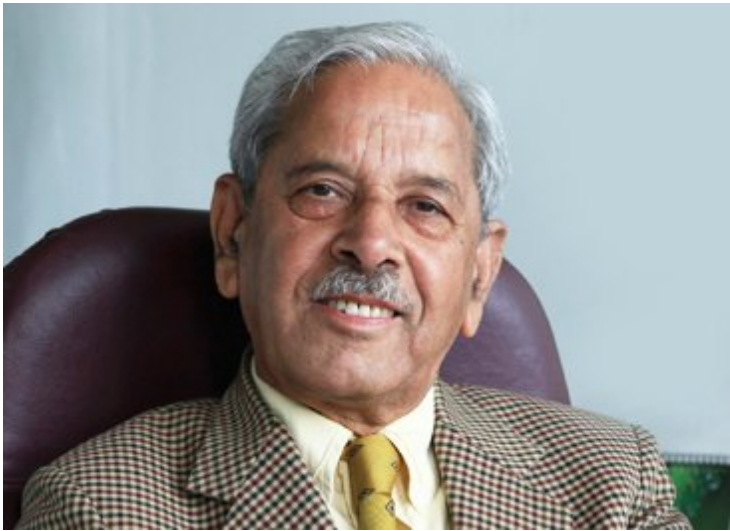


Bioagri in India: Challenges and Future

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Biotechnology uses scientific knowledge and technology for the exploitation of living organisms and systems for the benefit of mankind. It is one of the fastest-growing areas of scientific, technical and industrial innovation in agriculture, pharma and health sectors. Today, the biotechnology sector is embroiled in heated controversy in the world. In this article I have focused on biotechnology in agriculture since it is more controversial.

The controversy is that, big agri-business houses promise solutions to food security through cultivation of genetically modified (GM) crops, while environmental extremists think GM crops, especially when the farmers have to incur high cost on GM seeds in comparison to traditionally bred seeds, as Frankenstein monsters capable of unleashing super-weeds, allergies, toxins, fatal deaths and various environmental problems. The people, especially the farmers, are confused and are at cross roads for using GM crops in agriculture.

Today, we are facing the biggest challenge of feeding the ever increasing population. The 2009 FAO report on "Global agriculture towards 2050" has projected the world population to be 9.1 billion which will be more than 40 percent of today's population. We have to produce about one billion tonnes of more cereals from the present annual production of 2.3 billion tonnes to plus 3 billion tonnes. With 1.747 billion people and 2.4 percent of the total global land mass, India is projected to be the most populous in 2050 and we shall be under tremendous pressure to raise the food production manifold on limited agricultural land.

In the sixties of the last century, we were in a similar dilemma and we overcame the situation by ushering in the "Green Revolution" based on cultivation of high yield Mexican varieties of wheat and rice with high inputs of irrigation, fertilizers and pesticides. According to Nobel Laureate Dr Norman Borlaug, the father of the Green Revolution, it will be impossible to feed the people of this millennium with the current agricultural techniques and practices. Further, the food needs of the fast growing population in this century can be only met by increasing food production using new technologies, including biotechnology and recombinant DNA, otherwise millions of people will be condemned to hunger, malnutrition and starvation,

as well as to social, economic and political chaos.

In view of non-availability of additional agricultural land, the cultivation of pest and drought resistant GM crops holds the most promise for producing more food on less land and diverting the spared land for forestry purposes. This would also help in increasing our forest cover and achieve the national goal of maintaining a minimum of 33.3 percent of the country's land area under forest cover for a healthy and sustainable environment as per the Forest Policy; actual forest cover at present is only 21.05 percent (State of the Forest Report 2011).

The commercial cultivation of first Bt crop (Bt cotton) in India in 2002 is considered as a landmark for the introduction of GM crops in the country. At present, about 80 percent cotton production is due to Bt cotton crop. The Bt Brinjal became the first biotech food crop to be cleared in October 2009 by the Genetic Engineering Appraisal Committee (GEAC) for cultivation in India. Following protests and concerns raised by anti-GM activists, the Government of India imposed an indefinite moratorium on the release of Bt brinjal in the country.

This has seriously jeopardized our efforts to meet the challenge of doubling the current level of food production for meeting the needs of our people in 2050 through Second Green Revolution. The success of the First Green Revolution is largely attributed to the political support and commitment of the then Prime Minister Late Ms Indira Gandhi. She gave a free hand to Prof. MS Swaminathan, noted agricultural scientist, to organize a new agricultural program based on high yield dwarf varieties of crops that made the country not only self sufficient but also surplus in food production. We would have remained food deficient and prone to famines, and dependent on PL 480 wheat from the USA if there was political dithering at that time.

The political indecisiveness, largely in response to unfounded fears and protests by anti-GM lobby of environmental extremists and some NGOs, has already delayed the adoption of Second Green Revolution, and we are heading for crisis of acute food shortages that we were able to overcome 50 years ago. The time is running out, and a clear political direction and policy on GM crops is the need of the hour. According to International Service for the Acquisition of Agri-biotech Applications report, biotech crops are grown over 160 million hectares in 29 countries, and no adverse effects of these crops have been reported.

Being a biologist and cytogenetist, I am convinced that GM crops are as safe as crops produced through conventional breeding. Since Gregor Mendel's experiments on peas to produce hybrids, plant breeders have been shuffling thousands of genes between plants without knowing their function, and we have been accepting these hybrids without raising eyebrows. Ironically, when we insert a single gene with a known function from one organism to another, there is a big hue and cry. Acceptance of GM crops by the people is now a major challenge facing the biotech sector. Our scientists have to come forward and allay the fears in the people's minds about GM crops. I shall be too willing to take a lead in this endeavor.

Finally, the success of GM crops also depends on the governmental policies in dealing with socio-economic issues of the farmers, who are concerned about the monopoly of large agro-business companies in the sale of high cost GM seeds of infertile plants. The farmers are, therefore, perpetually dependant on these companies for the supply of seeds every year. To break this monopoly, the International Maize and Wheat Improvement Center in Mexico (CIMMYT) shall be producing low-cost GM seeds of maize and wheat to help farmers in developing countries to grow more food. In this effort, Microsoft founder Mr Bill Gates and Mexican telecom magnate Mr Carlos Slim have donated \$25 million to CIMMYT for building the latest biotechnological facilities.

The government of India with 42 agricultural universities and host of research institutions should emulate CIMMYT for producing cheaper GM seeds for the growth of food crops in the country. This will go a long way in ushering second green revolution in the country. Needless to say, one of the main reasons for the success of first green revolution was due to the easy availability of low-cost seeds of high yield varieties of rice and wheat. Moreover, the low cost of GM seeds and other agro inputs would go a long way in tackling socio-economic issue of the farmers' committing suicides.

In our country, the weather conditions like irregularity or failure of the monsoons are important risk factors for the crop production. As cheaper GM seeds would require less investment by the farmers every year, they shall be able to withstand the loss in case of crop failure due to adverse climate. Loss of crop and consequently farmers' inability to repay back the loans taken for purchasing high cost Bt cotton seeds and pesticides are considered as the primary causes for committing suicides by them.