

Agricultural Biotechnology: What is in it for Developing Countries? - A Perspective from a Nongovernment Organization

Lim Li Lin¹

Although many biotechnology applications have a positive role to play in the context of sustainable agriculture and development, the author disagreed on the use of modern biotechnology or genetic engineering based on issues of biosafety, bioethics, cultural appropriateness, preservation of local and indigenous systems and effects on the livelihood of millions of small farmers. The importance of making the right production and consumption choices by developing countries was emphasized. Expansion of organic and other forms of ecological farming was noted not only in developing countries but in the North also with western holistic scientific knowledge complementing traditional knowledge and improving existing practices. Agricultural policy and research must be farmer-driven and must recognize and understand the critical role of farmers' knowledge and traditional production models, their integration in the ecosystem and the role they play in maintaining local resources. Further, the Cartagena Protocol on Biosafety was discussed as it relates to developing countries.

The term 'biotechnology' describes a vast number of applications and many of these applications have a positive role to play in the context of sustainable agriculture and sustainable development. However, the field of modern biotechnology or genetic engineering biotechnology is a departure from conventional biotechnology, and one that has received considerable attention and concern, from scientists, governments, and the public.

Genetic Engineering Biotechnology

Genetic engineering is a significant departure from traditional methods, and introduces significant differences. Genes can be transferred between distant species that would never interbreed in nature. Reproduction is bypassed altogether as genetic engineers can transfer genes horizontally (as opposed to vertically, from parent to offspring) often making use of artificially constructed vectors.

The constructs are designed specifically to overcome species barriers and natural mechanisms that prevent foreign genetic material from inserting themselves into the genomes. Most of the constructs have never existed in nature.

Genetic engineering introduces new genes and new combinations of artificially constructed genetic material. The artificial constructs are derived from the genetic material of pathogenic viruses and other genetic parasites.

Invasive methods are used to introduce these constructs into cells, resulting in a random insertion of foreign genes into the genome.

Some scientists have begun to question whether current genetic engineering technology is really "technology". The term "technology" is derived from the Greek word

¹ Researcher, Third World Network

'tekhne,' which is connected with handicraft or the arts. The term is associated with predictability, control, and reproducibility. But genetic engineering is hit or miss and not at all precise as it depends on the random insertion of the artificial vector carrying the foreign genes into the genome.

This is the root of the problem. Many genetically engineered (GE) seeds and crops are already undergoing field trials and some have been commercialized, but there is no evidence of the long-term stability of the GE inserts in terms of structure or location in the plant genome.

Genetic engineering can give rise to unpredictable, random effects, including toxins and allergens. There is also potential for the generation of new viruses and bacteria that cause disease and mutations, including cancer in mammalian cells. In the United States, there have been reports by farmers of inconsistent performance of GE crops, which has led to a decline in their overall yield.

The actual and potential hazards of GE organisms to human and animal health, the environment, and biological diversity are well known and well documented. Some of these are openly acknowledged by governments and regulators in the North.

More worrying is the suppression of scientific evidence and opinions of potential dangers of genetic engineering. A lawsuit against the US Food and Drug Administration has revealed that it ignored the warnings of its own scientists who cautioned that genetic engineering introduces new risks. The lawsuit has also revealed that the first commercialized GE organism, the Flavr Savr tomato, did not pass the required toxicological tests.

Risk Assessment

Wading through all these potholes and pitfalls, what becomes abundantly clear is that present scientific knowledge is inadequate, and a reliable and adequate risk assessment framework is virtually impossible. For instance, knowledge about the complex interactions in the ecological system is lacking, but this knowledge is crucial because releases of GE organisms into the environment cannot be recalled and may cause irreversible changes in the ecosystem.

The term "risk" is often confused with probability. But risk is the probability or likelihood that something will take place multiplied by the effects that arise if that event does indeed take place. In other words, something may have a small chance of happening, but if the consequences of it happening are catastrophic, the risk is immense. But both these components (probability and adverse effects) are not known.

This understanding of risk and the scientific application of the Precautionary Principle must be factored into any assessment of the potential utility of any GE crop or application. There should be a cost-benefit analysis conducted to see if there is even a need for the GE organism, and if there are safer or sustainable alternatives.

Agricultural Genetic Engineering Biotechnology for Developing Countries?

It is absolutely essential for developing countries to make the right production and consumption choices. What is at stake for developing countries is food security; access to safe, nutritious, and culturally appropriate food, the health and diversity of their ecosystems, the preservation of local and indigenous knowledge systems, and the livelihood of millions of small farmers.

Technology is only one part of the solution toward achieving all this.

The proponents of genetic engineering biotechnology insist that more food production, particularly in developing countries themselves, is necessary to adequately feed people, now and in the future – the “Green Revolution” went some way toward increasing food production, but with declining yields and a growing realization of the environmental and health impacts of chemical and intensive farming, the so-called “Gene Revolution” is now necessary.

Yet, out of the estimated 786 million hungry people in the world, roughly two-thirds of them live in Asia, where the Green Revolution seeds did contribute initially to the greatest production success. Technological fixes alone cannot ensure that the hungry are fed. It is precisely because people are poor and have no access to land that millions are hungry.

The need for the so-called second generation of “functional” GE organisms such as the much touted “Golden Rice,” also fails to convince by much the same reasoning. In the final report of a 10-year FAO project to reduce Vitamin A deficiency, John Lupien, Director of the Food and Nutrition Division of the FAO, concluded that “a single nutrient approach towards a nutrition-related public health problem is usually... neither feasible nor desirable.”

There are plenty of cheap, alternative sources of Vitamin A or pro-Vitamin A such as green vegetables and unpolished rice, which would also provide for other nutritional needs. Yet those suffering from Vitamin A deficiency are being offered a technological fix which has cost US\$100 million so far and which might never be commercialized as is tied up with 70 major patents.

In fact, the “Golden Rice” uses standard first generation technology and is potentially even more hazardous to human health and biodiversity than the herbicide-tolerant Bt crops. Professor Bevan Moseley, molecular geneticist and the current Chair of the Working Group on Novel Foods in the European Union’s Scientific Committee on Food, has expressed concern about the so-called “functional foods” as they will pose an even greater health risk due to the increased complexity of the gene constructs.

Sustainable Agriculture in Developing Countries

Agricultural research has been strongly directed by the commercial self-interests of agro-industry. In general, the research has been focused on single technological fixes that fail to take into account the complexity and diversity of the ecosystem. Current agricultural research is geared toward increasing the profits of agro-industry by increasing their ownership and control over agriculture production, for example, through

patented GE seeds. For the farmer, this means higher input costs and greater dependency on the companies and their technology.

But despite the aggressive push by agro-industry to market their chemical inputs, hybrid seeds, and genetically engineered seeds and crops, and despite the lack of funds that has been directed to support research into sustainable ecological agriculture, an estimated 12.5 million hectares of land worldwide are under agro-ecological farm systems.

Millions of farmers in developing countries are practicing traditional and indigenous methods of farming. Organic and other forms of ecological farming are also rapidly expanding in the North. In many cases, western holistic scientific knowledge is complementing traditional knowledge and improving existing practices.

Successive studies have shown the productivity and sustainability of traditional small farm agriculture based on agro-ecological principles. Agro-ecological farming systems that emphasize diversity, synergy, recycling and integration, combined with social processes that emphasize community participation and empowerment, are seeing significant yield increases.

Not only does yield increase and stabilize, other ecological benefits, such as improved natural pest regulation mechanisms and soil and water restoration and conservation, are also reaped. These results are a breakthrough for achieving food security, and ensuring environmental protection in developing countries, and for protecting the livelihood of millions of small farmers.

Significantly, a landmark study by the National Research Council in the US has found that "alternative farmers often produce high per-acre yields with significant reductions in costs per unit of crop harvested" despite the fact that "many federal policies discourage adoption of alternative practices."

Agricultural policy and research must be farmer-driven, and must better recognize and understand the critical role of farmers' knowledge in traditional production models, their integration in the ecosystem, and the role they play in the maintenance of local resources. Existing research in the fields of holistic agricultural systems that are rooted in the scientific discipline of agroecology must be mainstreamed.

Agricultural research over the past 20 years has been grossly imbalanced in favor of genetic engineering. This must be redressed immediately. Only then can real scientific, technological, and policy choices be made.

The Cartagena Protocol on Biosafety and What It Means for Developing Countries

Scientific concerns about the actual and potential risks and hazards of genetic engineering led the international community, under the auspices of the United Nations, to begin negotiations for a Biosafety Protocol. The Protocol has now been adopted. When it was opened for signature at the 5th Conference of the Parties to the Convention on Biological Diversity in Nairobi in May, 68 countries signed the Protocol. Most of these countries are developing countries.

Almost all developing countries had consolidated themselves into a negotiating bloc (known as the Like-Minded Group) during the course of the Protocol negotiations.

Developing countries had consistently negotiated for a strong Protocol, and for, inter alia, the application of the Precautionary Principle, socioeconomic considerations to be taken into account and the inclusion of a liability and redress regime.

Developing countries face an even greater environment risk from GE organisms than countries in the North as most of the centers of crop origin and diversification are located in the South. The growing consumer rejection of GE organisms in the North (particularly in Europe, and now spreading to North America) means that, increasingly, markets are being sought in developing countries for GE organisms and their products. Many developing countries fear becoming dumping grounds for GE seeds and food that are being rejected in the North.

The Protocol is very significant because for the first time, GE organisms are regulated by international law, a recognition of the fact that GE organisms are distinct and inherently different, and carry special risks and hazards. It is also significant for the reaffirmation of the Precautionary Principle which is operationalized in the decision-making procedures in the Protocol. The Protocol puts in place procedures that regulate the international transboundary movement of GE organisms, allowing the potential importing country to make an informed decision, based on risk assessment and the Precautionary Principle, before permitting import.

Parties to the Protocol, and developing countries in particular, now need to build capacity in a number of key areas: comprehensive national and regional biosafety laws, scientific capacity for risk assessment and risk management, and monitoring and implementation capabilities. Most developing countries do not as yet have national biosafety legislation, adequate scientific biosafety capacity, or the infrastructure to monitor and enforce biosafety adequately.

The Biosafety Protocol was a heavily negotiated text, given the fact that the main exporters of GE organisms were ruthless in protecting the interests of the biotech industry in their countries. There are some serious deficiencies in the Protocol. Nevertheless, the Protocol merely sets minimum standards that Parties are obliged to implement nationally. Parties may take action that is 'more protective of the conservation and sustainable use of biological diversity than that called for in the Protocol.' Comprehensive national biosafety legislation must strive to fill the gaps in biosafety regulation based on the highest standards of biosafety and the Precautionary Principle.