

Discussion on the paper: "Economic Potential Of Biotechnology In Agroforestry" by Professor Rouchdy S. Saleh

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Professor Saleh has thoroughly reviewed the benefits and economic potentials of biotechnology in whole areas of agriculture and forestry. I am totally in agreement with Professor Saleh. Genetic engineering technology over the past twenty years has excited the imagination of scientists because it offers a powerful methodology for manipulating living organisms to improve their services to mankind using "unnatural" means of genetic hybridization. I am one of those who believe in genetic engineering being the goose who lays golden eggs when it is properly handled. Because of these potentials, thousands of genetic engineering companies are sprout out all over the world in the last ten years. We have been talking about the genetic engineering and its promises in the last twenty years and, however, I have not yet heard of anybody making a lot of money out of it. But

I have not lost my faith in the potentials of genetic engineering. I think that genetic engineering still is the technology of the future since it offers substantial opportunities and inexpensive solution to some of the most urgent problems plaguing mankind such as shortage of food and energy as well as being itself energy-economic and resource-economic. If the rate of progress in molecular biology continues to accelerate as in the past twenty years, the next ten years of research should be gratifying to the scientists and the society that support these efforts. I truly believe that this new technology will fulfill its promises and I myself work hard for them. It seems ideal industrial technology for countries with poor natural resources like Korea. Now then what are the obstacles?

1. Not all the necessary knowledge and technologies are on hand yet. They are rather in the processes of development and it will take a quite sometime! For example, Professor Saleh mentioned about the nutritional improvement of plant storage proteins. One of the works he cited was actually done by a Korean scientist, Professor M.S. Yang, who works now in a university in Chunju, Korea. That work still need a considerable technical improvement in order to make it in practical use. In other's works too, in my knowledge, there is

no example of successful work that warrant economically feasible applications. Genetic engineering on plant storage proteins is not easy take: manipulation of plant storage protein gene or expression of a foreign DNA sequence under the control of storage protein promoters are very difficult to achieve because the plant storage proteins are synthesized through very complicated post-translational processes and require strictive conformational requirements for transport through cellular membranes and packaging.

The introduction of nitrogen-fixing capability to plant or establishment of new symbiotic relationship with nitrogen-fixing bacteria are also technically very difficult. They may not be impossible but need a lot of basic research and may take a quite sometime to achieve. Many technical and theoretical problems must be resolved before the feasibility and the limit of this approach become fully evident.

The breedings of pest-resistant and herbicide-resistant plant are more technically easy and economically feasible projects. Many new plants have been already created by the genetic engineering technique and still many more are coming. Then there is another obstacle!

## 2. Approvals of genetically engineered plants or other organisms

for human consumption and environmental release are another major obstacle to the successful application of genetic engineering to agriculture and forestry. I understand that many technically successful genetic engineering products are currently waiting for the governmental approval for field tests or marketing in the United State and elsewhere. Concern about the conjectural harzards and environmental impacts of genetic engineering are compelling reasons for the tedious regulatory measures.

Since arguments for or against genetic engineering were fully discussed previously by Dr. M. Giampietro and Dr. Moon H. Han, I am not going to repeat here. But I just want to mention that most scientists now agree that to a large extent what were earlier considered potential hazards do not exist in reality. Because of genetic engineering research touches problems associated with human dignity and biosphere, I agree that some sorts of regulatory measures or guidelines are necessary. At the same time, we should contribute more of our efforts to the basic research that can clarify uncertainty of the risks of genetic engineering. We always have to keep in mind that the growth of public understanding and support is essential for the progress of biotechnology. We must learn how we can contribute our efforts to enhance the public support and participation.

Conclusion : Genetic engineering is still a technology of the future. It is attracting wide public attention for the obvious reason that genetic engineering has much to do with the basic needs of human beings in terms of food,energy, and medicine. Indeed, genetic engineering allows men to pave the way for designing their own future for the first time and alter the course of evolution. However, we have to contribute more of our efforts to the development of basic science and technology and winning the consensus of public in order to make the dreams come true.