

## GM technology in India – is it a quiet burial?

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India missed the Industrial Revolution under the British rule and is still paying the price for it. When biotechnology revolution can offer technologies to improve agriculture and food security in free India, it is dithering and procrastinating to the point of self-defeat. When one reads that the Kerala Government is opposing limited trial of GM-rubber, approved by the Genetic Engineering Approval Committee (GEAC) of the Ministry of Environment and Forests (MOEF), it makes a mockery of all scientific edifice backing the technology. The Minister states that Kerala wants to be GM-free. According to reports, genetic modification has involved introduction of multiple copies of superoxide dismutase, an enzyme that seems to confer protection against prolonged draught. The gene is from rubber itself and not from any exotic organism. The argument against it is because of the advice that agro-biodiversity hotspots should be GM-free. Can any one define the genome composition of pure, pristine rubber? Can any one state how many bacterial and fungal genes are part of the rubber genome? Even between two rubber plants, these gene sequences can be different. In nature, horizontal and vertical transmission of genes is taking place all the time in the evolutionary scale; and in a population of rubber plants there will be polymorphic (replacement of one base with another in the DNA), differences and too much is being made of biodiversity, when the genome of every plant is a mosaic. This means that in the background of a unique fingerprint of DNA for a particular plant species, there would also be acquisitions from the environment. In that sense every plant is genetically modified in nature. Then why so much fuss on the introduction of additional copies of one gene that is already present in rubber? The fuss is because it is done by genetic engineering technology in the laboratory. This does not make sense.

Much has been discussed about *Bt* brinjal and every opportunity is only being used to nail the coffin. One can go all over the scientific arguments, but it is not clear whether it would make any dif-

ference to MOEF and the activists. *Bt* gene is not toxic to humans, animals or the environment. Millions of people in different parts of the world, including USA, Canada, Argentina, Brazil, China and other countries are consuming *Bt* corn over several years without any authenticated reports of a mishap. The antibiotic markers used for selection when the transgene is introduced into the plant are not of much consequence in terms of causing antibiotic resistance in people who consume the product. These genes are poorly expressed in the plant. Gut bacteria will degrade these genes and so it is most unlikely that they will acquire antibiotic resistance by this process. Antibiotic resistance is actually caused by over prescription of the same for treatment by physicians and not by GM crops! Brinjal available in the market is a pesticide bullet, and the claim is that *Bt* brinjal can substantially decrease pesticide sprays and benefit the farmer from increased yield and decreased exposure to such sprays. The least the MOEF can do is to let limited independent trials in farmers' fields to verify the claims. However, much time and energy is being spent in trashing the inter-academy report that has supported the introduction of *Bt* brinjal for limited trials. There is a hue and cry about plagiarism, since part of the report is a verbatim copy of an earlier article. This should have been avoided, but the author is the same in both cases and perhaps, got tired of stating the same facts over and over again in different fora! However, the intention of the activists is to divert attention to an irrelevant issue in this context, since the facts stated are irrevocable. I am disappointed that the MOEF is also being led by activists to spend time in trashing the academy report, rather than look to ways of lifting the moratorium. We may run to the US for nuclear power, but choose to discard its huge experience with GM crops. In that case, let us look at China, and it has approved commercial trials of *Bt* rice<sup>1</sup>. This means that *Bt* rice could be available in the market in a few years. I will not be surprised if we import *Bt* rice from China sooner than later! Interest-

ingly, the Philippines is using Indian data with *Bt* brinjal to introduce its version in the country. Argentina has blazed a trail as leader in GM crop cultivation among developing countries<sup>2</sup>. The European Union has accepted GM potato (AM-flora, in principle)<sup>3</sup>. Europe is finding it hard by the day to resist GM crops and activists have to look elsewhere for inspiration. Even African countries are drawing inspiration from the success stories of countries like Brazil<sup>4</sup>. In the meanwhile, Monsanto has introduced eight genes (Genuity Smartstax) in corn against aerial pests, subsoil pests and to provide herbicide resistance. Further studies would be needed to assess the advantages. Are we blind to what is happening elsewhere in the globe? Are we guided only by scientists who are generally commissioned by activists to write 'scientific' reports on GM crops? Most of these are exaggerated and misinterpreted versions of scientific facts, but provide a handle to the opponents of GM technology. In addition, many such analysis should be viewed in the context of a developing country like India. In developed countries, modern methods of agriculture are perhaps providing 80% of the theoretical yield and a transgenic technology can only push it up to say 90%. In India, we are at 30–40% productivity levels compared to the developed countries. Any technology that can push up the yield to say 60% would have a tremendous impact. Further, when developed countries suffer from over-nutrition, we desperately need to improve the nutritive quality of our food. Norman Borlaug, the Nobel laureate who inspired India's green revolution, and Gurdev Khush, a recipient of the World Food Prize, who is responsible for the improvement of 300 varieties of rice, including IR 36, support GM technology as the route for increased agricultural productivity.

*Bt* cotton in India is a huge success story. If the pest develops resistance to the first generation *Bt* version, a second and third generation with multiple genes can follow. An appropriate crop-rotation strategy can tackle many of these issues. I cannot understand why organic farm

enthusiasts are against *Bt* crops? If the objective is not to use chemical pesticides, *Bt* crop has to be the central player. Why then make resistance development a doomsday prediction? As I have stated earlier, resistance development will be an important issue, but research has to find newer solutions during the window period<sup>5</sup>. There are newer leads, including the use of SiRNAs<sup>6</sup>. Similarly, strategies are available to generate marker-free events to avoid use of antibiotics and research on the use of stage-specific and tissue-specific promoters can give rich dividends. We need to send the message that scientists are indeed sensitive to public issues, whether real, exaggerated or engineered. But, to suggest that we will look at GM-technology only after these developments have taken place would defeat the whole purpose and postpone utilization of this technology forever. One can always find newer issues to derail the use of this technology. The moratorium is not affecting the MNCs, but our own scientists in the country, who are ready with a dozen genes and more than a dozen crops to protect against environmental stresses and to improve nutritive quality, including Golden Rice to provide vitamin-A precursor. Ingo Potrykus, the generator of Golden Rice passionately appeals for the ease of unimaginative regulations stating, 'I hold the regulation of genetic engineering responsible for the death and blindness of thousands of children and young mothers'<sup>7</sup>. There is an interesting report that *Bt* corn has a halo effect in promoting higher yields by the surround-

ing non-*Bt* corn, because of lesser eggs being laid by the pest<sup>8</sup>. Everyone talks about improvement in agricultural technology to enhance yields and to address under-nutrition in the country. Here is a technology, which at least provides a window of opportunity to leap forward.

Does science have any role to play in the development of this country or it is just lip sympathy? Few scientists in the field speak up for fear of being attacked by friends and activists, and even the Minister. We are even afraid to stand by the science academies, of which some of us are Fellows, but choose to attack even when the content makes sense and the error committed has been acknowledged and regretted. There have been a couple of supportive analyses of GM technology in the media. But, in general, the media picks up isolated failures or precautionary laboratory leads to project GM technology as a failure for whatever reason. But, the complete devastation of non-*Bt* crops by pests is, perhaps, not newsworthy. It is important that the media projects the virtues of this technology for the good of our country after adequate research and consultations. It is distressing that even the Science Ministry, which is investing in R&D with GM technology is keeping mum. It is proving difficult to be positive and build a value system, when it is fashionable to attack and be self-destructive. I would like to appeal to active scientists in the field to take up the cause of GM technology vigorously for the benefit of our country. It is important for the country to have the Biotechnology Authority in place and strengthen the

organizational structure, especially in the states to conduct trials, at the earliest. The farmers need appropriate technical advice on a continual basis and the public need to be given correct information. These will take time to establish, if ever parliament has time to discuss such trivial issues! But none of these organizational requirements should delay the independent field testing of *Bt* brinjal, if the Government wants to encourage exploitation of this technology in a broader sense and provide a positive environment for scientists to work in the area. A great opportunity is being frittered away and it is sad that activists are ruling the roost, whereas scientists have to take up a defensive position to justify a technology based on sound science, ethics and concern for the society.

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