The Inter-Academy Report on Genetically Engineered Crops: Is It Making a Farce of Science?

SUJATHA BYRAVAN

The leading academies of science in India have, at the request of the government, prepared a report that was expected to give an independent scientific review of transgenic crops and the proposed Biotechnology Regulatory Bill. But the Inter-Academy Report that has been prepared is disappointing on several fronts – in its science, ethics and writing style.

In October 2009, the Genetic Engineering Approval Committee (GEAC) gave permission to go ahead with the commercial planting of Bt-brinjal, the brinjal containing the pesticide gene from *bacillus thuringiensis*,[1] in India. In the wake of protests from various groups, a series of public consultations were held following which the Ministry of Environment and Forests decided to place a moratorium on the commercial planting of this transgenic[2] plant variety.

Jairam Ramesh, union minister of state for environment and forests, and K Kasturirangan, member of the Planning Commission, then requested the leading scientific academies of India to provide an independent scientific review of transgenic crops and the Biotechnology Regulatory Bill under discussion in the government. The National Academy of Agricultural Sciences had earlier submitted suggestions on the Biotechnology Regulatory Bill. The inter-academy report (IAR) concentrated on genetically modified (GM) crops and on Bt-brinjal in particular.[3] The presidents of leading Indian scientific academies – The Indian Academy of Sciences, the Indian National Academy of Engineering, The National Academy of Sciences (India), The Indian National Academy of Agricultural Sciences, and The National Academy of Medical Sciences – have signed off on the IAR, which includes an appraisal and a set of recommendations that are intended to be useful to policymakers (Sood et al 2010).

Problems

This IAR is disappointing on several fronts: in its science, ethics and writing style.

The report largely ignores the problems related to GM crops that have been identified by the scientific community. There are different kinds of environmental concerns and a few of them are highlighted below. The scientific literature is peppered with studies demonstrating that cross-pollination from GM plants has been observed in a number of cases and is becoming a serious threat to the environment and, potentially, to biodiversity. Studies show adverse effects of pesticide transgenes on friendly insects, soil microbes, and water. Widespread use of herbicide resistant plants can lead to excessive use of herbicides and consequently to the development of resistance to herbicides in weeds. As transgenic plants containing pharmaceuticals, new pesticide genes and other properties are being grown in experimental fields, the issue of bio-containment of transgenes gains special importance.

The potential for impact on human health has been raised since developmental problems and other health effects have been seen in animal studies. Some people claim that if long-term health effects have not been seen in the United States (US), where GM plants have been consumed unlabelled for over a decade, there surely must be no adverse impacts. But we have no idea what to look for and where to look for it. Increase in novel allergens, production of new toxins, and complications as a result of the antibiotic-resistance genes used along with the transgene, are some of the adverse health effects one might expect from GM plants.

The report says that the complete safety of GM crops cannot be guaranteed. This is correct, and so we should pragmatically invest in tried and successful methods of conventional breeding coupled with low chemical input agriculture, tissue culture and other methods, technologies we know yield results and are safe. The 2009 report from The International Assessment of Agricultural Knowledge, Science and Technology for Development, conceived by the Food and Agriculture Organisation and the World Bank, recommends alternative paths to achieve food security (IAASTD 2009). At present, we appear to be placing most of our investments in the technology basket of GM. Doing this is financially and practically unsound.

The question of yield from GM crops, another area that the report speaks to, has in fact been reviewed much more thoroughly in a recent study of the Union of Concerned Scientists (Gurien-Sherman

The views expressed in this article are her own and do not reflect the opinion of any organisation.

Sujatha Byravan (*sbyravan@yahoo.com*) is with the Centre for Development Finance, IFMR, Chennai. She is a board member of the Council for Responsible Genetics, Cambridge, Massachusetts, US.

2009). This study examined GM crop yields to find out if Bt and herbicide resistance, the traits used for the longest time in the US, have really increased yields. The results show that there was no significant increase in yields with GM crops. Furthermore, the study finds that conventional breeding practices and other methods have contributed more to yield increase than transgenic plants. Based on the available evidence, it seems unlikely that an increase in agricultural production will come from GM crops anytime in the near future.

The notion of a gene being a discrete particle uniquely responsible for the expression of a trait is by now an archaic notion.[4] Scientists have begun to understand that genes are more fluid and proteins, other nucleic acids, the cellular and external environments play a role in the expression of a trait. How important each actor is and how they work together may vary at different times in development and in different systems. Genes, it turns out, do not necessarily play the dominant part and we are constantly learning more about the role of other cellular components in gene expression (Pearson 2006). In fact, some of the problems seen in the case of GM crops may be because transferring the gene alone is insufficient for establishing the desired trait in all environments and circumstances.

More significantly, the context of agriculture in India and the system within which the technology of GM will operate are completely ignored in the IAR. Patents and seed monopolies by agribusiness are a serious threat to food security everywhere and are especially important in a country like India dominated by poor farmers working in small farms. More than half the people in the country are engaged in agriculture and related activities, providing a livelihood for the vast majority of Indians.

In fact, patents by agribusiness interfere not just with access to seeds and food security, but also with scientific research. In 2009, an anonymous public statement was signed and submitted to the US Environmental Protection Agency (EPA) by 26 leading scientists, entomologists who work with insects that infect corn. It stated that scientists are unable to conduct independent research on GM crops as patents prevent full access to research materials and the ability to grow and study these plants. As a consequence, the scientists stated, the data that the scientific advisory panel of the EPA has available to it is unduly limited. Some of the scientists who signed the statement said that they were not opposed to genetic engineering per se, but were simply interested in researching these crops.

The IAR provides no references or sources and many of its statements read like clichés or deeply held convictions, a tone that is inappropriate for a scientific report. It only demonstrates that this report was taken lightly, treated superficially and not considered as a serious responsibility entrusted to the academies. If the fellows of the academies had a variety of views that were expressed, it would have been helpful, for instance, to list them in a table, demonstrating that diversity, instead of simply making a sweeping statement regarding the plurality of science.

Conflict of Interest

Further demonstrating the casual manner in which this study was treated are news reports that now reveal that significant and important portions of the text were plagiarised from a document by The International Service for the Acquisition of Agri-biotech Applications, an industry lobby group that works to promote GM crops. Portions were also taken from a document by Ananda Kumar, a proponent of GM, who heads the National Research Centre on Plant Biotechnology (Kumar 2009). When asked about this copied text, the response given to the press was that the sources merely had not been indicated. Rules concerning plagiarism are quite clear, however, that if something is taken directly, word for word, from a source, at the minimum it needs to be within quotation marks, with the sources clearly stated.

These concerns are more generally tied to the notion of conflict of interest that does not seem to figure as an ethical concern in governing bodies in India and in academia. Those in regulatory agencies, in decision-making committees, and governing bodies must not be part of the revolving doors between science-business-government. If they are in such decision-making bodies they need to declare affiliations that may compromise their fairness in advance and recuse themselves from deciding on issues from which they may have financial gains. While scientists and others who are part of such entities may claim that they can be objective and impartial, an examination of decision-making when the outcome is self-serving reveals the opposite. Work by Sheldon Krimsky of Tufts University on conflict of interest has demonstrated the existence of a "funding effect" (Krimsky 2004). Industry-sponsored studies are more likely to reach conclusions that are favourable to their sponsors than non-industry studies. The inference is that scientists who we rely on to make objective judgments on important public policy matters should not be drawn from the same pool of experts who have a financial interest in the success or failure of the products they are commenting on.

Role of the Media

Lastly, scientists too are subject to human qualities such as self-doubt, fear of losing their jobs, fear of being called a Luddite, the need for recognition and fame, and peer pressure. There is also a professional culture of science, which includes the desire to be objective, loyalty to colleagues, belief in the scientific process – perhaps even when it may not be working – and faith in technology.

Just as we need scientists who can be free thinking and brave, we also need a media that understands how science works and is willing to play a responsible role in engaging scientists and educating people regarding the nature of science. Instead, even knowledgeable and smart members of the press have been framing this as a polarised debate, thus further accentuating divisions. For instance, I have been asked, "Why do scientists not come out of the closet?" The implications of this metaphor do injustice to science and scientists while showing that the media is not doing its homework. Scientists work within paradigms, or belief systems, that may grow, dominate, coexist with others and or shift. Thus, for example, while all biologists may recognise that genes are not as important as was once believed, this notion is not yet the only, or the dominant, paradigm.

Scientists do not inhabit intellectual closets but live within walls of belief and are trained in particular kinds of analyses. They, like other professionals, are part of a culture, which imbues certain traditions

of behaviour and thinking. They are not necessarily filled with self-doubt and angst and waiting to come out, but are generally comfortable in their places: be it a laboratory, an ivory tower, or the pedestal on which they have been placed. There are frequently conversations within science (and society) regarding science itself, the nature of GM and the role of technology. Such conversations, while insufficient can be encouraged and supported by good media. But technical reports such as the recent one from the academies along with the polarisation fanned by the media only quell debate. And that is an injustice to both science and society.

NOTES

1 *Bacillus thuringiensis* (or Bt) is a bacteria used by farmers as an alternative to pesticides. The gene for the Cry toxins are extracted and inserted into plants in the case of Bt transgene containing plants.

2 A transgene is a gene or genetic material that is transferred from one organism to another using various techniques. More specifically, it is often used to describe the segment of DNA that is transferred and can code for a particular RNA or protein. This foreign insert may alter the expression of a gene or trait in the organism.

3 A report by Andow A David, *Bt Brinjal: The Scope and Adequacy of the GEAC Environmental Risk Assessment,* is based on the analysis of the expert committee and various supporting materials submitted to seek approval for commercialisation of Bt-brinjal. "The main thesis of the report is that the GEAC set too narrow a scope for environmental risk assessment of hybrid brinjal".

4 Plenty of articles have been written on epigenetics. For special issues on the subject, see *Nature*, Vol 447, Issue 714, 24 May 2007 and *Science*, 293, Issue 5532, 10 August 2001.

REFERENCES

Gurien-Sherman, Doug (2009): *Failure to Yield,* Report by the Union of Concerned Scientists, Cambridge, MA.

International Assessment of Agricultural Science and Technology for Development (2009): *Agriculture at a Crossroads: The Global Report* (Island Press).

Kumar, Ananda (2009): "Br-Brinjal: A Pioneering Push", *Biotech News*, Department of Biotechnology, December.

Krimsky, Sheldon (2004): *Science in the Private Interest: Has the Lure of Profits Corrupted Biomedical Research?* Rowman & Littlefield Publishers, Inc.

Pearson, Helen (2006): "What Is a Gene?" *Nature*, Vol 44, 399-401.

Sood, A K, M Vijayan, P S Koel, M Rai, K K Talwar and A Datta (2010): "Inter-academy Report on GM Crop", September, unpublished, downloadable from http://bit.ly/cQbyCI.