



India needs home-grown GM food to stop starvation

Indian scientists must develop domestic genetically modified crops rather than rely on unsuitable foreign technology, says Anurag Chaurasia.

At the beginning of this month, Prime Minister Narendra Modi announced a road map to guide India's science and technology over the next two decades. Launched during the Indian Science Congress at the University of Mysore, the plan signalled a cautious approach to techniques such as genetically modified (GM) crops, noting that "some aspects of biotechnology have posed serious legal and ethical problems in recent years". That is true, but a different and much larger problem looms for India. According to the 2015 United Nations World Population Prospects report, India will surpass China by early next decade as the most populous country on Earth, with the most mouths to feed. India is already classed as having a 'serious' hunger problem, according to the 2015 Global Hunger Index of the International Food Policy Research Institute. There is a danger that many of these new Indians will not have sufficient food.

Where can additional food come from? Grain production is stagnant, and rapid urbanization is reducing available land. To increase food production, India needs to invest in modern agricultural methods, including GM crops.

Indian researchers have shown that they have the expertise to generate GM plants, most obviously the pest-resistant cotton that is now widely grown in India. But almost all of this work has relied on molecular-biology research done elsewhere — India has in effect borrowed or been given the genes. This leads to complications, usually conflict over intellectual property (IP) rights.

Most high-profile was the insecticide-producing GM cotton variety that was released by the Indian Council of Agricultural Research in New Delhi in 2009. It was based on a *Bacillus thuringiensis* gene to which the agricultural biotechnology company Monsanto, based in St Louis, Missouri, owed the IP rights. The ensuing controversy has seeded confusion among Indian researchers, scientific managers and administrators over IP rights, patents and the related rules and regulations.

In response, India is turning to research based on old discoveries, including genes that are in the public domain or no longer protected by patents. The problem here is that insects have already developed resistance to the toxins produced by such genes: the companies that developed first-generation GM crops with these genes are already on second- and even third-generation versions of the same plants. Increased use of this old technology in India can only accelerate resistance and make the situation more difficult. Other developing countries (including Pakistan) are also turning to such redundant technology.

India should stop trying to build the Taj Mahal with borrowed bricks. We need a concerted effort at home to discover and manipulate relevant

genes in indigenous organisms and crops (such as chickpea and rice). Indian microbial institutes should take up projects in this direction, because most of the currently used genes for transgenic generation are of microbial origin. That requires a change in direction from an Indian GM-food strategy that has traditionally aimed at quick product development instead of careful assessment of the underlying science.

Such home-grown GM crops would also reduce reliance on transgenic technology produced by multinational companies, which is expensive and rarely optimized for the conditions of specific regions. Some GM crops designed abroad need more water than is usually available in some parts of India, for example, putting great stress on farmers.

Indian scientists need better training in IP issues, especially when our researchers join foreign collaborations to examine and exploit the molecular biology of our natural resources. Otherwise, Indian researchers may get the scientific credit for discoveries but fail to claim the right to commercialize the products developed.

Indian regulators should exert tighter controls on IP rights. At present, they focus only on the export of physical material, such as seeds and tissue. They need also to monitor, and make claims on, molecular information drawn from this material, down to the level of genes and promoter regions. According to the Food and Agriculture Organization of the UN, India is the largest donor of crop germplasm to the world. Without realizing its importance, we are giving away the rights to exploit one of our most precious assets.

Agrarian India is excelling in space science, but it needs to focus closer to home as well. It needs to follow the example of China, which is

slowly but steadily building a GM-food market that is based on domestic discoveries. Compared with China, India has three times as much land planted with GM crops, but whereas India's plants were mostly created with technology bought from abroad, China's fields contain crops that were developed, tested and commercialized by Chinese scientists. India does not have to reject the expertise of international companies, but it must do more to build knowledge and skills at home.

Mahatma Gandhi only wore clothes that he had woven himself. He gave India the slogan "from *swadeshi* to *swaraj*", which means "be indigenous in order to self-rule". The Indian government should take this message on board when planning future investment in biotechnology. The theme of this month's science congress, after all, was "science and technology for indigenous development in India". Indigenous development needs indigenous research. ■

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