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Bioenergy- A Boon for Mankind

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Introduction

The acuity of sustainable development has been greatly developed as a means of integrating the environmental, social and economic objectives of the society in order to maximize human well-being in the present system without compromising the ability of future generations. Development that is not sustainable will inevitably lead to negative environmental, social and economic repercussions (OECD 2001). Biotechnology, in recent scenario, is globally recognized as a rapidly budding and far-reaching technology, and is aptly described as the technology of hope for its promising sustainability in food, health and environment. In 1919, a Hungarian engineer, Karl Ereky, coined the term "biotechnology" to refer to the science and the methods that permit products to be produced from raw materials with the aid of living organisms. According to the convention of biological diversity, biotechnology is "any technological application that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use". The recent and ongoing advances in life sciences clearly unfurl a situation energized and driven by the new tools of biotechnology. In addition to these there are a large number of agri-biotech and industrial biotech products that have enormously helped mankind.

As necessity is the mother of invention, the most recent application of biotechnology is in production of "bioenergy". Bioenergy is the energy produced through the processing of biomass. The rising energy demand possesses a real growing threat to the world's energy security. This rising energy demand also stresses that this trend lead to continued growth in energy related emissions of carbon dioxide etc. In view of the dramatic consequences that higher global temperatures and changes in climate may cause especially in developing countries, newer alternative policies are urgently required. Thus, with careful strategies and under appropriate regulatory frameworks, bioenergy and in particular biofuels, are now influential to slowing down global warming and enhancing energy security, as well as possibly providing opportunities for countries to diversify agriculture production and raise rural incomes.

Within the bioenergy sector, biotechnology, and in particular genetic engineering, has the potential to be applied to agricultural production to optimize the productivity of biomass of energy crops:

1. To raise the maximum potential yield per hectare
2. To modify crops to enhance their conversion to fuels and to the biomass conversion process, for example by developing more effective enzymes for the downstream processing of biofuels.

Whether genetic engineering will hold its promises, when the different technologies will become available and at which cost remains, however, to be seen.

Genetic modification could be used to produce plants which have nitrogen fixing ability, consume relatively little water, are easy to harvest and can be grown extensively to produce protein, carbohydrates and fibres which can be processed through a bio-refinery into a range of industrial, edible and energy products . The second major potential application of genetic engineering in the energy sector is in the manufacturing process. Biologist is using genetic engineering to overcome two major difficulties that are hindering the conversion of lignocelluloses into fuels: the high cost of cellulases, the enzyme that break down cellulose, and the limited ability of the microbes to ferment the breakdown products. Other researchers aim to overcome the limited diet of yeast. Yeast fermentation breaks down glucose and other hexoses but not the pentoses that result from the breakdown of hemicellulose, which comprises 15-50% of lignocelluloses, depending on the type of plant.

Nowadays, biofuels from algae have gain lots of importance as using algae is very economic than other substrates. Some energy experts believe that algae fuel is the biofuel of the future that will significantly decline the need for fossil fuels as, algae grow fast, algae can have high biofuel yields, algae consume CO_2 and algae do not compete with agriculture. The algal species are subjected to genetic engineering to increase biofuel production. In this context, the goal of genetically engineering algae is to select for individuals with hardy strands which can in turn convert sunlight and CO_2 into lipids or triglycerides which can then be converted into biofuels: genetic engineers are attempting to do this by manipulating their current genes.

The most widely used liquid biofuels are bioethanol and biodiesel. Ethanol is actually an alcohol and is used as an automotive fuel by itself and can be mixed with gasoline called "gasohol". Because the ethanol molecule contains oxygen, it allows the engine to more completely combust the fuel, resulting in fewer emissions. Since ethanol is produced from plants that harness the power of the sun, ethanol is also considered a renewable fuel. Therefore, ethanol has many advantages as an automotive fuel. Ethanol can be used as an octane booster, pollution-reducer, additive in unleaded gasoline, thereby substitute for chemical additives such as methyl tertiary-butyl ether (MTBE). Biodiesel is a synthetic diesel like fuel. It can be used directly as fuel or blended with petroleum diesel. While there is much attention on biofuels for the transport sector, the use of biofuels for cooking is a potential application of great relevance globally, especially in rural areas of developing countries. Combustion of biofuels for cooking will yield far lower emissions of pollutants than emissions from cooking with solid fuels. Thus biofuels could play a significant role in improving the health of billions of people.

If an appropriate regulatory agenda is in place and if careful strategies are developed, biotechnology applied to the energy sector may offer opportunities for developed and developing countries alike. Under sound strategies and appropriate regulatory frameworks,

increased use of bioenergy may represent to alleviate the serious problems that most countries face at present with high prices and possible supply disruptions in international petroleum markets, and may facilitate access to energy, especially for poor people in developing countries. Bioenergy may contribute to environmental preservation; by reducing greenhouse gas emissions; provide new opportunities to rural communities' especially in developing countries and add new value to agricultural commodities. If it keeps up to its promise, genetic engineering may play a vital role in enhancing bioenergy production and have making it an increasingly important component of the global energy mix. For a country like India, this newer approach will definitely boost its economy a great deal.