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SUSTAINABLE DEVELOPMENT IN AGRICULTURE: ROLE OF BIO-TECHNOLOGY

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ABSTRACT

Sustainable development in the agriculture sector aimed to increase the productivity, efficiency and level of employment, protect and preserve the natural resources by the over utilization. It also provides mechanism to reduce the soil degradation through multiple cropping systems, deforestation and some other reasons. Indian Agriculture has been witnessing a blinding pace of growth and development in recent times. But this growth has raised concerns from sundry quarters as regards its basic texture and health. Experts are now calling for "sustainable development" and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy. Further, it aims to compare the sustainable agriculture system with the traditional system and the current system in practice, across the dimensions of ecological, economic and social sustainability. It also tries to give long term solutions to solve the problems plaguing the system so that sustainable practices can be promoted and practiced. Being the largest private sector 'agriculture' enjoys a very important position in Indian economy. As it is having link from various sectors like production, processing and marketing; agriculture continuously dominate to change in the India. This paper attempts to tackle and explore the issue of bio technology for sustainable development in agriculture in India.

KEYWORDS: *Sustainable Development; Bio-Technology; Bio-Pesticides; Bio-Fertilizers; Molecular Biology.*

INTRODUCTION:

Agriculture plays a vital role in Indian economy; it is one of the major employment sources in the country. Being the largest private sector 'agriculture' enjoys an extremely significant position in Indian economy. As it is having link from various sectors like production, processing and marketing. Agriculture continuously dominates to change in the India. The term "Sustainable Development" was first brought into use in the year 1987 by the world commission on environment and development. The Brundtland Commission defined as "Meeting the needs of present generation without compromising the needs of future generation". It is however, rather difficult to precisely articulate the concept of 'Sustainability' as it is not possible to argue that all natural resources be preserved as they are, from natural resources should be preserved in some aggregate compensated elsewhere. In other words, sustainable

development means the development that lasts. The achievement of sustained and equitable development remains the greatest challenge which facing the human race. Despite the good progress over the past generation, more than one million people are still live in acute poverty and suffer grossly inadequate access to the resources, especially land, which required giving them a chance for better life. The essential task of development is to provide opportunities, so that these people and the hundreds of millions not much better off can reach their potential.

OBJECTIVES OF THE STUDY:

The following are the basic objectives of the study;

1.To analyze the Components of Sustainable Development.

2.To discuss extent of sustainable development in the agricultural sector.

3.To discuss the sustainable development with bio technology and innovative techniques in agriculture sector.

SIGNIFICANCE OF STUDY:

A growing movement has emerged during the past two decades to question the role of the agricultural establishment in promoting practices that contribute the various social problems. Today this movement for sustainable agriculture is garnering increasing support and acceptance within mainstream agriculture. Not only does sustainable agriculture address many environmental and social concerns, but it offers innovative and economically viable opportunities for growers, laborers, consumers, policymakers and many others in the entire food system. This descriptive paper aimed to study the extent and importance of sustainable development and its impact on the agricultural practices in the country and how the production policies are changing in accordance with changing scenario of the economy.

Components of Sustainable Development:

The concept of sustainability assumes three things, a long-term perspective, equity between generation and dynamic phenomenon it implies an increase in use intensity and higher productivity of natural resources without permanently damaging those resources. The best method to address to the prospects of sustainable development is to have;

i.Faith in technological progress and institutional capacity to react to change.

ii.Believe in the appropriate scale and relationship between humans and nature.

iii.Try to know the time frame in which any physical limits to apply for the growth.

iv.Anticipate failures due to knowledge uncertainties and also due to market and government deficiencies.

The sustainable development requires new strategies that differ from those that emanate from strategic, rational and deterministic planning. These strategies should allow for technological progress to resolve the environmental problems but not depend solely on such proffer. Moreover any strategy should be open to revision when any unexpected 'novelty' or currently unforeseen possibility occurs.

The achievement of sustained and equitable development remains the greatest challenge facing the human race. Despite the good progress over the past generation more than one million people still in acute poverty and suffer grossly inadequate access to the resources, especially land required to give them a chance for better life. The essential task of development is to provide opportunities so that these people of hundreds of millions not much better off can reach their potential.

In many developing countries, there is a need for the faster growth, as in these countries, the per capita income is very low and problems of poverty and unemployment are limiting the economic development. The concerns for the environmental implication for economic development gained importance in 1970s onwards. It is realized that the economic growth deserves to pay much attention on environment. The term sustainable development is included as an element of economic development policy. The concept of sustainable development views the economic growth and environmental protection as complementary and not a conflict. The thrust of this new perception is that economic growth and environmental quality can go together.

Sustainable Development in Agricultural Sector:

The policy will seek to promote technically sound, economically viable, environmentally non-degrading and socially acceptable use of country's natural resources – land, water and genetic endowment to promote sustainable development of agriculture. The required measures will be taken to contain biotic pressures on land and to control indiscriminate diversion of agricultural lands for non-agricultural purposes. The unutilized wastelands will be put to use for agriculture and a forestation. Particular attention will be given for increasing cropping intensity through multiple-cropping and inter-cropping system.

Rational utilization and conservation of the country's abundant water resources will be promoted. Conjunctive use of surface and ground water will receive highest priority. Special attention will be focused on water quality and the problem of receding ground-water levels in certain areas as a result of over-exploitation of underground aquifers. Proper management of water resources for the optimum use of irrigation potential will be promoted.

Erosion and narrowing of the base of India's plant and animal genetic resources in the last few decades has been affecting the food security of the country. Survey and evaluation of genetic resources and safe conservation of both indigenous and exogenously introduced genetic variability in crop plants, animals and their wild relatives will receive particular attention. The use of bio-technologies will be promoted for evolving plants which consume less water, drought resistant, pest resistant, contain more nutrition, give higher yields and are environmentally safe. Conservation of bio-resources through their ex situ preservation in Gene Banks, as also in situ conservation in their natural habitats through bio-diversity parks etc., will receive a high priority to prevent their extinction. Specific measures will also be taken to conserve indigenous breeds facing extinction. There will be a time bound programme to list, catalogue and classify country's vast agro bio-diversity.

Sensitization of the farming community with the environmental concerns will receive high priority. Balanced and conjunctive use of bio-mass, organic and inorganic fertilizers and controlled use of agro chemicals through integrated nutrients and pest management will be promoted to achieve the sustainable increases in agricultural production. A nation-wide programme for utilization of rural and urban garbage, farm residues and organic waste for organic matter repletion and pollution control will be worked out.

Agro-forestry and social forestry are prime requisites for maintenance of ecological balance and augmentation of bio-mass production in agricultural systems. Agro-forestry will receive a major thrust for efficient nutrient cycling, nitrogen fixation, organic matter addition and for improving drainage. Farmers will be encouraged to take up farm/agro-forestry for higher income generation by evolving technology, extension and credit support packages and removing constraints to development of agro and farm forestry. Involvement of farmers and landless labourers will be sought in the development of pastures/forestry programmes on public wastelands by giving financial incentives and entitlements to the usufructs of trees and pastures.

The history and traditional knowledge of agriculture, particularly for the tribal communities, relating to organic farming and preservation and processing of food for nutritional and medicinal purposes is one of the oldest methods in the world. Concerted efforts will be made to pool, distil and evaluate traditional practices, knowledge and wisdom and to harness them for sustainable agricultural growth. Agricultural research and extension of education after the best hope as the technological advancement in agricultural can act as substitute for natural resource. Thus, the technology must be eco-friendly for farm production. This eco-friendly technology is helpful in different ways as mentioned below;

i.Minimizes the use of inputs that caused to damage the environment.

ii.Preserves bio-diversity.

iii.Minimizes post-harvest losses.

iv.Encourages alternative agricultural system such as agro-techniques based on integrated nutrition management, integrated pest management and bio-technology.

v.Promote recycling of farm wastes.

According to the technical committee of the Consultative Group on International Agricultural Research (CGIAR) the goal of sustainable agriculture should be to maintain production at levels necessary to meet the increasing aspiration of an expanding world population without degrading the environment. Sustainable agriculture involves the successful management of resources for agriculture to satisfy the changed human needs

while maintaining the quality of environment and conserving natural resources. Sustainable agriculture consists of the following the three components;

i.Growth component associated with maintenance of long run productive capacity of agriculture so that it could meet the needs of present as well as future generations.

ii.The distributional component involving more equitable sharing of benefits to reduce absolute poverty especially in developing countries like India where agriculture is the main source of livelihood.

iii.The environmental component which is concerned with the conservation of natural resources necessary to sustain the agricultural growth process over time. Thus sustainable development demands production efficiency, social justice and environmental protection.

Under sustainable development effective environmental planning is needed with regarding the utilization of renewable and non-renewable resources. Further sustainable development requires the adverse impact of development activities on the quality of air and water to be minimized. Therefore the production pattern in agricultural sector has to be designed in such a manner so as to meet the needs of the growing population with minimum environmental hazards. Agriculture has been considered once as a drag on economic growth and development because of its low productivity syndrome. The determinants of low productivity are use of inadequate resources, limited capacity to survive risks and limited information base for making production decision, technological progress through effective research and development system which provides support for output growth and the choice to get over biotic stress stability.

Sustainable Development with Bio-Technology in Indian Agriculture:

Bio-technology is based upon better and inclusive understanding of molecular mechanisms that control biological processes and are operated through genetic modification done at the DNA level. For example in plant breeding instead of conventional methods of recovering recombinants through sensual process DNA sequences are identified that encode a specific trait. Crop bio-technology research has now resulted in genetic constructs that can modify a variety of traits of economic importance. The modification of these traits will have a major impact on production structure. Today it has been widely felt that, the bio-technology could be remedy for the economic ecological and sociological crisis currently appearing throughout the world the following basic principles to be followed to minimize the negative effects of this crisis;

i.Development of renewable raw materials which can be removed from the ecosystem without harming it.

ii.Processing at a lower temperature with minimum increase in entropy.

iii.Useful by products, this can be safely recycled in the ecological cycle.

iv.Facilitation of decentralized production and supply units, which are linked to the local ecosystem.

To enhance the quality of environment and ecological resources and at the same time to avoid economic losses, the legal and political remedies must make use of bio-technology. Immoral exploitation of natural resources would not only economically and ecologically harmful but it also a theft of the inheritance of the next generation. The next generation would be left with a despoiled earth and the collapse of the bio-system. Making the unification of bio-technology and micro electronics would make possible a safe and highly productive technology. It could work in small, manageable units in the nature and it could also be linked in a compatible way with the local eco-system. The newly emergent paradigm of development lays equal stress on ecological sustainability and non-economic and social sustainability.

Application of Bio-Technology in Agriculture:

In many developing countries “Environmental Breakdowns” have affected the poor, particularly the rural people. The excess population growth affects the available resource base of crop lands, wood, fuel and even fresh water. Therefore, the nexus among the people, resources, environment, technology and agriculture is closer to-day. Sustainable development by enhancing production capacity and upgrading degraded and would help to avoid “environmental catastrophe”.

Unsustainable practices as pointed out by Professor N.L. Gupta and R.K. Gurjat are the following;

i.Intensive cultivation of land without taking adequate care of soil fertility and soil structure would lead to

desertification.
ii.Irrigation methods without proper arrangement of drainage would make even the most fertile soils into alkaline through water-logging.
iii.Indiscriminate application of variety of pesticides, fungicide, and herbicide would cause alternatives in the established biological balance and even increase the incidence of cancer and other diseases to human beings through the raised toxic residue contents in food grains.
iv.Incurable and rapid replacement of the indigenously adopted varieties with only one or two high yield verities in contiguous areas might lead to spread of diseases capable of wiping out the entire crops.

Sustainable agricultural development has its own complexities, which need ecologically balanced sound crop management practices. The new developments in bio-technology such as genetic redistricting of plant architecture and physiological behavior are bringing drastic changes in agricultural production.

To-day bio-technology is used for a wide range of research activities such as Protoplast, cell and tissue culture, Genetic engineering using recombinant techniques, and Bio-processing, microbiological upgrading of celluloid material, fermentation and forms of processing of agricultural biomass.

BENEFITS AND HARMS OF BIO-TECHNOLOGY:

Three major fields namely; Bio-pesticides, Bio-fertilizers and Molecular Biology were developed to improve the production of agricultural crops as a component of low input sustainable agriculture. Crop losses due to pests and disease have been estimated to millions rupees. Pesticides consumption has grown abnormally in the recent years. These fertilizers have resulted in many adverse effects in the environment. They have eliminated the beneficial natural enemies of the pests and also caused the largest pets to develop resistance also. Bio-pesticides appear to be an environment friendly alternative to the chemical pesticides. After assessing the potential of bio-control agents, the Department of Bio-technology, Government of India implemented the project on Biological control of insect pests diseases and weeds control Bio-technology with two major objectives, such as development of system for mass production of bio-control agents and large scale filed demonstration of the efficacy of these agents on economically important crops in farmers fields.

Fertilizer requirement in India has been increasing in day by day. The use of naphtha-based fertilizers increases our import bill and the heavy priced chemical fertilizers bring adverse effect on the ecosystem and therefore there is need for finding an alternate source to substitute the chemical fertilizers. The bio-fertilizer, rhizobium, azozpirillum and blue green algae have developed to fix atmospheric nitrogen and enhancing the yield of pulses, oilseeds, rice, cotton, sugarcane, vegetable and fruit crops. The department of Bio-technology, Government of India has sponsored various projects to develop “strains” for ecologically and agronomically useful characters to suit the different agro climatic condition.

In the near future, the only path way left for our country to feed out growing population will be continues growth in crop yield through tools of bio-technology and conventional research. The reason is that, there is not much scope for the expansion in area of cultivation. The department of Bio-technology has setup a network for three natural gene banks at New-Delhi, Lucknow and to gather and store rare, threatened and important species medical and aromatic plants. They also help to build up a national level database on such plants. They store and converse species that are extensively used in traditional medicines, species difficult to propagate and species of high commercial value.

The researches under agro-biotech from the cloning of existing gene types, selective breeding, production of vaccines for animals and chemical additives to improve crop yield or breed animals can help to solve a number of problems like sustainable production, health care and protection of the environment in many developing countries. Bio-technology even though it has many technological development, it has some negative consequences for developing countries. For example, substitution of primary commodities, industrialization of agriculture and privatization of knowledge and technology are considered as negative features of bio-technology.

The bulk of the on-going field of large bio-technology components in the world is geared to creating crops, which are more tolerant to herbicides. The logic is herbicide resident crops would increase the sale of

herbicides from these components. Many researches are being concentrated on a narrow band of genetic material. This would affect the objective of developing more sustainable agriculture. To-day there is another problem of bio-race substitution of crops like sugar; coco and vegetable oil by synthetic food material expect to affect many developing countries. For example, sugar exports from the Caribbean and Philippines to USA have been affected by substitute sweeteners derived from the corn. Many of the western countries do not want to give importance to increase in agricultural productivity by using bio-fertilizer and bio-pesticide to-day agricultural cropping pattern no longer flow out of soil condition and local needs; they are dedicated by demands of international markets. The recent studies showed that 70 percent of the children in Central America are under-nourished due to the diversion of most fertile agricultural land for the growth of cash crops for exports.

It is revealed that although bio-technology is a powerful tool in modern crop science, it may create some problems in the long run. A major problem is the stability of the genetically engineered crop. Another problem is the genetic uniformity of bio-technologically developed crop. This would render the entire crop susceptible to diseases and pest. Another problem is the possibility of a creation of new hybrid virus particles that did not exist in nature before viruses are used extensively in genetic engineering to transfer traits. There are also many uncertainties about the end result of transgenic products getting into the food chain. Therefore, in India the department of Bio-technology has done a lot of work on the development of bio-fertilizers and bio-pesticides but it is not doing much for transfer the technologies developed in laboratory to the field.

CONCLUSION:

The rulers of the nation should concentrate to sustain the country with sustainable agriculture development. Agriculture in India is confronted with three major challenges in the coming years namely: increase the availability of nutritious food to an increasing population, use natural eco-system more sufficiently and make a contribution to economic development. All these challenges can be resolved by paying more attention on technology particularly bio-technology. Technology is a key input therefore it is necessary to engage in modern bio-technology for agricultural advancements. Thus modern bio-technology has an increasingly acceptable potential in developing countries like India to raise agricultural productivity in an environmentally acceptable manner, supply cheaper and more nutrition's food and contributed to the alleviation of poverty.

It has been observed that for a growing country like India the practice of sustainable agriculture is of quite importance as it accelerates the productivity, efficiency, employment, and providing guidance to reduce the practices which affect the quality of soil, water resources and degradation of other natural resources. It is basically aimed at adopting specialization and using environment friendly tools to protect and preserve the environment as well as to enhance the level of production without harming to the environment. As we see the performance of agricultural sector of India we will be easily recognize that performance have been increased in a significant manner over the years. Despite of many challenges like urbanization, Growth of secondary sector etc. it has achieved a significant growth.

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