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Recent Progress in Agriculture Biotechnology In The Light Of Climate Change

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ABSTRACT: Climate change is the major concern of the 21st century and can affect many parts of the world in particular agricultural ecosystems. Tropical regions, or poor nations, are more affected than temperate ones by higher temperature variations and regime transitions. Addition, although mild warming improves crops in mid and high latitudes, even moderate warming reduces the yields in the low latitudes in the seasonally dry areas. There are so many problems that remain a difficult issue with how to avoid and fight climate change. In developing countries which are densely populated and prone to droughts, food insecurity may be particularly widespread. Total global food production capacity is anticipated to increase if the average region's temperature increases from 1 to 3°C (however it will drop with a rise in temperature), but the world's food safety is under threat from harsh weather and socioeconomic challenges. It is noteworthy that thorough national study and does not take potential adaption techniques into consideration the Intergovernmental Panel on Climate Change's grim forecasts of low latitude agricultural production. On the other hand, the impact on food safety is important. Food safety in all four dimensions is affected (production, food commerce, food supply stability, food access, and food usage). In future study focus upon climate change will increase and exacerbate the burden for impoverished countries already struggling with severe food shortages.

KEYWORDS: Agricultural, Biotechnology, Climate Change, Crops, Food Security.

1. INTRODUCTION

Climate change is one of the most urgent challenges facing humanity now and will remain a major worry for long-term development. It also presents more hazards due to unforeseen temperatures and rising sea level. Strengthening its impact on the global, regional, national, and local levels will result in a real feasible solution to this problem. Climate change is caused by the emission of greenhouse gases into the air. These gases grow in the atmosphere and cause global warming. All worldwide climate variables that influence temperature, precipitation, soil humidity, and sea level [1].

On the other hand, the exactness of the climate change forecasts is disputed. For billions of people worldwide, particularly the poor in the Asia-Pacific, climate change affects agriculture, food security, and rural life. Agriculture is the most climate-related business, as it is so dependent on weather and the environment, and farm labourers are frequently poorer than town dwellers. Agriculture provides a livelihood, either directly or indirectly, for about 60% of the population in the region. There is no firm information as to what happens if concentrations of Greenhouse Gas (GHG) rise in atmosphere and uncertain the exact time period. In light of climate change, agriculture is an essential industry to examine. Climate change affects and contributes to the agriculture industry [2].

1.1 Impact of Climate Change:

During the preceding decades, warming trends and extreme weather occurrences like as droughts, cyclone-crossing, floods and hail in the Asia-Pacific region have continued. The poorest people in the world live in the region. In many of these countries, poverty is largely connected to recurring climate risk exposure. As a consequence of climate change, these dangers and vulnerabilities are becoming widespread. According to United Nation

Development Program (UNDP), climate shocks can hinder human development by means of four major routes or risk multipliers. This includes

(a) Loss of productivity prior to an occurrence.

(b) Early adaptation expenses,

(c) Physical capital erosion, and

(d) Human opportunity erosion.

Even before the occurrence, there might be a threat of human development costs to vulnerable persons in climate change areas. Uninsured hazards may lead to the avoidance by customers of risky businesses and decreased income. Likewise, the negative consequences of the second channel, the cost of human adjustment, are widely recognised. These expenditures can impact human development on a long-term basis. The third way is the depletion of resources. Climate change can damage domestic wealth and savings [3].

There is no clarity as to what finally takes place as a consequence of increased atmospheric GHG concentrations and the duration is unclear. Agriculture is a matter of concern in terms of climate change. Changes in the climate impact agriculture and contribute to it. GHGs enable light to enter the earth, limit infrared radiation (infrared rays) and function as a trapping heat greenhouse. CH_4 is the most powerful greenhouse gas, with the global warming potential 300 times as much as CO and 20 times as NO. Nitrogen fertilisers, paddy fields, soil management and conversion, biomass combustion and animal production, and related fertiliser management are the primary sources of gas [4].

The average area temperature increases markedly due to the emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). More carbon dioxide and other gases in the atmosphere are believed to be responsible for 50 percent increase since the Industrial Revolution in global warming. Atmospheric carbon dioxide (CO_2) levels were growing by anthropogenic emissions from 285% in 1998, up from 285% per million in the late 19th century before the industrial revolution, to around 366% in 1998. The reason in the atmosphere is around 405 Giga tonnes of carbon (C). Industrialization (fossil fuel consumption and cement production) accounted for 67% of the increase and the remaining 33% of the land-use change. As a result of the rising greenhouse gas levels in the atmosphere, climate change is well recognised.

Experiments with the American model's sensitivity to changes in CO_2 levels in Kerala rice fields showed an increase in sensitivity owing to its potential influence and greater efficiency in water consumption. According to famous agronomic Swaminathan, changes in agriculture have significant influence, and an annual loss of 6 million tonnes of grain can lead to a rise in temperature of one degree in India's rice terraces. In order to feed an increasing population, the goal of the Green Revolution was to boost productivity. The wonder of the 20th Century was that the output of arable land remained constant while the global food production quadrupled or tripled. The green revolution took the ideas of efficiency of the industrial revolution even farther by increasing output. These hybrid seeds must be obtained and fertilised to obtain the optimal output. The input is unique to a particular crop that boosts crop development and raises the risk of pest problems. Pesticide introduction and elimination of pests [5].

As the hybrid seeds became increasingly prevalent, however, dependence for chemical inputs increased. This technique seemed at first beneficial, but was rapidly overwhelmed by issues and complications. The environmental impact of agricultural operations, in particular greenhouse gas emissions in agriculture, stems from the progress made during the Green

Revolution in agriculture. In various strains or races on the same plant, even in early seeds and plants, higher genes are commonly discovered, and molecular propagation may be used to determine directly and rapidly the existence of the gene(s). People can increase their accumulation substantially in the actual world Do not publicise the stress of the matter. In order to correctly identify DNA fragments (specific alleles, genes and Quantitative Trait Loci (QTL)), Marker Aids Backcrossing (MAB) and Marker Assisted Repeated Selection (MARS) are complex techniques. The migration of less desirable genes and plants can be reduced into the plant line. Soy, maize, rice, sorghum and all the potatoes have been sequenced recently. The process accelerates, enabling big and complex genomic sequences like wheat and barley for crops due to the high output of next generation sequencing. You may easily find desired loci in one genome in other genomes [6].

2. LITERATURE SURVEY

C. Aydinalp et al. presented in the article that the impact on Nigerian agriculture of global warming is being experimentally investigated and the drivers of adaptation to climate change are evaluated. The data from both primary and secondary sources have been obtained in this study. Coverage may be checked with secondary data sources for three circumstances (1971-1980; 1981-1990 and 1991-2000). In the primary data set there are 1,500 respondents, however only 1,250 are useful instances. The study analyses the determinants of climate adaptation in agriculture via randomised and multi-selector simulations to assess the impacts of fast climate change on Nigerian cereal production and climate change on Nigeria's population. Over a decade, under a number of climate scenarios, the computer model of cereal output, consumption, and storage. In most situations an optimistic 1.85 percent increase or a pessimistic 0.75 percent increase was used in the basic agricultural production. The natural growth rate of the population is estimated at 1.65% each year, excluding hunger-related deaths. The findings show that hunger deaths might rise if grain output is not able to match population growth in disadvantaged places. Climate adaptation, however, has a significant impact on agricultural productivity [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 anticipated emissions of greenhouse gases and sulphate aerosols in an experiment with oceans and atmospheric modelling culminated with a realistic climate changes scenario for the Indian sub-continent at the middle of the next century. Compared to the 1980s, a seasonal surface temperature increase of around 1.5°C in the monsoon and a seasonal increase in rainfall by 2040 to 2049 of roughly 2 mm a day in Kerala is shown. Model simulation Crops are also projected in the IPCC that by the middle of the century the level of CO_2 available to crops would reach about 460 ppm. Rice maturity in countries that have evaluated the scenario of climate change is projected to decrease by an average of 8%, while returns are expected to increase by 12%. Only high temperatures have reduced crop maturity by 8 percent and reduced crop simulation yield by 6 percent. This means that, as is predicted in climate change scenarios, State-wide gains in crops and precipitation induced by increased CO_2 fertilisation are more than equalising the adverse impacts on rice plants of rising temperatures. Tests in sensitivity in rice models have demonstrated a greater yield of CO_2 concentrations due to fertilisation and improved water use in rice fields. The results are seen in the state-wide CO_2 concentration increase. According to temperature sensitivity studies, positive temperature variations up to 5°C result in persistent loss in yield. Performance fell by

around 6 percent with each increase. In another experiment, the physiological effects of ambient CO were found in a concentration of 425 ppm to offset loss of yield as a result of an increase in temperature of up to 2°C. Rainfall above the level recorded near an exponential function increases rice output. Rice production is increasing. But as precipitation drops, yields are dropped constantly every 2mm/day at a rate of roughly 8% to some 16mm/day [8].

3. DISCUSSION

3.1 Drought and Climate Change:

As a result of climate change, droughts are also projected to intensify across Asia. Usually, long, hot, and dry rice cultivation. The next quarter of a century is expected to lose up to 80 percent of Himalayan glaciers that are feeding rivers and streams in China and India (Global Hunger Index). Meanwhile, extreme weather events like storms and floods occur in temperate parts of the world like North America and Europe. Biotechnology from agriculture has the ability to benefit rural people in the globe significantly. Genetically engineered plants are produced which are nutritious and disease-resistant. GM crops are designed to thrive in poor soil, undergo extreme conditions such as drought and heat, and retain plants' edible amounts of minerals and vitamins. Heavy metals and pollutants might be removed and utilised to produce other crops from the polluted soil, which would result in more acreage available. New crops designed to react to future climatic change challenges would substantially improve food security [9].

As a result of climate change, the nitrogen demands of plants due to fertiliser use might alter. In Sub-Saharan Africa, for example, fertilisers are scarce or non-existent. Nitrogen continues to be a stable diet in industrialised nations, however, causing problems with its passage into rivers and environmental emissions like greenhouse gases. Agricultural biotechnology stands as a special instrument to create climate-resistant features and cultivars. Biotechnology in agriculture has enhanced productivity, lowered production costs and decreased input intensity while being contentious in a number of policy areas and public fora.

3.2 Urgency of Climate Change:

Reduced poorness and food security will be a significant concern for most nations in the world, especially in Asia-Pacific in the 21st century, as experts have observed in the past, in the face of the severe climatic circumstances caused by global climate change and rising production costs. The entire anthropogenic greenhouse gas emissions now accounted for 13 percent of agriculture, including agricultural land, pasture and livestock animals. Indirect sources such as fertilisers, food manufacturing and other power-intensive sectors are not included in this procedure. The economy of the nation is closely linked to natural resources, accounting for 65% of the workforce involved in agriculture and associated industry, as well as more people living in coastal regions owing to tourism and fishing. As most of the country's poorest people are living in rural areas and vulnerable to climate change because they rely virtually solely on natural resources for food, housing and livelihoods.

Due to climate change's severity, large-scale remedies need to be taken immediately. The greatest important obstacle to our ability to feed us in the next decades is definitely climate change. Experts do not allow themselves to wait until things get worse. Instead, individuals have everything to do to feed themselves in a far worse case and to help reform our food production system so that global warming is prevented. Biotechnology currently represents a practical and wide-ranging alternative to fight climate change. In addition, biotechnology may be utilised to produce crops which are tailored to our changes and result in sustainability in the

long run. When considered as a response to climate change, biotechnology has the capacity to bridge the scientific-ecological divide by enabling sustainable agriculture to be created. Agricultural innovation has become more essential than ever due to a worldwide population rise, especially in some of the poorest countries with high population growth, improved inadequate nutrition, and obvious consequences for local environmental economics.

3.3 New Areas of Biotechnology:

The priorities of biotechnology are salt resistant crops. The introduction of salt tolerant mangrove genes into food crops is responsible for this resistance. It improves the utilisation of little amounts of water, and the region near the sea risks salinizing since groundwater is beneficial for salt resistant plants. By increasing research and investment in these adaptable seeds, biotechnology will play an important role in adapting agriculture to the difficulties of the changing climate. The National Research and Development Authority, which was the first to embrace GM crops, states that inter-specific gene flows are not a significant concern in the USA. Meanwhile, a growing number of economic and agricultural studies show how current farm biotechnology might improve the potential for soil crops for carbon storage, reduce need for arable land expansion and minimise carbon-intensive inputs. The use of agricultural inputs such as fuels and pesticides has been demonstrated to minimise emissions of greenhouse gases. Herbicides can be used for gene editing in future to address these problems by creating seed that, in some conditions, is resistant to changing farm settings. Through droughts and water constraints, biotechnology develops plants that can resist 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 stresses is climate change. Water pressure is produced by climate change. It makes it clear. Plants which do not need water thus need to be cultivated. Innovative ways to tackling climate change are available through biotechnology. Drought resistance may be transformed to plants such as rice. These new weather-resistant seeds have been created and are currently being tested on the market [10].

3.4 Water Efficient Plants:

Throughout recent decades in temperate and tropical Asia, floods, drought, forest fires and tropical cyclones have grown increasingly prevalent. In dry and semi-arid areas of Asia, runoff and water supplies are expected to decrease. An increasing sea level and more tropical storms will drive tens of millions to evacuate Asia's low-lying coastal areas, with roughly 17 per cent of the continent anticipated to be flooded by the sun. Bangladesh. The increased intensity of precipitation in temperate and tropical Asia and a weaker monsoon, on the other hand, increase the risk of flooding. The efforts of the region for the achievement of food production objectives are and remain a key impediment to water. Consequently, water efficiency should be a key concern for all stakeholders. Furthermore, special attention should also be paid to existing water storage systems such as small ponds, large reservoirs, recharging and storage of groundwater and rural low-lying areas.

3.5 Food Security:

In the 21st century, food safety for everybody will be a key problem. Malnutrition impacts a billion people worldwide, with almost one third suffering from malnutrition. The probable threat of climate change aggravates the situation with the growing world population. Due to the many links between climate change and the diet systems, it is feared, although little is known, that climate change could worsen food poverty. Consequently it is important for research to understand and react promptly and effectively to the consequences of climate

change on food security. This oscillation shows the major effects on ecological systems of climate change and rising tempers. Everything has altered in hydrological, terrestrial, organic, marine and freshwater systems. Trout and floods will grow more regular and will pose a danger to local production, in especially in the self-sustaining low-latitude sector. The effect of climate change on the world's food supply is expected to be considerable. In the next 50-70 years, high risk sub-Saharan Africa is thought to be able to turn agricultural products into a desert, while less than 10 percent of land is vulnerable to drought presently.

By 2050, the population of the globe will have more than 9 billion people and will require almost triple agricultural production to feed everybody. At the same time, water shortfalls and climate change have an even more severe influence on the global agriculture industry, which increases the risk of under-production in a world that has already under-nourished over one billion people. These challenges may all be addressed through biotechnology, innovation and proper agriculture and trade development strategies. The importance of technology in dealing with food security and climate change and the great potential of it as an economic growth engine should be encouraged for countries to look favourably Sadly, a lack of scientific regulation in many countries hampers innovation and flexibility while also building trade barriers.

3.6 Bio-fortified and Other Nutritionally Enhanced Foods:

Improving the nutrition of crops increasingly considered a staple diet to the impoverished of the globe is one way of meeting the growing demand for food crops. The production of rice, wheat and maize that are bio enriched can support individuals with fewer calories, with lower diets that feed many people today, with enhanced levels of mineral substances and vitamins. The production of plants with a high level of micronutrients might thus be a method to aid plants in the face of a food deficit due to climate change. Climate change has to do with diversity. For example, vitamin A deficiency is blinding in around 500,000 children. The vitamin A concentration of rice and other major food crops can significantly lower this amount. Examples of ways of bio-improvement include maize, cassava and rice, as well as calcium-rich carrots and tomatoes.

Additives such as iodized salt and vitamin-enhanced milk have long been considered as measures for public health to combat nutrition in big groups of people. Health-conscious clients seek foods with additional benefits via the use of vitamin and calcium-enriched drinks, omega 3 fatty acid-enriched bread and phytosterol-enhanced vegetable oils. These foods include nutrients that contribute to or enhance the health and well-being of the whole body in many ways including the heart, bones, digestive system, eyes and brain. The game was completed with components. The decrease of weight has several advantages, including greater energy and enhanced immune function as the most important. Extra-biosynthetic transgenic crops, such as 'golden rice' high in vitamin A, can be utilised for bio-enriched meals to produce modifications to the physiological body in general. More micronutrients, for example iron-rich wheat, can be collected from the soil. Plants which collect more vitamins and minerals can be developed and produced for the health of the plant. Nutrient-dense plants are capable of withstanding the harshest climate changes. Bio-enriched food may readily be integrated into impoverished rural diets and agricultural efforts in undeveloped countries. Those having access to organic fortified foods are more willing to face the negative impacts of climate change.

4. CONCLUSION

It might lead to a large number of repercussions, particularly for agricultural systems, but also for many regions of the planet. Climate change is the most urgent issue of the twenty-first

century. Tropical countries or poorer nations tend to be more affected than temperate ones, since when it rains, the demand for water increases due to greater temperature volatility and changes in the regime. In addition, whereas mild warming enhances cultivation in mid and high latitudes, even moderate heating lowers yields in the seasonally dry zones in low latitudes. This impacts not just everybody on the globe, but the rest of the environment as well. Preventing climate change and tackling it remain a contentious issue with so many concerns. Food insecurity is particularly frequent in highly populated and drought-prone developing nations. Total worldwide food production capacity, although the area's average temperature is expected to grow by 1–3°C (albeit at a moderate rate), is at risk from harsh weather and socio-economic worries regarding global food security. It is worth stressing that the negative projections of low-latitude agricultural productivity by the Intergovernmental Panel on Climate Change are not based on comprehensive country research and do not address potential adaptation options. On the other hand, the influence is tremendous on food safety. Food security influences all four factors (production, food commerce, food supply stability, food access, and food usage). For future studies the concentration on climate change will aggravating and exacerbating the strain on poor countries already facing acute food insecurity.

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