

## AGRICULTURE AND Bt BRINJAL CONTROVERSY: WHAT SHOULD BE THE FUTURE ROADMAP FOR INDIA

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“Green Revolution” as have been noted since mid-sixties of last century, had the main components of dwarf high yielding seeds (HYVs), plenty of water, heavy inorganic fertilizers as also chemicals as pesticides, fungicides, weedicides, etc. These combined together could produce significantly higher yield, particularly in irrigated condition. HYVs were mostly prominent in cereals, specially rice, wheat, maize and few others along with many vegetables. Another notable positive factor leading to success was that nearly fully government and public funding in most of the public research and educational institutes did the miracle. No doubt, in India sufficient food grain with overflowing buffer stock led us to believe that food security probably has been achieved. But throughout last decade of 20<sup>th</sup> century continuing through this decade with decelerated and stagnant food production rate agricultural scenario indicated technology fatigue, showing alarmingly static food production hovering around 210 million tons with signs of little hope up to 2004-2005. Signs of recovery were there for a couple of years although situation is still grim due to severe weather fluctuation. Not only we faced severe food crisis but also non recoverable degradation of water and soil resources whereas narrowing of gene pool and diversity due to mono-cropping systems was very much evident. Globally environmental degradation reflected through rise in temperature, irregular, scanty and heavy rainfall. Disasters in the form of drought, flood, cyclone and tornado have become a regular feature in recent times causing alarmingly reduced yield of agricultural crops, specially food crops. Records suggest that since the beginning of liberalization and market reforms declining agricultural production has been noted to be mostly visible in the last 15 years, excepting only 2-3 years. Reasons for this can be attributed to drastic cut in public funding on research and very little concern about eco-friendly farming and cropping systems both in irrigated and rain fed conditions. Planners have found out that to satisfy our need, 11<sup>th</sup> plan should target to increase cereals, pulses and oilseed production to the extent of 1.61, 2.14 and 3.63 times respectively during this plan period. Although targeted to achieve 4% agricultural growth rate we won't be able to achieve 2% this year due to aberrant weather. Thus producing enough food for our growing population while use of eco-friendly technologies in saving the planet and future mankind are the two main challenges ahead of us.

With the advent of liberalization and severe encroachment of multinationals in seed, fertilizers and chemical components of agricultural production, there is an ill conceived attempt to focus on genetically modified crops and organisms in crop production where more than 95% of patented products are owned by private corporations like Monsanto, Syngenta, Kargill and others.

We would confine our discussion on the intended multinational control on our seed sector through the means obtained by agricultural biotechnology tools. Firstly we would attempt to trace out the initiation of GMO production and subsequent spread in respect of area and crop coverage as also different traits till 2008. The discussion would then try to cover the benefits and problems associated with GMO cultivation, while stressing on Bt brinjal and other food crops getting approval from appropriate quarters for commercial cultivation and marketing. Debates

arising out of these steps and decisions taken would be examined, while in conclusion, the future roadmap necessary to make agriculture sustainable would be outlined.

Agricultural biotechnology, of which gene transfer technology is one of the most important tools has made tremendous progress to make it like a magic wand. Through this tool, particular trait or character as embedded in the specific gene could be transferred and implanted in the genome of targeted species and organisms. Unlike hybrid technology practiced by the breeders among the same species, gene transfer methodology can take place among different species including men, animal, fungus, bacteria, etc. This can revolutionize agriculture if transfers are successfully made to impart characteristics like drought and flood resistance, yield augmentation, disease and pest resistance, etc. Unfortunately, with patent right in possession private companies, specially multinationals are very much in the race for overall control resulting nearly 95% of patents in transgenic crops and organisms are owned by them.

First GM tomato, 'Flavr Savr' with delayed ripening characteristic was released by Calgene in 1995 but withdrawn from the market a few years later, supposedly causing health problem. Again, attempt to evolve 'Terminator Seed' by giant corporate seed companies although failed but they are still active to introduce for having monopoly in seed sector. Data on area coverage(FAOSTAT Report,2006) suggest that 21 countries cultivated GM crops over 90 million Ha of land, although 90% cultivation were in four countries(US55%,Argentina19%,Brazil10%,Canada6%)whereas for the remaining 10%, the shares were, in China-4%,Paraguay-2%,India-1% and South Africa-1% and 8 countries sharing the rest. Four GM crops namely, corn, soybean, canolla(rape/mustard} and cotton were mainly commercially cultivated as animal feed and other purposes excluding human food.

The recently published book, Genetic Roulette by J.M.Smith(2007) has stated that presently produced 89% of soyabean,75%canolla,83% cotton and 69% of corn are GM crops. Available marketed GM crops are primarily chosen and used in the fields for exhibiting three traits. These are (i) Lepidoptera type of insect resistant Bt GM crops (ii)weedicide tolerant GM crop 'Round up Ready', and (iii)Golden Rice GM crop. Extensive research and commercial utilization of GMOs are mainly carried out by three multinationals, namely, Monsanto U.S.A, Syngenta of Switzerland and Bayer Crop Science of Germany.(Source:R.N.Basu in Manorama Year Book-2008)

Bacillus Thuringensis or Bt gene is obtained from a soil living bacteria and this when implanted in crop(like cotton,brinjal) genome at molecular levels these become toxic to fruit and shoot borer, bollworm etc. of Lepidoptera type insects .Thus insects of this particular type when they try to attack any plant part die immediately.

Herbicide tolerant gene, HT gene is also obtained from a soil living bacteria. This gene exhibits the property of selectively inhibit action of certain weedcides like "Glyphosate"(ofMonsanto)or'Glufosinate'(ofBayerCropScience),etc. When cultivated, weedcides can't make any harm to GM crops although being destructive to other weeds. A farmer is rather forced to buy particular selective weedicide from the company when purchasing company manufactured GM crops. Golden Rice, very much enriched in vitamin A content, is a product from Syngenta and recommended to prevent night blindness through its use. Common approach of pro-GM lobbies is to establish concrete proofs about showing positive signs of characteristics expressed through engineered genes as also highly increasing effect of harvested marketable yield in nearly all trials.

Trials conducted by Union of Concerned Scientists, USA, mainly on Soybean and corn in different locations of USA, however, could not find yield augmentation with GM crops as compared to ordinary ones.(source:Doug GurianSherman:Report,entitled"Failure To Yield",April,2009).

Before entering into the debate on Bt brinjal commercialization let us briefly state the status of Bt cotton cultivation in India and the issues we need to address in this connection. In India Bt hybrid cotton seeds are product of Monsanto where Mahyco a Maharashtra company is acting as an Indian agent for spearheading commercial cultivation of cotton. Since initiation of cultivation in 2002, significant increase in both area and production under Bt cotton suggest its acceptance by the farmers in cotton growing states of Gujarat, Maharashtra, Andhra Pradesh, Vidarbha and Karnataka. Presently its (Bt) area, expanding more than 4 times is now 7.6 million hectares(2008-09), with production of 4.9 million tonnes, constituting 89% of total cotton(source:Report of Asia Pacific Consortium on Biotechnology-2009).However questions remain about large number of cotton farmers' suicides presumably due to very high cost of cultivation of Bt cotton. It is costly for small and medium farmers to cultivate Bt cotton. Trials also suggest very little yield augmentation when cultivated in rainfed zones. Reports in different sources indicate severe attack of mealy bugs and other pests increasingly with passage of time. Decreased effectiveness of Bt gene against bollworm were also noted. Other social and ecological as also bio-safety issues also need to be seriously addressed.

On 14 October, 2009, on the basis of test results submitted by MAHYCO (Indian agent of Monsanto) on Bt brinjal, developed by them, the GM crop was approved for commercial cultivation. Incidentally this is the first GM food crop to be cultivated and directly used for human consumption as till date GM corn and GM soy had been cleared only for animal feed in U.S, although they are used for human consumption in processed form. To trace the history, it can be noted that since 2000, with the initiation of breeding and trials continuing for 4-5 years in India, data on preliminary aspects were examined by Review Committee on Genetic Modification (RCGM) and the Company was permitted to conduct multi-locational field trials with Bt brinjal hybrids. Next 3 years were followed by large-scale field trials of 8 selected hybrids and experimental seed production from these. On the basis of analysis performed by MAHYCO on different aspects, data, after being screened and examined by Expert Committees, the final report was submitted to GEAC. GEAC then gave it the final approval.

From different organizations representing scientists (including Supreme Court appointed expert Dr.Pushpa Bhargava in the Expert Committee), research organizations, NGOs, Farmers' organizations and number of state governments, protests were lodged in courts of law while questioning various methodologies adopted in conducting trials, collection of data and various other issues concerning ecology, bio-diversity, bio-safety, bioethics and international laws and protocol. In the following paragraphs we will point out some of the points raised by pro and anti-GM lobbies on this burning issue.

Multinationals as also some of the premier organizations are strongly of the view that rigorous screening and evaluation of all possible aspects have been made and all these have clearly confirmed that GM i.e Bt brinjal is nutritionally at par with other varieties, safe to consume and there is no possibility of long term health hazard. Further, Bt will reduce insecticidal spray hazard and thus cost of cultivation will come down and benefit will accrue to the farmers. Several ICAR organizations after few trials have recommended cultivation of this

GM crop. DST, and CSIR chief among others are in favour of introducing Bt brinjal while suggesting to monitor future results.(Hindu website).

Apprehensions from the other end arises the way where undue haste is noted in giving 'go ahead' permission. They have expressed genuine concerns on,

- (i) Anti-biotic resistance and allergenicity of introduced material.
- (ii) Absence of long term nutritional and health hazard trials in the submitted data.
- (iii) Bio-diversity will be threatened and maintaining varietal purity will be difficult. This may happen due to pollen transfer and subsequent out crossing.
- (iv) More research is needed on the toxic (for Lepidoptera) effect on human, animals and others.
- (v) Purchase of hybrids each year will enrich MAHYCO; but it is not affordable for poor farmers.
- (vi) All the bio-safety and bioethical issues agreed upon by 188 countries in Cartagena Protocol on bio-diversity have been violated before giving approval.

Cause of concern also stems from different field and laboratory experiments on feeding and other trials all over the world enlisting economic, environmental, agronomic and health hazards (R.N.Basu: Monorama Year Book 2008 ).Commenting on GEAC approval Dr P. Bhargava, Supreme court appointed invitee member of the Expert Committee and leading Molecular biologist (Founder Director,CCMB,Hyderabad) expressed " The decision is one of the biggest disaster of independent India " (source: Down to Earth ,Dec.1-15, 2009 )

India produces about 7.6 million tones of brinjal from 472,000 hectares with an average productivity of 16.3 tonnes per ha. West Bengal, being one of the largest producer with hundreds of brinjal varieties locally used we have to take utmost cautious step before allowing Bt brinjal and other GM food crops for commercial cultivation in our country. For this reason several states including West Bengal, Kerala, Chattisgarh, Bihar, Karnataka and few others have banned commercial cultivation of this crop.

International Assessment of Agricultural Science and Technology for Development (IAASTD) with its monumental work involving 400 scientists with 1000 associates for a period of 4 years in planning future Agricultural Roadmap of the world with stress on developing countries, submitted report in April, 2008, to the United Nations where India is one of the signatories. The report clearly stated that GM is not a solution for cheap food. In order to use the tool of biotechnology for agricultural development the report has suggested 'Molecular Assisted Selection, MAS' for all important traits in potentially hopeful crops and to follow up in the next order is 'Molecular Assisted Breeding' with involvement of Breeders, Agronomists and others. As this agenda will not be suited to Corporate bodies, the report further emphasized public funded research activities to be the topmost priority in future. Without private initiative, country could achieve phenomenal progress in agriculture and thus Indo-US Knowledge Initiative signed in 2005 will not increase agricultural growth as planned. Rather initiative must be taken to strengthen public institutes. **Research agenda should be on Sustainable Production to achieve Food Security through utilization of available resources without mining in a non renewable manner,** it concluded.

I would conclude with an excerpt of lecture delivered by United Nation General Assembly President on 25 September, 2009:

“The essential purpose of food, which is to nourish people has been subordinated to the economics of a handful of multinational companies that monopolize all aspects of food production from seeds to all major components in nearly all distributing chains and they have been the prime beneficiaries of world crisis. Research conducted by UNEP suggested that organic small scale farming (for us Integrated Farming) can deliver the increased yield, thought to be the preserve of Industrial Farming without environment and social damage”