

DEBATE



- ▶ Do the benefits of GM crops outweigh possible damaging side-effects?
- ▶ Can the government afford the delay in deciding on the issue?
- ▶ If GM crops were banned, could such a ban be enforced?
- ▶ If a ban is imposed but cannot be enforced, do we risk getting the side-effects without getting the benefits?

P K Ghosh

Advisor;

Deptt of Biotechnology

GENETICALLY modified (GM) crops carry one or more genes from an unrelated species. This is accomplished by genetic engineering (GE). GE has major advantages over breeding methods in scope, reliability, precision and speed. It reduces the production costs by minimising the use of pesticides, simplifying agronomic practices, improving productivity and by enhancing crop value. GE technology is gaining gradual acceptance.

In order to dispel apprehensions about GM crops, countries are conducting case-by-case safety evaluation before releasing them into the new environment. In India, no GM crop has yet been commercially released. India's transparent, three-tier regulatory regime oversees the development of GM crops from research to commercial use. Violation of the regulatory procedure attracts penal actions.

Carefully tested GM crops introduced into the environment can benefit the society whereas introduction without evaluation can be dangerous. Weakly expressed insect resistance genes in GM plants can cause a change in the insect population, facilitating rapid emergence of resistant insects. Viral resistant plants can cause the development of more virulent strains through recombination with wild strains. Herbicide resistant plants may lead to development of super weeds. Antibiotic resistant marker genes can get transferred into pathogenic microbes. Introduction of transgenic sequences at undesirable site of the chromosome can lead to undesirable morpho-physiology of the crop plants. Transgenic proteins entering into human or animal food chain can be allergic or toxic.

India started handling GM crops based on technologies of multinational companies. Indian public sector expertise is developing but is not geared to commercial exploitation. Elite planting materials available in the country can be used to agronomic

advantage by incorporating transgenic traits with the assistance of technological capabilities and materials of multinational companies. Teaming up is therefore advantageous. The two transgenic plants, namely the Bt Cotton and the herbicide resistant Indian mustard, which have made noteworthy progress in open field evaluation, use technologies of Monsanto, USA and Plant Genetic System, Belgium respectively. All other GM crops being tested like tobacco, tomato, cabbage, cauliflower, potato, eggplant and paddy have to go a long way before they qualify for release. New Seeds Act is likely to be

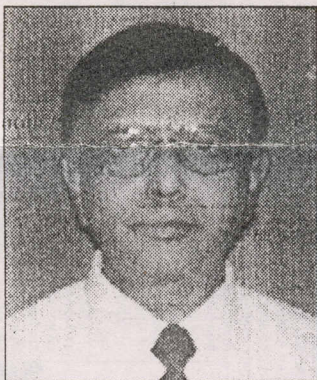
in place shortly. Consequently, unauthorised introduction of GM plants on large scale in near future is unlikely.

Introduction of useful GM crops cannot be avoided or prevented because of technological and economic advantages. However these have to be strictly

evaluated.

There are several other issues associated with use of GE technology like enhancing existing capacities to assess long-term environmental risks and to conduct food allergenicity evaluation. Risk assessment includes analysing data on a case-by-case basis for informed decision making. Unique identification methods for GM traits are also required. These issues need to be addressed adequately and local capabilities enhanced.

Over the past 6 years India has developed some scientific, managerial and legal expertise to handle GM crops. A large number of locally developed scientific protocols have been utilised to assess short-term risks. India has gained experience from several field experiments though there are gaps in the assessment of a few long-term risks. There is therefore a need to strengthen infrastructure, accelerate R & D, develop more protocols, and train manpower in different universities and institutions in order to upgrade capacity building, besides promoting creation of public awareness to facilitate the adoption of appropriate GM crops in Indian agriculture.



DEBATE

ISSUES

P K Ghosh
Advisor,
Deptt of Biotechnology

GENETICALLY modified (GM) crops carry one or more genes from an unrelated species. This is accomplished by genetic engineering (GE). GE has major advantages over breeding methods in scope, reliability, precision and speed. It reduces the production costs by minimising the use of pesticides, simplifying agronomic practices, improving productivity and by enhancing crop value. GE technology is gaining gradual acceptance.

In order to dispel apprehensions about GM crops, countries are conducting case-by-case safety evaluation before releasing them into the new environment. In India, no GM crop has yet been commercially released. India's transparent, three-tier regulatory regime oversees the development of GM crops from research to commercial use. Violation of the regulatory procedure attracts penal actions.

Carefully tested GM crops introduced into the environment can benefit the society whereas introduction without evaluation can be dangerous. Weakly expressed insect resistance genes in GM plants can cause a change in the insect population, facilitating rapid emergence of resistant insects. Viral resistant plants can cause the development of more virulent strains through recombination with wild strains. Herbicide resistant plants may lead to development of super weeds. Antibiotic resistant marker genes can get transferred into pathogenic microbes. Introduction of transgenic sequences at undesirable site of the chromosome can lead to undesirable morpho-physiology of the crop plants. Transgenic proteins entering into human or animal food chain can be allergic or toxic.

India started handling GM crops based on technologies of multinational companies. Indian public sector expertise is developing but is not geared to commercial exploitation. Elite planting materials available in the country can be used to agronomic

- ▶ Do the benefits of GM crops outweigh possible damaging side-effects?
- ▶ Can the government afford the delay in deciding on the issue?
- ▶ If GM crops were banned, could such a ban be enforced?
- ▶ If a ban is imposed but cannot be enforced, do we risk getting the side-effects without getting the benefits?

advantage by incorporating transgenic traits with the assistance of technological capabilities and materials of multinational companies. Teaming up is therefore advantageous. The two transgenic plants, namely the Bt Cotton and the herbicide resistant Indian mustard, which have made noteworthy progress in open field evaluation, use technologies of Monsanto, USA and Plant Genetic System, Belgium respectively. All other GM crops being tested like tobacco, tomato, cabbage, cauliflower, potato, eggplant and paddy have to go a long way before they qualify for release. New Seeds Act is likely to be

in place shortly. Consequently, unauthorised introduction of GM plants on large scale in near future is unlikely.

Introduction of useful GM crops cannot be avoided or prevented because of technological and economic advantages. However these have to be strictly

evaluated. There are several other issues associated with use of GE technology like enhancing existing capacities to assess long-term environmental risks and to conduct food allergenicity evaluation. Risk assessment includes analysing data on a case-by-case basis for informed decision making. Unique identification methods for GM traits are also required. These issues need to be addressed adequately and local capabilities enhanced.

Over the past 6 years India has developed some scientific, managerial and legal expertise to handle GM crops. A large number of locally developed scientific protocols have been utilised to assess short-term risks. India has gained experience from several field experiments though there are gaps in the assessment of a few long-term risks. There is therefore a need to strengthen infrastructure, accelerate R & D, develop more protocols, and train manpower in different universities and institutions in order to upgrade capacity building, besides promoting creation of public awareness to facilitate the adoption of appropriate GM crops in Indian agriculture.

Prof M S Swaminathan
Winner of the World Food Prize, 1987

LET me illustrate from our work the power of genetic modification to do immense good to agriculture and food security. It is now clear that the 21st century may witness changes in temperature, precipitation, sea level and ultraviolet radiation, as a result of global warming. This led us to initiate an anticipatory research programme to breed salt tolerant varieties of mustard, pulses and rice in coastal areas, in order to be prepared for sea water intrusion into farmland

as a result of a rise in sea level. The donor of salt tolerance was a mangrove species. Transferring genes for tolerance to salinity from mangrove tree species to rice, mustard or tobacco is an impossible task without recourse to recombinant DNA experiments. Thus, the immense benefits that can accrue from genomics and molecular breeding are clear. What are the principal concerns?

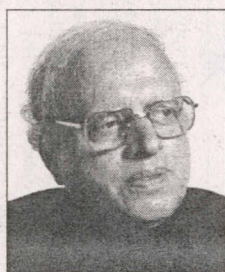
Besides bio-safety concerns, the following three issues: First, India is a land of small farm holdings. There is concern that expansion of proprietary science and shrinking of "public good" research supported from public funds may lead to a situation where the technologies of the future remain in the hands of a few transnational corporations. Only resource-rich farmers may have access to them, thereby enlarging the genetic divide.

Second, the monopolistic control over crop varieties could lead to a situation where large areas are covered by very few genetic strains or hybrids. What will happen to the livelihoods of farm men and women operating small holdings with institutional credit and with no crop insurance cover, if GM cotton, maize, soybean, rice, potato or other crops are affected by serious diseases as a result of the breakdown of resistance? Hence, GM crops should be cultivated only with appropriate disease containment agronomy.

A third issue relates to the potential impact of GM foods on bio-diversity.

This aspect has two dimensions - one dealing with the replacement of numerous local cultivars with one of two GM strains, thereby leading to genetic erosion, and the other relating to equity in benefit sharing between biotechnologists and the primary conservers of genetic resources and the holders of traditional knowledge.

At present, the primary conservers remain poor, while those who use their knowledge (for example, the medicinal properties of plants) and material become rich. This has resulted in accusations of bio-piracy. It is time that genetic engineers promote genuine bio-partnerships with the



holders of indigenous knowledge and conservers of genetic variability, based on principles of ethics and equity in benefit sharing.

Unless research and development 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 about the ultimate nutritional, social, ecological and economic consequences of replacing numerous local varieties with a few GMOs. Also, under conditions where the market is the dominant factor in determining research priorities, "orphans will remain orphans" in terms of investment of research funds, unless the public sector steps in.

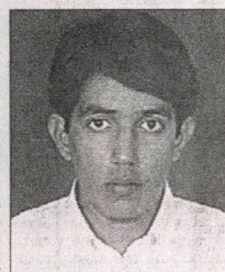
We should not throw the baby with the bath water. Genetic engineering is only a tool for bringing about novel genetic combinations. Molecular genetics is the pathway to precision breeding. We should not condone unauthorised releases of GMOs, as in Gujarat. What is important is to put in place an objective and speedy risk-benefit analysis mechanism which inspires public trust. For this purpose, the government of India should set up without further delay a multi-stakeholder National Commission on Genetic Modification for Food and Health Security. Recent events with Bt Cotton in Gujarat underline the urgency of such a multi-stakeholder body which functions in a transparent and professionally credible manner.

Bhagirath Choudhary
Fellow,
NISTADS / CSIR

THE health and environmental risks from the use of genetically modified crops in agriculture have been the centre of controversies but few have been observed and not yet scientifically and conclusively proved.

Yet another initiative on this front was the establishment of Cartagena Protocol on Biosafety (2000) as biosafety clearing house, for countries to share their information as well as experience on technological safety about genetically modified

organisms. There is hardly any scientific evidence on potential environmental risks. Only the precautionary approaches of selection of crops to be genetically modified and the integrated gene and pest management practices can ease the effects of gene flows to close relatives and the development of



pest resistance to pest-protected crops. In Indian conditions, the non-food crops like horticulture, cash crops etc, which are vital for farmers' economy, need to be genetically modified, tested and commercially adopted before genetic modifications are tried for food crops.

Do the benefits of GM crops outweigh possible damaging side effects? Of course, yes. The GM technologies have the potential for "tailor-made food and non-food crops" against biotic and abiotic stresses such as insect, drought, salinity and alkalinity. It broke the barrier between plant and animal kingdoms by providing a process of recombining the "specialty genes" of different plant and animal species, thereby triumphing over deceleration of food and non-food crops productivity. In addition, the crops can also be customised to the required nutritional quality. Globally, the area under cultivation with GM crops such as soybean, corn, canola and cotton has shown a remarkable growth since 1996 and is likely to reach 125 million acres at the end of 2001. Consider the case of cotton, the government has been importing raw cotton (worth of

US\$270 million in 2000-01) to meet the demand of worlds competitive and ever growing Indian textile and clothing industry. The Ministry of textile has set the textile and apparel export target to US\$50 Billion by 2010 keeping in view the trade opportunities created by the implementation of WTO. At domestic level, cotton yield is decelerating, even if 48 per cent of total insecticides used in India that is worth almost Rs 2000 crore per year are spread over 9Mha cotton growing area to mitigate the damage caused by Bollworm complex. The potential loss caused by insects amounts to more than Rs

5000 crore per year. The WHO Hazard list (I) contains most of chemical ingredients used in the manufacturing of cotton insecticides and advocates minimum use of such insecticides. Only a poor farmer can feel the environmental degradation caused by such insecticides, not the environmentalists. Perhaps,

we can not afford the delay, neither on the economic front as huge opportunity cost is involved nor on environmental front while deciding on the GM issue.

If GM crops were banned, could such a ban be enforced? It is unlikely for two reasons. Enforcing a decision requires certain strength in government machinery, which is not visible. Secondly, the ban itself would be against the spirit of innovation and therefore lacking in moral authority.

If a ban is imposed but can not be enforced, do we risk getting the side effects without getting the benefits? No, however it would promote unfair corporate practices, unreasonable marketing procedure and illegal sale of banned products as is presently happening in the case of Bt Cotton. The poor farmers or end users would economically suffer and be the eventual losers. The government regulating agencies should encourage such experiments in the farmers' fields with a controlled manner and closely monitor developments with a view to influence their cause.

Per Pinstrup-Andersen
Director General,
IFPRI, Washington, D C

TO begin, let me directly address the first question: Do the benefits of GM crops outweigh the risks of possible side effects?

The answer: No damaging side-effects have been detected from any genetically engineered crops submitted for approval. This basic fact must be noted at the outset of the debate itself.

With respect to Bt Cotton, experience from South Africa and China, where it has been approved for on-

farm production, shows large benefits. The use of chemical pesticides have been reduced dramatically. This has reduced production costs for farmers, protected the environment from pesticide residues, and reduced illness and death from pesticide poisoning. No damaging side-

effects have been found. And huge benefits have accrued to all sections of society. It should therefore not be a surprise that Indian farmers want to grow Bt Cotton. All new technology should be tested for health and ecological risks before it is approved for release on farmers' fields. However, if such tests do not identify any risks or if benefits are judged by a responsible panel of people representing consumers and producers to outweigh risks, I see no reason for withholding approval.

Can the government keep delaying a decision on GM crops? Each GMO should be judged on its own merits. A blanket rejection of all GMOs does not seem to make much sense. If a particular GMO, say a seed resistant to a certain pest, has been tested and no unacceptable risks have been identified, I see no reason for delaying approval.

If GM crops were banned, can the ban be imposed? I predict that the demand for the release of safe GMOs from population groups who stand to gain, including small farmers and poor consumers will be so strong that the government will

find the ban to be a political liability. After all, what would be the justification for the ban? This is especially more true of poor developing countries, where Economics dictates that all possible means of gain be pursued. Poor farmers are even more likely to go for Bt Cotton because of the potential gain. Governments will be unable to stop them without serious political risk.

And if not, do we risk suffering the side-effects without getting the benefits? As illustrated by the illegal action by the cotton farmers, it may be difficult for the government to enforce a ban on something with

large potential benefits and no known risks. If the government wishes to regulate the release and use of GM crops, it should be able to justify the regulations on grounds that can be understood and agreed to by the population.

I strongly believe that the risks are hyped out of all proportion while the benefits are being ignored. This is especially so in the context of the developing world because, unlike the European consumer who spends a very small proportion of his income on food and hence can afford to ignore the cost-reduction benefits of GM food, poor consumers in the developing world spend close to 60-70 per cent of their income on food. Any reduction in the price of food because of the higher productivity due to genetic modification is a net gain to him. Of course, in the final analysis, it's a choice that each country must make, it is not for multilateral agencies to try and influence the choice or thrust it down the throats of developing countries.

There are also some preconditions that must be in place. These include a bio-safety system that can test for possible risks; European NGOs that oppose GM foods don't say no to genetic modifications in the sphere of medicine. That's because they know they need it, but they don't need GM food. Indians must note this!

