Biotechnology and its Impact on Environment

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Abstract

The rapidity of change has left scant opportunity for investigation of the consequences of biotechnology adoption on long-term ecosystem or economic system functioning. The process of Developing and making of technological applications that uses Biological systems or living organisms is called Biotechnology. Depending on the tools and applications that are developed; it helps to modify the products or processes for a particular use. Biotechnology is also used in agriculture and food production and also in preparing medicines. The word "Biotechnology" was given by Hungarian in the year 1919. Breeding programs like artificial Selection and Hybridization are used. The rapidity of change has left scant opportunity for investigation of the consequences of biotechnology adoption on long-term ecosystem or economic system functioning. Environmental biotechnology is a multidisciplinary branch of science covering wide aspects of day-to-day life, where environmental pollution is one of the major challenges faced by environmental biotechnologists. Under normal circumstances, remediation of the pollution related to soil, water, and air is naturally taken care of by recycling of the natural resources. However, recently, the widespread pollution beyond natural healing is a major concern. The increase in population and industrialization, issues associated with agriculture (such as erosion of fertile soils and over usage of chemical pesticides), accidental-intentional release of hydrocarbons in sea and land (oil spills), generation of electronic/electrical waste releasing endocrine disruptors, and uncontrolled use of antibiotics both as medicine and in meat industries are few reasons among others. Microbial biotechnology offers environmentally friendly approaches that can be implemented effectively for environmental bioremediation. Aspects of microbial- mediated bioremediation process can benefit the environment by exploiting the capabilities of microorganisms that enable the utilization of noxious compounds, thereby transforming them into utilizable intermediates and value added products. Recent times have seen a surge in research related to innovation, invention and product orientation. In fact, top experts have made it clear that innovation in biosciences can make it a bigger industry than information technology. But basic research must remain the cornerstone of the biotech edifice, for without basic research the country will always remain knowledge deficient. Hence, the Department of Biotechnology has developed a very strong bench for basic research in modern biology. Nano biotechnology is a relatively new programme. Initiated as a stand-alone programme in the year, 2007 it fosters research, leverages the fast growing knowledge in different areas of Nanoscience to create values in Biomedical and Agricultural business space. Nanobiotechnology requires a multidisciplinary research approach. The aim of the Biodiversity Conservation and Environmental Biotechnology programme is to solve environmental problems in a sustainable way through the use of biotechnology.

Keywords: Environmental biotechnology,

Introduction

Environmental biotechnology is biotechnology that is applied to and used to study the natural environment. The application of Biotechnology to solve the environmental problems in the environment and in the ecosystems is called Environmental Biotechnology. It is applied and it is used to study the natural environment. According to the international Society for environmental Biotechnology the environmental Biotechnology is defined as an environment that helps to develop, efficiently use and regulate the biological systems and prevent the environment from pollution or from contamination of land, air and water have work efficiently to sustain an environment friendly Society. Humans have been manipulating genetic material for centuries. Although many benefits are provided by these manipulations, there can also be unexpected, negative health and environmental outcomes. Environmental biotechnology, then, is all about the balance between the applications that provide for these and the implications of manipulating genetic material Textbooks address both the applications and implications. Environmental engineering texts addressing sewage treatment and biological principles are often now considered to be environmental biotechnology texts. These generally address the applications of biotechnologies, whereas the implications of these technologies are less often addressed; usually in books concerned with potential impacts and even catastrophic events. Environmental biotechnology could also imply that one try to harness biological process for commercial uses and exploitation. The international society for environmental biotechnology defines environmental biotechnology as "the development, use and regulation of biological systems for remediation of contaminated environments and for environment- friendly processes. Environmental biotechnology can simply be described as "the optimal use of nature, in the form of plants, animals, bacteria, fungi and algae, to produce renewable energy, food and nutrients in a synergistic integrated cycle of profit making processes where the waste of each process becomes the feedstock for another process". Farmers have manipulated plants and animals through selective breeding for tens of thousands of years in order to create desired traits. In the 20th century, a surge in technology resulted in an increase in agricultural biotechnology through the selection of traits like increased yield, pest resistance, drought resistance, and herbicide resistance. Environmental microbiology is the ecology of microorgenisms: their relationship with one another and with their environment. It concerns the three major domains of life – eukaryota, archaea, and bacteria—as well as virus. Microorganisms, by their omnipresence, impact the entire biosphere. Microbial life plays a primary role in regulating biogeochemical systems in virtually all of our planet's environments, including some of the most extreme, from frozen environments and acidic lakes, to hydrothermal vents at the bottom of deepest oceans, and some of the most familiar, such as the human small intestine.

Aims of The Study

Article of “Biotechnology And It’s Impact On Environment” a broad-based Article was founded Biotechnology applications in therapeutics, diagnostics, genetically modified crops for agriculture, processed food, bioremediation, waste treatment and to provide a rapid turn-around time possible for reviewing and publishing and to disseminate the articles freely for research, teaching and reference purposes.

Types of Biotechnology

On basis of uses in different fields, biotechnology are mainly three types.

Medical Biotechnology

Medical biotechnology helps in preventing human diseases. The use of living cells and cell materials is called medical biotechnology. The living cells and cell materials serve the purpose for research and also helps produce pharma products and diagnostic products which eradicate human diseases. The medical research studies are conducted by the medical biotechnologists and these biotechnologists work for academic and industrial needs. The biotechnologists conduct various experiments which part of the research which helps to identify, treat numerous diseases and how to prevent diseases. The biotechnologists have been very successful in bringing various techniques in the field of medical Biotechnology. The contributions towards developing drugs and vaccines have been majorly contributed by the industrial biotechnologists. Techniques like environmental clean-up, market microbial pesticides and insect- resistant crops are all introduced by the Biotechnologists in the field of Biotechnology. In Simple words, Medical Biotechnology is the study of micro-organisms like bacteria, plants and animals. It also helps in studying enzymes which is imminent in industrial and manufacturing sectors and processes which help in producing foodstuffs, important drugs used for making medicines and synthetic hormones. The research studies related to deoxyribonucleic acid (DNA) is the pioneer illustration of the inventions in the field of medical biotechnology also including the invention of insulin and growth hormone. The study of Genetic engineering involves in identifying the human genes and this study is done by many biotechnologists in the field of Biotechnology. Diseases like Parkinson's and Alzheimer's syndrome can be possibly are cured with the help genetic engineering.

Agricultural Biotechnology

The technique used for improvising the plants, micro organisms and animals is called Agricultural Biotechnology. DNA tests help the scientists to measure and develop solutions to enhance agricultural productivity. It also helps to enhance breeders' in order to make improvements in new crops and livestock. DNA plays a key role for new improvements and developments in Agricultural Biotechnology. Agricultural Biotechnology is majorly used in Genetic engineering, Molecular makers, Molecular diagnostics, Vaccines and tissue culture. For decades, the farmers have been working hard to improve the quality of crops, plants and animals through selection and breeding processes. Since the twentieth century the process of breeding in agricultural biotechnology became a very imminent and a vital process for the farmers and in the agricultural industry. The process of breeding helps to enhances flavour, it is pest resistant and it helps to increase the productivity of the endth results post agricultural process. The Breeding traits are passed from one generation to another generation which help of genes which is made out of the DNA tests. According to the recent study the scientists have learned to work in accordance to the genes or the DNA which is responsible for the future changing traits in the agricultural industry. The cells those are present in all the living things including fruits, vegetables, and meat function in accordance to the genes found in the cells present in living things and eatables.The use of modern biotechnology is very important in order to improve the quality of crops in Crop production. Few genes are transferred from one crop to another to improve the quality of each increased crop cultivated. This process of transferring the genes helps to enhance the nutritional qualities, taste and the look and feel of the eatables it also reduces the dependency of on artificial fertilizers and pesticides and agrochemical products for the cultivation of these crops. The process of modifying the living organisms is called Animal Biotechnology. It is used in science and engineering of Animals. The main aim and goal of Animal biotechnology is to produce quality products and enhance micro organisms for a particular agricultural uses. Examples of Animal biotechnology are new breeds of animals introduced by humans and with the help of Cloning process (introducing identical animals). The traditional Breeding techniques are used in animal biotechnology decades ago.

Industrial Biotechnology

The use of Plants, marine organisms, algae, fungi and micro organisms is called industrial Biotechnology. Biological resources are used to produce the chemicals, materials and energy required for the development of industrial goods. Industrial Biotechnology is also known by the name "white Biotechnology". It is also used to make Biobased products in certain sectors like paper, pulp, textiles, biofuels and biogas. Industrial Biotechnology helps the environmental benefits and it also helps in improving the performance of the industry and a value add to its products too. Industrial biotechnology has proved to be the most contributing, innovative and promising approaches towards the industrial growth and it has helped in lowering greenhouse gas emissions. It has also contributed the impacts in climatic change in the industrial sector and in the other sectors too. As the industrial technology improvises day by day, generations after generations it helps not only the changes in the climatic conditions but also it helps are economy to growth in the industrial sector and in the other sectors too. As the industry improvises there is growth and scope for innovation and technology. It also helps in pollution prevention, resource conservation and cost reduction. If proper measures are planned, executed and practised industrial biotechnology can be proved the largest sector in comparison to Agricultural and medical biotechnologies or sectors. Industrial biotechnology is referred to as the Third wave in Biotechnology. According to the latest study and update new industrial processes can be considered from the industrial lab study to commercial sectors or applications two to five years down the line. Industrial Biotechnology helps in protecting the environment while it offers the business industry in cost cutting techniques and helps to create more and more markets in the business world. Also it is not a time consuming process in comparison to drug products undergo. It is considered as the most quickest and the easiest industry for the businesses and for the various markets. Since the invention of industrial biotechnology is so new that the benefits and advantages of this sector is unknown and not understood and explored by the consumers and industry itself. The improvements in the industrial processes has improved so much that certain inventions that have happened so far in the industrial biotechnology sector has helped to up-lift the industry to a greater height in the world. It is not only transforming the manufacturing process but also helping us to invent to newer products that we could have failed to imagine a couple years ago. It has helped in preventing air and water pollution this is one of the best illustrations of industry Biotechnology. Other illustration of industrial biotechnology includes the production of fermented products like beer, Cheese, Yogurt and vinegar. As time passes by invention in this sector will keep improvising and by overcoming the de-merits it will reach greater heights.

Application of Environmental Biotechnology

As A Biomarker

This type of application of environmental biotechnology gives response to a chemical that helps to measure the level of the pollution effect caused. So that biomarker can also be called as the biological markers the major use of this applications helps to relate the connection between the oils and its source.

In Bio-Energy

The collective purport of biogas, biomass, fuels and hydrogen are called the bioenergy. The use of this application of environmental biotechnology is in the industrial, domestic and space sectors. As per the recent need it is concluded that the need of clean energy out of these fuels and alternative ways of finding clean energy is the need of hour.

In Bioremediation

The process of cleaning up the hazardous substances into non-toxic compounds is called the bioremediation process. This process is majorly used for any kind of technology clean up that uses the natural microorganisms.

In Biotransformation

The changes that take place in the biology of the environment which are changes of the complex compound to simple non-toxic to toxic or the other way round is called the biotransformation process. It is used in the manufacturing sector where toxic substances are converted to bio-products.

Crop Modification Techniques

Traditional Breeding

Traditional crossbreeding has been used for centuries to improve crop quality and quantity. Crossbreeding mates two sexually compatible species to create a new variety with the desired traits of the parents. For example, the honeycrisp apple exhibits a specific texture and flavor due to the crossbreeding of its parents. In traditional practices, pollen from one plant is placed on the female part of another, which leads to a hybrid that contains genetic information from both parent plants. Plant breeders select the plants with the traits they're looking to pass on and continue to breed those plants. Note that crossbreeding can only be utilized within the same or closely related species.

Mutagenesis

Mutations can occur randomly in the DNA of any organism. In order to create variety within crops, scientists can randomly induce mutations within plants. Mutagenesis uses radioactivity to induce random mutations in the hopes of stumbling upon the desired trait. Scientists can use mutating chemicals such as ethyl methanosulfonate, or radioactivity to create random mutations within the DNA. Atomic gardens are used to mutate crops. A radioactive core is located in the center of a circular garden and raised out of the ground to radiate the surrounding crops, generating mutations within a certain radius. Mutagenesis through radiation was the process used to produce ruby red grapefruits.

Polyploidy

Polyploidy can be induced to modify the number of chromosomes in a crop in order to influence its fertility or size. Usually, organisms have two sets of chromosomes, otherwise known as a diploidy. However, either naturally or through the use of chemicals, that number of chromosomes can change, resulting in fertility changes or size modification within the crop. Seedless watermelons are created in this manner; a 4-set chromosome watermelon is crossed with a 2-set chromosome watermelon to create a sterile (seedless) watermelon with three sets of chromosomes.

Protoplast Fusion

Protoplast fusion is the joining of cells or cell components to transfer traits between species. For example, the trait of male sterility is transferred from radishes to red cabbages by protoplast fusion. This male sterility helps plant breeders make hybrid crops.

RNA Interference

RNA interference is the process in which a cell's RNA to protein mechanism is turned down or off in order to suppress genes. This method of genetic modification works by interfering with messenger RNA to stop the synthesis of proteins, effectively silencing a gene.

Transgenics

Transgenics involves the insertion of one piece of DNA into another organism's DNA in order to introduce a new gene(s) into the original organism. This addition of genes into an organism's genetic material creates a new variety with desired traits. The DNA must be prepared and packaged in a test tube and then inserted into the new organism. New genetic information can be inserted with biolistics. An example of transgenics is the rainbow papaya, which is modified with a gene that gives it resistance to the papaya ringspot virus.

Genome Editing

Genome editing is the use of an enzyme system to modify to DNA directly within the cell. Genome editing was used to develop herbicide resistant canola to help farmers control weeds.

Importance of Biotechnology

Feeding the Poor

It is well-known that, at least on the global scale, people are not hungry because of insufficient agricultural yields. Rather people are hungry because they are poor. Consider the Green Revolution which was motivated by the public concerns to feed a hungry world. The hybrid vigor and dwarf plant characteristics that resulted meant that overall food production of major cereal crops doubled or even tripled in some regions. Despite such successes, the extent to which the poor actually benefitted from the "Green Revolution" has been the subject of much debate. In many countries, the major benefits of new varieties accrued to the landowner elites and not the laborers. The ultimate impact of the "Green Revolution" on the poor has depended on the geographic, social and political circumstances and has been quite uneven across the globe.While the "Green Revolution's" high-yielding varieties were potentially poverty-alleviating, a broader context of appropriate non-distortionary agricultural and rural development and economic policies was needed. Until food access for the population who lie outside of the market is resolved, growing more corn, soybeans, or wheat will do little to feed the world's hungry.

Yield Increases and Biotechnology

While there is not a direct relationship between increased world crop yields and food security for the poor, fewer acres have been devoted to agricultural purposes than if yield increases had not occurred. Without continual agricultural yield improvements, many more millions of acres will have to be devoted to agricultural uses as world population grows and as incomes and diets improve. However, the question remains whether biotechnology is the only or best way to achieve these yield increases, as well as whether biotechnology will increase yields in the location and crops most advantageous to the poor. While some assert biotechnology is the solution to achieving a high yield, environmentally protecting agriculture; others suggest it should be considered an essential partner with more ecological approaches such as integrated pest management and with improved economic policies. Still others contest whether modern biotechnology is necessary to achieve yield advances. For many reasons, many farmers around the world are not near the potential of their land using either conventional or (non-biotechnological) alternative practices. Thus, some argue, and some studies suggest, that biotechnology is only one of a suite of possibilities for raising world food yields. Many assert that building human capital, not technological fixes, should be the key investment in pushing the developing countries toward higher sustained food production. Human capital is essential to devising agricultural systems that fit the physical, biological, economic, social and cultural bases that govern food production in those countries. Finally, some doubt that adequate investments are being made to break the physiological constraints that limit future increases in crop yields, and thus "it would appear exceedingly rash to predict that...[there will be] any measurable impact on production in the next several decades". Since the "Biotechnology Revolution" is being led by private companies, there is little reason to believe the products that emerge are destined to feed the billions on the planet or to protect the environment. Because the private sector is motivated by incentives such as profits, timely return to stockholders, and market share, it is not surprising that the genetic manipulation funded by the private sector would emphasize certain "Research and Development" investments and product attributes that would differ from that of a more complete public agenda. Put more formally, one would expect the private sector to invest in low exclusion goods such as seed-chemical-machinery "packages" or value-added foods and neglect high exclusion goods, such as protection of biodiversity or the improvement of minor traditional crops in the developing world. Private investments can thus be expected to focus on high-value crops, on labor-saving technologies, and the needs of capital intensive farming in order to feed those who can pay not on the needs of the smallholder farmers in the developing world nor environmental conservation. Nevertheless, there are cases where private companies have partnered with public institutions or foundations to focus on the needs of poor people. For example, Monsanto has entered into agreements with both Kenyan and Mexican research institutions for the development of virus resistant crops. While these partnerships appear to be working well, they are few in number, modest components of philanthropic programs. And, many argue that public or foundation funding for biotechnology products geared to environmental protection or the needs of the poor are quite inadequate. There may also be barriers to more innovations directed at the needs of the poor. Even if barriers posed by the high cost of biotechnology research drops, new firms and public institutions may be unable to gain access to the information for, or the right to, create new products—such as customized seeds for micro-climates or transgenic crops that do not require pesticides. "Public sector plant breeders are handicapped by the high disparity in resources and negotiating power between themselves and the companies.

Yields and Wildlife

It is not obvious that high yields correlate well with acreage in wilderness and enhanced benefits for wildlife nor that low yields are necessarily detrimental to wildlife. Wildlife and agriculture, for example, are not necessarily incompatible—farmland can support a broad diversity of wildlife as well as water quality and flood control benefits. And, while expansion of agriculture into wilderness areas can occur because of high prices for commercially traded foods and fibers—perhaps as a result of low yields relative to quantities demanded—expansion can also occur as poor farmers pursue low-input extractive farming systems for a subsistence living. The latter motivation may have little to do with world yields or prices. A study of the Amazon forest, for example, found that intensifying existing cropland use did not remove the pressures of deforestation.

Impact on The Environment

The concerns surrounding potential negative environmental and eco-system function outcomes of agricultural biotechnology include impacts stemming from changes in pesticide use, impacts on non-target species, and pest and virus resistance.

Pesticides' Use Impact

An environmental concern with respect to genetically engineered crops is whether they will be able to provide more environmentally benign methods of managing weeds and insect pests, as promised. Unfortunately, an accurate assessment of the contribution of herbicide-tolerant or *Bt* crops to either to environmental improvements or producer profits will require a decade or more of actual field use. This long evaluation period is necessitated by the variability in weather, market prices, and pest infestation across regions. The introduction of genetically transformed potato plants did not have a major impact on insecticide use. Such variable outcomes could be the result of early adoption problems or the severity of pest problems and may not be representative of results over longer periods of time. Because of changes in types and severity of pest infestations and hence chemical use, the overall impact on the environment from agro-chemical use following the adoption of transgenics, then, depends on the toxicity of and exposure to the chemicals used compared with the pre-transgenic chemical portfolio. There may also be offsetting environmental impacts. For example, herbicide-resistant plants may also allow reductions in plowing (as opposed to pre-transgenic chemical portfolios) and thus reduce wind and water sediment damages. However, at least to date, there is not enough evidence to conclude whether overall pesticide damages to the environment are reduced due to the adoption of biotechnology products.

Non-Target Species Impact

Although major crop acreage is in transgenics, there has not been an independent assessment of whether certain species are benefitting or being harmed by the transgenics. Many crops are habitat to a range of insects or predatory arthropods that prey on unwanted insect pests, that provide food for birds, and that pollinate plants. These insects are referred to as "beneficials" in integrated pest management strategies. *Bt* toxins can harm both pests and "beneficials"—although so can conventional insecticides. There is a laboratory research result that *Bt* transgenic plants pollen kills non-target Monarch butterfly larvae, if the larvae are exposed to *Bt* pollen. Whether wild Monarchs—whose larvae prefer to eat milkweed and not corn—will actually be killed in significant numbers by *Bt* crops, however, is not yet resolved. For another example, no harm has been shown to come to bees from *Bt* toxins. *Bt* is only the first generation of built-in plant toxin; patents have already been secured on genes for toxins from scorpions, cone snails, funnel spiders and wasps. The impact of the successful expression of these genes on non-target species appears to be unknown. Other concerns include whether there can be a disruption of soil ecological functioning from the breakdown of crop tissue and release of toxins or if sequestration of toxins by herbivores could have unintended secondary effects on their predators or on the herbivore themselves. A fundamental concern with respect to biotechnological impacts transcends the potential unintended impact on any single species. It relates to whether the reduction in diversity of crop and wild plant and animal species creates a more fragile, less sustainable agricultural system. Such narrowing of diversity has been happening for some time, but could be accelerated by biotechnology. The concern is that the very uniformity demanded and rewarded by the emerging food system creates greater environmental risks for system collapse or biological damage.

Pest and Virus Resistance

Another major environmental concern is that engineered plants will either become weeds themselves or will transfer pollen to wild relatives that will become weeds. If these weeds are herbicide-resistant, they may become extremely difficult to control in agricultural settings. Thus, in regions where plants have weedy relatives, resistant weeds may pose a threat and may out-compete native plants. Such competition could alter the current eco-system of a region and/or threaten wild crop gene pools. Such threats appear to be probable. For example, a team of scientists advised the Rockefeller Foundation that the likelihood of gene transfer from cultivated Asian rice to weedy relatives was of such a magnitude that it will probably occur. There are also numerous cases where "exotics" associated with agriculture have caused problems and where genetic diversity has been diminished by the introduction of crops.Similar concerns relate to the possibility of intensifying existing or creating new viruses. Viral epidemics from natural recombinations have already occurred. For example, the African cassava mosaic virus is just such an epidemic. An additional concern addresses organic agriculture. Should key pests develop resistance to *Bt*, organic growers will have lost a major pest control tool. Susceptible insects can be thought of as an open access resource. Economic theory suggests that if the benefits of drawing on this stock of susceptibility is high enough, the stock will be drawn down too fast from a social accounting perspective. The ultimate impact on the environment of herbicide-tolerant insects could be negative, as organic farmers resort to other insect control chemicals and practices. An alternative, less chemical dependent path could be supported by different biotechnology products than those that are currently emerging. Many argue that the alternative path is more socially desirable and can be yield-enhancing. But it is a path that requires a reorientation of agricultural research in ways that embed the lessons of evolutionary biology. However, it is difficult to capture the profits from many of these alternatives, thus they tend to be neglected by the private sector.

Conclusion

The pace of biotechnology advances and adoption have been so rapid that they are outstripping our knowledge and the capacity of our institutions. Complicating the situation is the lack of a credible, mature information base by which to evaluate environmental concerns; empirical evidence is just beginning to emerge. The stakes for assuring sound oversight and decisions about transgenic crops and animals are large. Designing appropriate regulatory institutions is not only in the interests of those concerned about negative environmental effects, but of the industry as well. If a large human or environmental health catastrophe emerges due to poor national or international oversight, it could not only cause a short-term setback for the industry, but also jeopardize the entire future of biotechnology and its considerable potential. A more fundamental criticism of the biotechnological approach to pest control is that it continues along the path of providing a single control component per pest and thus encourages dependence on pesticides. Not only does such a path assure that there will soon be pests that are resistant to the control of the crops, such a path also diverts attention from whole system management techniques undergirded with understanding of ecological connections. Hence, sound precautionary approaches that create ex ante safe minimum standards and avoid large irreversible losses for industry and the environment seem prudent.

References

1. *Ervin, D.E. Agricultural biotechnology is a double-edged environmental sword.*
2. *Hassebrook, C. Biotechnology, sustainable agriculture, and the family farm.*
3. *Hazell, P.B. and C. Ramasamy (1991). The Green Revolution reconsidered: the impact of high-yielding rice varieties in South India.*
4. *Heffernan, W.D. Biotechnology and mature capitalism: feeding people or feeding firms.*
5. *Hubbell, B.J. and R. Welsh. Transgenic crops: engineering a more sustainable agriculture? Agriculture and Human Values 15: 43-56.*
6. *Just, R.E. and D.L. Hueth. Multimarket exploitation: the case of biotechnology and chemicals.*
7. *King, J. and D. Stabinski. Patents on cells, genes, and organisms undermine the exchange of scientific ideas. The Chronicle of Higher Education.*
8. *Krimsky, S. and R. Wrubel. Agricultural biotechnology and the environment: science, policy and social issues.*
9. *Liebman, M. and R.R. Jancke. Sustainable weed managements.*
10. *Lipton, M. and R. Longhurst. New seeds and poor people.*
11. *Losey, J., L. Rayor, and M. Carter. Transgenic pollen harm Monarch larvae.*