Asian Journal of Research in Social Sciences and Humanities
ISSN: 2249-7315 Vol. 11, Issue 12, December 2021 SJIF 2021 = 8.037
A peer reviewed journal

SIGNIFICANT ADVANCEMENT IN AGRICULTURAL BIOTECH IN THE ERA OF CLIMATE CHANGE

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DOI: 10.5958/2249-7315.2021.00340.3

ABSTRACT

Tropical areas, especially impoverished countries, are more impacted than temperate ones by greater temperature fluctuations and regime changes. When it rains, the demand for water rises. In addition, while mild warming benefits crops in mid and high latitudes, even moderate warming decreases the yields in the low latitudes in the seasonally dry regions. This has an effect not only on everyone in the globe, but also on the rest of the ecosystem. There are so many issues that remain a tough issue with how to prevent and combat climate change. In developing nations which are highly populated and prone to droughts, food insecurity may be especially prevalent. Total worldwide food production capacity is expected to grow if the average region's temperature rises from 1 to 3°C, however the world's food safety is under danger from severe weather and socioeconomic problems. It is notable that comprehensive national research and does not take possible adaptation methods into account the Intergovernmental Panel on Climate Change's gloomy predictions of low latitude agricultural output. On the other hand, the effect on food safety is significant. Food safety in all four dimensions is impacted. Climate change will raise and aggravate the burden for poor nations already dealing with acute food shortages.

KEYWORDS: *Agricultural, Biotechnology, Climate Change, Food Security, Greenhouse, Plants.*

1. INTRODUCTION

Climate change is one of the most serious problems confronting mankind today and will remain a significant worry for long-term development. It also poses additional risks owing to unexpected temperatures and increasing sea level. Strengthening its effect on the global, regional, national, and local levels will result in a genuine viable solution to this issue. Climate change is produced by the release of greenhouse gases into the air. These gases develop in the atmosphere and cause global warming. All global climatic factors that affect temperature, precipitation, soil humidity, and sea level[1].

On the other hand, the exactness of the climate change predictions is contested. For billions of people globally, especially the impoverished in the Asia-Pacific, climate change impacts agriculture, food security, and rural life. Agriculture is the most climate-related industry, since it is so reliant on weather and the environment, and farm workers are often poorer than urban residents. Agriculture provides a livelihood, either directly or indirectly, for approximately 60 percent of the people in the area. There is no solid knowledge as to what occurs if concentrations of greenhouse gas (GHG) increase in atmosphere and unknown the precise time period. In view of climate change, agriculture is an important sector to investigate. Climate change impacts and contributes

to the agricultural industry[2].

During the previous decades, warming trends and severe weather events such as droughts, cyclone-crossing, floods and hail in the Asia-Pacific area have persisted. The poorest people in the world reside in the area. In many of these nations, poverty is mainly linked to recurrent climate risk exposure. As a result of climate change, these risks and vulnerabilities are increasingly prevalent. According to UNDP, climatic shocks may impede human development by way of four main channels or risk multipliers. This comprises (a) loss of production prior to an incident. (b) early adaptation costs, (c) physical capital erosion, and (d) human opportunity erosion. Even before the occurrence, there may be a danger of human development costs to vulnerable people in climate change regions. Uninsured risks may lead to the avoidance by consumers of hazardous companies and reduced revenue. Likewise, the negative effects of the second channel, the cost of human adjustment, are well acknowledged. These expenditures may influence human development on a long-term basis. The third method is the depletion of resources. Climate change may harm domestic wealth and savings[3].

There is no clarity as to what ultimately takes place as a result of increasing atmospheric GHG concentrations and the duration is uncertain. Agriculture is a topic of concern in terms of climate change. Changes in the climate affect agriculture and contribute to it. GHGs allow light to penetrate the earth, restrict infrared radiation (infrared rays) and act as a trapping heat greenhouse. CH_4 is the most powerful greenhouse gas, having the global warming potential 300 times as much as CO and 20 times as NO. Nitrogen fertilizers, paddy fields, soil management and conversion, biomass combustion and animal production, and associated fertilizer management are the main sources of gas[4].

The average area temperature rises significantly owing to the emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). More carbon dioxide and other chemicals in the atmosphere are thought to be responsible for 50 percent rise since the Industrial Revolution in global warming. Atmospheric carbon dioxide (CO_2) levels were increasing by human emissions from 285 percent in 1998, up from 285 percent per million in the late 19th century before the industrial revolution, to approximately 366 percent in 1998. The reason in the atmosphere is approximately 405 Giga tonnes of carbon (C). Industrialization (fossil fuel consumption and cement production) accounted for 67 percent of the rise and the remaining 33 percent of the land-use change. As a consequence of the increasing greenhouse gas levels in the atmosphere, climate change is widely known.

Experiments using the American model's sensitivity to variations in CO_2 levels in Kerala rice fields revealed an increase in sensitivity due to its potential impact and better efficiency in water use. According to renowned agronomic Swaminathan, changes in agriculture have considerable effect, and an annual loss of 6 million tonnes of grain may contribute to an increase in temperature of one degree in India's rice terraces. In order to feed an expanding population, the aim of the Green Revolution was to increase production. The marvel of the 20th Century was that the yield of arable land stayed constant while the global food production doubled or tripled. The green revolution pushed the ideals of efficiency of the industrial revolution even further by boosting production. These hybrid seeds must be acquired and fertilized to achieve the optimum yield. The input is specific to a particular crop that promotes crop growth and increases the danger of insect issues. Pesticide introduction and eradication of pests[5].

As the hybrid seeds grew more popular, however, reliance for chemical inputs rose. This method appeared at first helpful, but was soon swamped by problems and complexities. The environmental effect of agricultural activities, in particular greenhouse gas emissions in agriculture, comes from the advances achieved during the Green Revolution in agriculture. In different strains or races on the same plant, even in early seeds and plants, higher genes are

frequently found, and molecular propagation may be used to identify directly and quickly the presence of the gene(s). People may expand their accumulation significantly in the real world Do not publicise the tension of the issue. In order to properly identify DNA fragments particular alleles, genes and Quantitative Trait Loci (QTL), Marker Aids Backcrossing (MAB) and Marker Assisted Repeated Selection (MARS) are sophisticated methods. The migration of less desirable genes and plants may be minimized into the plant line. Soy, maize, rice, sorghum and all the potatoes have been sequenced lately. The process accelerates, allowing large and complicated genomic sequences like wheat and barley for crops due to the high output of next generation sequencing. You may quickly locate required locations in one genome in other genomes[6].

2. LITERATURE SURVEY

C. Aydinalp et al. stated in the paper that the effect on Nigerian agriculture of global warming is being experimentally examined and the drivers of adaptation to climate change are assessed. The data from both primary and secondary sources have been collected in this research. Coverage may be verified using secondary data sources for three situations (1971-1980; 1981-1990 and 1991-2000). In the main data set there are 1,500 responders, but only 1,250 are relevant examples. The research examines the drivers of climate adaptation in agriculture through randomised and multi-selector simulations to evaluate the effects of rapid climate change on Nigerian grain output and climate change on Nigeria's population. Over a decade, under a variety of climatic scenarios, the computer model of cereal production, consumption, and storage. In most cases an optimistic 1.85 percent rise or a pessimistic 0.75 percent increase was utilized in the basic agricultural output. The natural growth rate of the population is calculated at 1.65 percent per year, excluding hunger-related fatalities. The results indicate that hunger fatalities may increase if grain production is not able to meet population growth in disadvantaged areas. Climate adaptation, however, has a major effect on agricultural output[7].

S. A. Saseendran et al. presented in the article current climate change impact estimates for agriculture were nonetheless investigated using the application of a validated and calibrated crop simulation model in the modelling of rice production inside Kerala, India's humid tropical environment for climate change impacts on agricultural output. The rice yield of the state. In Germany the combination of projected emissions of greenhouse gases and sulphate aerosols in an experiment with seas and atmospheric modelling concluded in a plausible climate changes scenario for the Indian sub-continent at the middle of the next century. Compared to the 1980s, a seasonal surface temperature rise of approximately 1.5°C in the monsoon and a seasonal increase in rainfall by 2040 to 2049 of around 2 mm a day in Kerala is indicated. Model simulation Crops are also predicted in the IPCC that by the middle of the century the amount of CO_2 accessible to crops will reach around 460 ppm. Rice maturity in nations that have assessed the scenario of climate change is predicted to drop by an average of 8 percent, while returns are likely to rise by 12 percent. Only high temperatures have decreased crop maturity by 8 percent and reduced crop simulation yield by 6 percent. This implies that, as is anticipated in climate change scenarios, State-wide benefits in harvests and precipitation caused by increasing CO_2 fertilization are more than equalising the detrimental effects on rice plants of rising temperatures. Tests in sensitivity in rice models have shown a higher output of CO_2 concentrations owing to fertilization and enhanced water usage in rice fields. The effects are evident in the state-wide CO_2 concentration rise. According to temperature sensitivity tests, positive temperature changes up to 5°C result in sustained decrease in yield. Performance decreased by about 6 percent with each increment. At another experiment, the physiological effects of ambient CO were observed in a concentration of 425 ppm to balance loss of yield as a consequence of an increase in temperature of up to 2°C. Rainfall above the level recorded near an exponential function boosts rice production. Rice output is rising. But when precipitation decreases, yields are reduced continuously every 2mm/day at a rate of approximately 8 percent to some 16mm/day[8].

3. DISCUSSION

As a consequence of climate change, droughts are also predicted to increase throughout Asia. Usually, lengthy, hot, and dry rice farming. The next quarter of a century is projected to lose up to 80 percent of Himalayan glaciers that are supplying rivers and streams in China and India (Global Hunger Index). Meanwhile, severe weather events like storms and floods occur in temperate areas of the globe like North America and Europe. Biotechnology from agriculture has the potential to help rural people in the world substantially. Genetically modified plants are created which are nutritious and disease-resistant. GM crops are intended to survive in poor soil, endure severe circumstances such as drought and heat, and maintain plants' edible levels of minerals and vitamins. Heavy metals and contaminants could be removed and used to grow other crops from the contaminated soil, which would result in additional acreage accessible. New crops engineered to respond to future climate change problems will significantly enhance food security[9].

As a consequence of climate change, the nitrogen needs of plants due to fertiliser usage may vary. In Sub-Saharan Africa, for example, fertilisers are limited or non-existent. Nitrogen continues to be a constant diet in developed countries, however, creating issues with its transit into rivers and environmental pollutants like greenhouse gases. Agricultural biotechnology stands as a unique tool to develop climate-resistant characteristics and cultivars. Biotechnology in agriculture has improved productivity, reduced production costs and decreased input intensity while being controversial in a number of policy sectors and public fora.

Reduced poorness and food security will be a major issue for most countries in the globe, particularly in Asia-Pacific in the 21st century, as experts have noted in the past, in the face of the harsh environmental conditions induced by global climate change and increasing production costs. The total human greenhouse gas emissions now accounted for 13 percent of agriculture, including agricultural land, pasture and livestock animals. Indirect sources such as fertilisers, food production and other power-intensive industries are not considered in this method. The economy of the country is strongly connected to natural resources, accounting for 65 percent of the workforce engaged in agriculture and allied industries, as well as more people living in coastal areas due to tourism and fishing. As most of the country's poorest inhabitants are living in rural regions and susceptible to climate change because they depend almost entirely on natural resources for food, shelter and livelihoods.

Due of climate change's severity, large-scale solutions need to be implemented quickly. The most significant barrier to our capacity to feed us in the coming decades is certainly climate change. Experts do not allow themselves to wait until things become worse. Instead, people have everything to do to feed themselves in a much worse scenario and to help change our food production system so that global warming is avoided. Biotechnology presently offers a viable and wide-ranging option to combat climate change. In addition, biotechnology may be used to create crops which are adapted to our changes and result in sustainability in the long term. When viewed as a solution to climate change, biotechnology has the potential to bridge the scientific-ecological gap by allowing sustainable agriculture to be developed. Agricultural innovation has become more important than ever owing to a global population increase, particularly in some of the poorest nations with rapid population growth, improved insufficient nutrition, and clear implications for local environmental economics.

The priority of biotechnology are salt resistant crops. The transfer of salt tolerant mangrove genes into food crops is responsible for this resistance. It increases the utilization of small quantities of water, and the area near the sea risks Stalinizing because groundwater is good for salt resistant plants. By expanding research and investment in these adaptable seeds, biotechnology will play a significant role in adapting agriculture to the challenges of the changing climate. The National Research and Development Authority (NRC), which was the first to adopt GM crops, says that

inter-specific gene flows are not a major issue in the USA. Meanwhile, an increasing number of economic and agricultural studies demonstrate how current farm biotechnology could enhance the potential for soil crops for carbon storage, decrease demand for arable land expansion and minimize carbon-intensive inputs. The use of agricultural inputs such as fuels and pesticides has been shown to reduce emissions of greenhouse gases. Herbicides may be utilized for gene editing in future to solve these issues by producing seed that, under certain circumstances, is resistant to altering farm environment. Through droughts and water restrictions, biotechnology creates plants that can withstand them. According to Professor Swaminathan, President of the Committee for Environmental Technology and President of India's National Commission for Agriculture, Food and Nutrition Security, the cause of drought or water constraints is climate change. Water pressure is generated by climate change. It makes it obvious. Plants which do not require water therefore need to be cultivated. Innovative methods of addressing climate change are accessible via biotechnology. Drought resistance may be converted to plants such as rice. These new weather-resistant seeds have been developed and are now being tested on the market[10].

4. CONCLUSION

It could lead to a huge number of consequences, especially for agricultural systems, but also for many areas of the globe. Climate change is the most serious problem of the twenty-first century. Tropical countries or poorer nations tend to be more impacted than temperate ones, because when it rains, the demand for water rises owing to higher temperature instability and variations in the regime. In addition, while mild warming improves agriculture in mid and high latitudes, even moderate heating reduces yields in the seasonally dry zones in low latitudes. This affects not only everyone on the planet, but the rest of the ecosystem as well. Preventing climate change and addressing it remain a difficult subject with so many worries. Food insecurity is especially common in heavily populated and drought-prone developing countries. Total worldwide food production capacity, while the area's average temperature is projected to rise by 1–3°C (although at a modest pace), is at danger from severe weather and socio-economic concerns about global food security. It is worth emphasizing that the negative predictions of low-latitude agricultural production by the Intergovernmental Panel on Climate Change are not based on extensive national research and do not consider possible adaptation alternatives. On the other side, the effect is enormous on food safety. Food security affects all four aspects (production, food commerce, food supply stability, food access, and food use). Climate change is increasing and worsening the pressure on impoverished nations already experiencing severe food insecurity.

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