking field visits of the sites of experimental facilities and issuing clearance for import/ export of vectors, germplasm etc.

2.2.3 **GEAC** – Genetic Engineering Approval Committee functions under MOEF and see the environmental concern. Following the GEAC clearance, the applicants are to seek the clearance of Ministry of Agriculture (MoA)

2.3 The GEAC process for approval is being questioned. The GEAC should emphasize on biological risk assessment. GEAC should regulate genetic technology like the US Recombinant Advisory Committee (RCA) does for genetically engineered drugs. RCA makes it mandatory for companies to provide a list of negative and harmful impacts and minimizes that impact before approving for commercial sale.

2.4 The GoI must invest in public funded research in the field of genetic engineering. Today, the research is done mostly in private domain by the big MNCs. A public funded research will ensure the truth behind the claims on either side of GM Crops.

3. The GM Crops Regulatory Authority

3.1 There is urgent need of such independent and autonomous authority.

3.2 The working and decision making of such authority must be transparent and must come under the provisions of Right to Information.

3.3 The relevant authority should not take away constitutional authority that the state governments have over agriculture and health.

3.4 There should be proper mechanism of public participation. Civil Society, farmers, NGOs should have a say in approval process of any GMO crop.

3.5 A proper liability regime is must in such regulatory authority. The crop developer should be made liable for any leakage. The penalty structure must be stringent and rigorous

4 Seed Industry

4.1 Seed is the basic input for increasing the agricultural production and productivity on which the food security and sovereignty of the nation rests.

4.2 MNCs are controlling 40% of the Rs 5000 Cr Seed business in India. Within next few years they may capture 90% of the seed market and dictate terms to the Indian farmers with high cost of seeds.

4.3 The legal & institutional framework needs to be strengthened to regulate the MNCs.

4.4 Presently, 100 % FDI is allowed in seed sector through automatic route.

4.5 There must be framework where companies dealing in genetically modified (GM) seeds have to meet some extra conditions after the approval. These approvals should include complying with safety norms, seeking permission from the Genetic Engineering Approval Committee and ensuring that they are operating under controlled conditions. The entire process should be under Ministry of Agriculture and Ministry of Environment & Forest.

4.6 The framework should also include regulating the final price of seeds the company is charging to the farmers.

5 Research & Development

5.1 The research in the field of GM Crops is done mostly in private domain performed by big MNCs. Monsanto spins financial growth out of crop growth. By making an early, successful R&D heavy bet on biotechnology, Monsanto transformed itself into global giant in the field of GM Seeds.

5.2 As it is private research, it is for private gain. So any policy decision based on such research is dangerous. A country like India, which seeks independent on technology front, shouldn't depend only on private research.

5.3 In this context, the proposal that GM research should mainly be in the public sector is of great relevance. There could also be public-private partnered GM crop production.

5.4 The R&D Institution should promote Basic & High End Research, International Collaboration, Translational Research for Product Development and Public-Private Partnership

5.5 It should also promote institutional capabilities for laboratory testing, field trials, environmental impact assessments etc.

5.6 The research should also focus on any other alternative technology like Organic Farming or Clonal Seed Technology. (The Clonal Seed Technology has the potential to revolutionise agriculture and would benefit farmers of developing countries in increasing yields of crop. It occurs naturally in a few plant species and not in food crop. High-yielding hybrids in crops are made by crossing two parental varieties, which are genetically different from each other.)

6 Environmental Concerns

6.1 Environmental risk assessments cover both the GMO concerned and the potential receiving environment. The large scale growth of GM crops may have both positive and negative effects on the environment. It affects directly the organisms that feed on or interact with the crops. The GM Crops also have wider effects on food chains produced by increases or decreases in the numbers of other organisms.

6.2 The assessment process includes evaluation of the characteristics of the GMO and its effect and stability in the environment, combined with ecological characteristics of the environment in which the introduction will take place. The assessment also includes unintended effects which could result from the insertion of the new gene.

6.3 Issues of concern include: the capability of the GMO to escape and potentially introduce the engineered genes into wild populations; the persistence of the gene after the GMO has been harvested; the susceptibility of non-target organisms (e.g. insects which are not pests) to the gene product; the stability of the gene; the reduction in the spectrum of other plants including loss of biodiversity; and increased use of chemicals in agriculture. The environmental safety aspects of GM crops vary considerably according to local conditions.

6.4 There are also concerns raised about use of animal strains in modifying genes of seeds. This is very serious issue in country like India.

6.5 Current investigations focus on: the potentially detrimental effect on beneficial insects or a faster induction of resistant insects; the potential generation of new plant pathogens; the potential detrimental consequences for plant biodiversity and wildlife, and a decreased use of the important practice of crop rotation in certain local situations; and the movement of herbicide resistance genes to other plants.

6.6 The biggest threat of GM Crops to environment is talked about in the form of loss of biodiversity, both genetic diversity and also biodiversity in general. But some research found that “cultivating GE crops appears to enhance the survival of biodiversity by raising the productivity of the cultivated land and thus avoiding assailing new lands that are often rich in biodiversity.”

6.7 To protect loss of biodiversity the ‘Seed Bank’ mechanism to be strengthened.

6.8 As of now, there is no evidence to prove any harmful effect of GM crops on environment. But this needs to be collaborated by further independent and transparent research before allowing them in India. Further, a diverse country like India needs to be adopted agro-climatic approach to study the impact of GM Crops on environment.

6.9 The concerns about use of animal strains needs to be researched and reassessed through an independent investigation and research.

7 Health

7.1 The health assessment of GM foods generally considers: Toxicity, Allergenicity, the stability of the inserted gene; Nutritional balance/imbalance associated with genetic modification; and any unintended effects.

7.2 The three main issues debated these days are tendencies to allergenicity, gene transfer and outcrossing.

7.3 GM foods currently available on the international market have passed risk assessments and are not likely to present risks for human health. In addition, no effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved.

7.4 So, the regulatory authority mandate should include post-marketing monitoring of GM food products and Continuous use of risk assessments based on the Codex principles.

8 Economic concerns

8.1 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 will raise the price of seeds so high that small farmers will not be able to afford seeds for GM crops, thus widening the gap between the wealthy and the poor.

8.2 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.

8.3 The Indian experience with Bt Cotton has already proved the high cost of seeds for the farmers. As Indian agriculture is mostly subsistence, high input cost would do away large portion of farmer's income.

8.4 The government should play enabling role here to regulate the seed prices as well as raising Minimum Support Prices (MSP) for such crops.

9 International Opinions

9.1 A research paper in Global Business – How Frankenfood Prevailed. A hungrier world validates Monsanto's tech-driven strategy – says, "…. There are already 120 GM plants approved or in the process of being approved in the EU (The moratorium has always been full of exceptions.). This is hardly broadcast by Europe's officialdom, whose scientists have no major disagreements with their colleagues in the US over food safety. That silence certainly suits European firms that might otherwise be forced to compete more directly with Monsanto, Dow AgroSciences & Pioneer Hi-Bred International."

9.2 The research paper also highlights cross-licensing collaboration or even partners among competitors, as companies seek innumerable seed-and-train permutations to help farmers boost yield.

9.3 C D Mayee, Directory ISAAA and former Vice-Chancellor of Marathawada Agriculture University, Parbhani said in February issue that GM Technology is the best option for sustainable Agriculture. In hostile climatic situations Genetic engineering is best option to do affordable agriculture. The issue also highlights environmental benefits of GM Technology. It said that from 1996 to 2008, due to use of Bt Seeds reduced the pesticides requirement by 8.4%. Also, due to reduced spraying around 1.2 tonnes of CO2 saved from released to atmosphere.

9.4 In 2010, the University of Warwick researchers published a study referred to earlier "The Impact of Bt Cotton on Poor Households in Rural India" in the Journal of Development Studies analysing the direct and spill-over effects of Bt cotton on poor households in rural India. The study shows that the main beneficiaries are vulnerable farmers, whose household income gains are 134 percent higher under Bt than under conventional cotton. Concluding that Bt cotton produces important benefits in large parts of rural India, the study also demonstrate that technology adoption entails important positive socioeconomic effects in the small farm sector as generated income gains for all types of households, including those below the poverty line. Underscoring the UN Millennium Development Goals (MDG) of halving poverty by 2015, the study concludes that GM crop applications can help reduce poverty, as such has wider implications and might further the debate about the role of agricultural biotechnology for sustainable development (Subramanian & Qaim,2010).

9.5 The annual global study of benefits generated by biotech crops, conducted by Brookes and Barfoot (2011, forthcoming), estimates that India enhanced farm income from Bt cotton by US$7.0 billion in the period 2002 to 2009 and US$1.9 billion in 2009 alone. Typically, yield gains are approximately 31%, a significant 39% reduction in

the number of insecticide sprays, leading to an 88% increase in profitability, equivalent to a substantial increase of approximately US$250 per hectare (Gandhi and Namboodiri, 2006). The earlier section in this Chapter on "Impact and Benefits of Bt cotton in India" documents a legion of referenced and compelling independent studies that confirm that Bt cotton has transformed cotton production in India by increasing yield, decreasing insecticide applications and through welfare benefits contributed to the alleviation of poverty for 6.3 million small and resource-poor farmers in 2010 alone; the potential of biotech cotton in India for the future is enormous.

9.6 "New biotechnological techniques in addition to conventional plant breeding are needed to boost yields of the crops that feed the World", Dr. Norman E. Borlaug Nobel Peace Prize Laureate.

Conclusion

The debate about the Genetic Engineering technology is polarized in India. The western opinions are also contrasting. India must be aware of these different viewpoints and should have its own independent thinking and action on the issue. We should be more concerned about Technology that offers higher income to our farmers rather than any corporate interest.

The Genetic Engineering technology has the potential to solve the hunger and malnutrition of the world. The GM Technology not only offers good seed, but it also ensures rise in income, poverty eradication. This needs to be further corroborated through extensive research activities.

At the same time the GM Technology also raises certain environmental as well as practical questions. The Swadeshi groups also raised certain genuine concerns. A strong regulatory framework and thorough, extensive, independent research can answer these questions.

To quote Prof. M.S. Swaminathan, "Unless R&D efforts on GM foods are based on principles of bio-ethics, bio-safety, bio-diversity conservation and bio-partnerships, there will be serious public concern in India, as well as many developing countries, about their ultimate nutritional, social, ecological and economic consequences."

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