

Genetically modified crops- issues and challenges

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Biotecnology provides new opportunities for achieving productivity gains in agriculture. Agricultural biotechnology is a precise science that enables us to find the most beneficial traits, in terms of added nutrition, increased safety or greater ability to fight pests or diseases, and incorporate them into various organisms. Biotechnology is providing practical answers to some of the greatest challenges we face at the dawn of a new millennium, such as hunger and malnutrition, as well as more effective ways to prevent diseases and treat serious illnesses. The global debate over how agriculture and food system can better meet people's need is passionate and often muddled. Some think bio-technology is the ultimate answer. But, is bio-technology going to solve world's food problem? This paper aims to discuss the various negative issues that GMOs could have on environment and on farmers.

Biotechnology is any technological application that uses biological systems (living organisms, or derivatives thereof), to make or modify products or processes for specific use. There is a universal recognition and realization that biotechnology can contribute significantly to the social and economic development of developing countries. This is particularly so in the areas of agriculture, health, environment as well as industry. Biotechnology is an accessible and exciting new development that is already improving the way we live. Discoveries in biotechnology allow some key crops to have their own protection against insects and disease, allowing these crops to be grown using less chemical pesticides.

Agriculture and biotechnology:

The potential benefits of GM in agriculture comprise increase in crop yields, improvement of nutritional content and storage characteristics of staple food (Bhagavan and Virgin, 2003). Crops resistant to pests, insects, diseases, and crops which can tolerate abiotic stress, are also being developed using GM technology.

With regard to agricultural biotechnology, three forms of its application are now benefiting poor farmers, they are, tissue culture, based primarily on advances in plant cellular biology. Marker-aided selection, based on our ability to analyze plant and plant-pathogen DNA and detect the presence or absence of particular DNA sequences, and Genetic engineering, based on recombinant-DNA technology and the ability to incorporate new genes into plant chromosomes.

What are genetically modified (GM) foods? :

Although "biotechnology" and "genetic modification" commonly are used interchangeably, GM is a special set of technologies that alter the genetic makeup of organisms such as animals, plants, or bacteria. Biotechnology, a more general term, refers to using organisms or their components, such as enzymes, to make products that include wine, cheese, beer, and yogurt.

Isolation of genes from variety of sources and formation of new gene combinations is called recombinant DNA technology, and the resulting organism is said to be "genetically modified," "genetically engineered," or "transgenic." GM products (current or those in development) include medicines and vaccines, foods and food ingredients and feeds. .

Potential risks of GMO:

GM crops are to some an answer to world hunger. To others, these crops are a health risk and an environmental threat because some GM crops have proven to be genetically unstable, do not do what they were designed to do ,are a risk to human health, particularly children. They cause animals who eat them to become immune to antibiotics; they spread and destroy natural crops (Laura, 2002).

There is also a concern that GM crops themselves might become weeds, a major ecological risk is that large scale releases of GM crops may promote transfer of transgenes from crops to other plants, which then could become weeds but also unleash unpredictable ecological effects (Darmancy, 1994). These are some of the risks associated with GM crops, there are many other risks also. Scientists generally agree that the transgenic crops currently being grown and the foods derived from them

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are safe to eat. But very little is known about their long-term effect. A study published by the Austrian government identified that genetically modified (GMO) crops pose serious threats to reproductive health. In one of the very few long-term feeding studies ever conducted with GMO crops, the fertility of mice fed with a variety of BT corn, a genetically-modified organism (GMO) was found to be severely impaired, with fewer offspring being produced than by mice fed on natural crops. Considering the severity of the potential threat to human health and reproduction, Greenpeace is demanding a recall of all GMO food and crops from the market, worldwide.

GM crops; is it a solution for poverty and hunger?:

The deployment of transgenic crops is occurring at a rapid pace, reaching about 44.5 million hectares in 2000. Although commercial cultivation is mostly confined to USA, Argentina, Canada, biotechnology proponents argue that expansion of such crops to the third world is essential to feed the poor in third world. Hunger is linked to poverty, lack of access to land and mal-distribution of food. Biotechnology exacerbates inequalities underlying the cause of hunger (Altieri, 2003). Agricultural biotechnology is clearly not the solution to poverty and hunger.

Rather, it is simply a set of powerful new tools that can facilitate the production, multiplication, and distribution of improved crop varieties. Improved crop varieties, in turn, represent just one of the contributions that science and technology can make to agricultural development. The top argument used by GM proponents is GM crops will feed the world's growing population, without explaining how GM crops will actually mitigate hunger.

According to a report given by, "the Food and Agriculture Organization" on world farming, biotechnology holds great promise for agriculture in developing countries, but so far only farmers in a few developing countries are reaping these benefits

Property issues:

The 1980 the U.S. Supreme Court upheld the right to patent living organisms in the now famous Diamond v. Chakrabarty case. That decision changed forever the landscape in research, development and commercialization of products produced using biotechnology. Today we have a very complex patent process, and there are many legal battles over who has the rights to genetic material. The one on the front page of major newspapers today involves the rights over stem cells. A major university that owns the patent on valuable embryonic stem cells is suing a major pharmaceutical

company that is seeking exclusive rights to develop therapies using them. Agricultural biotechnology is not immune from these challenges. In the celebrated "golden rice" discovery to alleviate vitamin A deficiency, it was covered by as many as 70 patents owned by 31 different companies or universities in various countries. Patent holders have agreed to charge no royalties for rice that is to be given free to poor farmers in developing countries. However, the licensing process has taken about a year to complete (Michael, 2001). In present days, biotechnology is a technology under corporate control, protected by patents and IPR, and thus contrary to farmer's millenary traditions of saving and exchanging seeds (Altieri, 2003). Monsanto, a biotech firm, does not allow farmers to save seeds, forcing them to continually buy more Monsanto seed.

TNCs (Transnational companies) such as Monsanto require farmers who buy their GM seeds to sign contracts agreeing not to save seed. In March 1998 RAFI (Rural Advancement Foundation International), reported that Monsanto had taken legal action against more than 100 soybean growers in the US, and had hired Pinkerton investigators (hired police) to identify those saving seeds. A particularly controversial transgenic technology has been described recently and has become known as "Terminator Technology". Terminator technology produces terminator seeds, which will not germinate in next generation. This was developed with a purpose that is, forcing the farmers to buy seed year after year. All these indicates that most biotech innovations available today bypass poor farmers; first because these farmers cannot afford the seeds that are protected by patents owned by biotechnology corporations, second these modern biotechnology is not adapted to the marginal environments where resource; poor farmers live. An estimated 850 million people live on land threaten by desertification. Another 500 million reside on terrain that is too steep to cultivate. Because of these and other limitations, about two billion people have been untouched by modern agricultural science. Moreover, most of the rural poor living the tropics a region that will be most vulnerable to the effects of global warming (Conway, 1997). The real cause of hunger is poverty, inequality and lack of access to food and land. Malthusian biotechnologists need to explain first why GM crops will feed hungry people, when millions of food grains in godowns cannot (Altieri, 2003). GM crops are profit driven rather than need driven.

Conclusion:

Biotechnology techniques, if applied responsibly, have

vast potential to increase crop production, control pests, produce novel food and environmental friendly products, conserve biodiversity and treat waste. Although biotechnology is expected to provide major benefits to agriculture and the environment, possible risks to human health, socio-economically, the environment and ethical perspective should be addressed adequately before releasing any GMOs to the environment and commercializing biotechnology products.

Adoption of the Cartagena Biosafety Protocol for GMOs release and export would help reduce the possible risks associated with biotechnology. Public attitude and acceptance towards GMOs release should be assessed as they are important stakeholders and ultimate consumers of genetically modified products (Latifah, 2002) The only way to determine the effect of biotechnology on the environment and on biodiversity is

conduct appropriate scientific studies including the assessment of relative risk, measures of gene flow, determine the fitness of hybrids, assessing the effects on non-target species and ecological monitoring for things gone wrong (Kjellsson and Strandberg, 2001).

Each individual, have the right to know whether the food or seeds that they buy contain GM ingredients, in order to make responsible decisions. However, until further studies can show that GM foods and crops do not pose serious threats to human health or the world's ecosystems, the debate over their release will continue.

Living organisms are complex and tampering with their genes may have unintended effects. It is in our common interest to support concerned scientists and organizations, who demand mandatory labeling of these food products, independent testing for safety and environmental impact.

REFERENCES

- Altieri, M.A. (2003). The case against agricultural Biotechnology.
- Bhagavan, M. R. and Virgin, I. (eds) (2003). Proceedings of a Workshop on Biosafety Capacity Building in Eastern and Southern Africa, Stockholm Environment Institute, Stockholm. www.sei.se
- Conway, G.R. (1997). *The doubly green revolution; food for all in the twenty-first century*. Penguin Books, London.
- Darmancy, H. (1994). The impact of hybrids between genetically modified crop and their related species : 'introgression and weediness'. *Mol. Ecol.*, **3** : 37 – 40.
- Kjellsson, G. and Strandberg, M. (2001). Monitoring and surveillance of genetically modified higher plants. BirkhauserVerlag, Basel.
- Latifah, A. (2002) Potential risks of genetically modified organisms release into the environment. Omar,R, Ali Rahman,Z, Latif M.T, Lihan,T and Adam J.H(Eds). *Proceedings of the Regional Symposium on Environment and Natural Resources* 10-11, Hotel Renaissance Kaula Lumpur, Malaysia Vol. 1: 205-214.
- Laura, spinney (2002) Biotechnology in crops :issues for developing world. Excerpts from an Oxfam research paper. <http://www.oxfam.org.uk/>
- Michael, J. Phillips (2001) The Future of Agriculture Biotechnology, D.W. Brooks Lecture (10/1/2001), College of Agriculture and Environmental Science, University of Georgia.

