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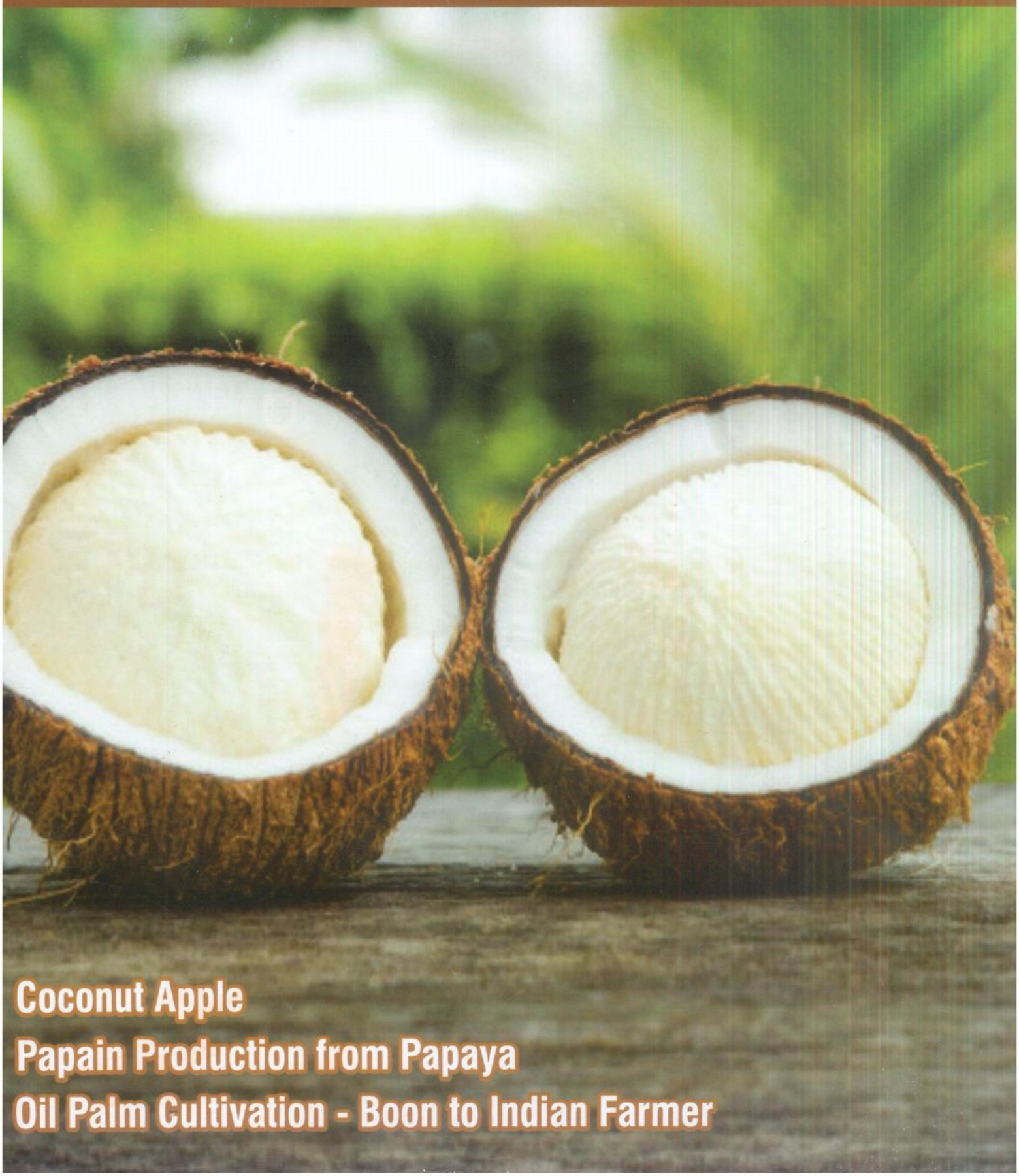

Coconut Apple
Papain Production from Papaya
Oil Palm Cultivation - Boon to Indian Farmer

CONTENT

EFFECTS OF CLIMATE CHANGE ON AGRICULTURE AND THEIR MITIGATING MEASURES

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Introduction

Agriculture is extremely vulnerable to climate change. In the long run, higher temperatures reduce agricultural yields of targeted crops while fostering the expansion of weeds and pests. The chance of both short-term agricultural yields and long-term productivity declines with changes in precipitation patterns. Climate change describes alterations to the atmosphere that go beyond the norm and are brought on by both natural and man-made variables, such as the concentration of greenhouse gases and aerosols in the atmosphere and variations in the earth's orbit, volcanic activity and crustal movements. A trend that will bring about large worldwide changes in the future is climate change, often known as global warming, which is the term used to describe the average rise in global temperature. Among its fourth assessment on climate change (2007), the UN Intergovernmental Panel on Climate Change (IPCC) provided substantial scientific data about its impacts and those evidences have since gained widespread acceptance. Greenhouse gas emissions are continuing to rise and the changes in the climate system have increased people's awareness of the fact that global warming cannot be stopped. Because it affects both ecological and human systems. The acceleration of global warming has become a critical issue on a national and international scale. Mitigation strategies, which concentrate on lowering greenhouse gas emissions and absorbing them, as well as adaptation strategies, which aim to lessen the effects of climate change on agriculture, make up the majority of methods used to address the global warming problem. This article reviews the data collected from the literature on the issue of climate change, its effects on plants and the agricultural industry, as well as its prospective and reported effects on growth, mitigation measures and their economic effects.

Agriculture in India

Agriculture is undoubtedly the foundation of the Indian economy. Agriculture contributes 15% of export revenue, which is a significant portion of all goods and services exported. Growth in the agricultural sector also directly contributes to the fight against poverty and is a key driver of job creation. The land use patterns and gas emissions that can contribute to climate change are mostly influenced by the agriculture industry. Agriculture's economic losses from climate change globally and natural disasters are increasing, and the agriculture sector is particularly susceptible to them. The United Nations Office for Disaster Risk Reduction (UNISDR) estimates that from 1998 to 2021, disaster-affected nations suffered direct economic losses totaling US$ 2908 billion. In the recent past, the agriculture industry has been more severely affected by climate change. According to the 2018, Economic Survey conducted by the Government of India, the negative consequences of climate change result in an annual loss of $9–10 billion.

Control Measures

Three possible solutions to overcome Climate Change are

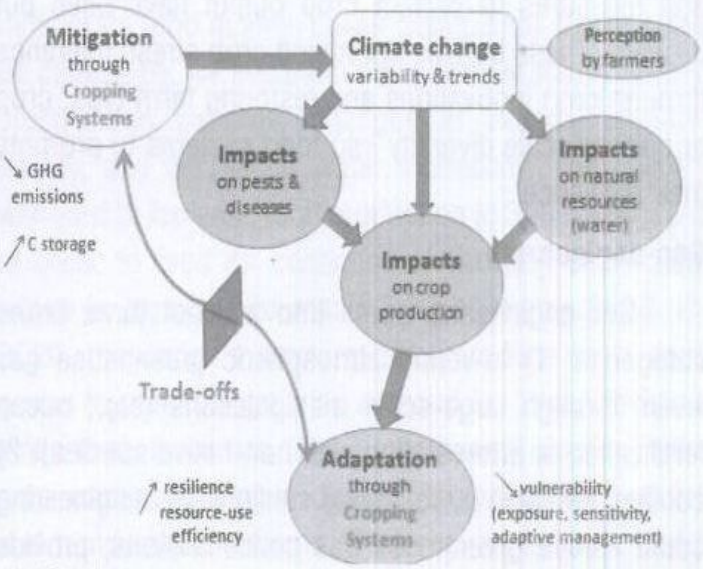
a) Mitigation b) Adaption c) Geo-engineering

Adapting to climate change: Indian agriculture Crop diversification, resource-conserving technologies (RCTs), enhanced pest management, better weather forecasts, crop insurance, modified crop management practices, improved water management, adoption of new farming methods, creation of cultivars tolerant to heat and salinity stresses and resistant to flood drought and exploitation of farmers' indigenous technical knowledge are some potential adaptation strategies to deal with the effects of climate change. Some of these strategies are discussed below.

- To preserve yield stability, new crop varieties with greater production potential and resistance to a range of stresses (drought, flood and salinity) will be developed.
- One of the goals of breeding programs should be to improve the germplasm of important crops for heat tolerance. Similarly, resistance to much abiotic stress as they arise in nature is crucial. Furthermore, it is critical to improve root effectiveness for soil water and nutrient uptake.
- The process of "gene pyramiding," which involves combining all advantageous traits in a plant to produce the "ideal plant type," which might also be a genotype that is "adverse environment tolerant," might be greatly aided by genetic engineering.
- For effective climate change adaptation, natural resources like water must be used wisely. With increasing temperatures and changing precipitation patterns, water will become even more restricted.
- It is important to promote crop-based irrigation planning, micro-irrigation technologies and on-farm water saving measures. Improved soil-water management could make use of ideas like increasing water infiltration through better soil aggregation, reducing runoff through the use of contours, ridges and vegetative hedges and lowering soil evaporation through the use of crop residue mulch.

However, adoption of such strategies would very probably necessitate spending on agricultural extension and capacity building. In water-stressed areas, rainwater collection can aid and meet water demand. By implementing more efficient irrigation techniques, such as drip irrigation and sprinkler irrigation, as well as laser-assisted ground leveling, the efficiency of water use can also be enhanced. It encourages consistency in the planting of seeds, seedlings and fertilizer, which inturn encourages strong plant stands, increased nutrient consumption effectiveness and higher output.

Figure 1: Climate change mitigation strategy



Mitigation:

Climate change mitigation refers to efforts that reduce greenhouse gas (GHG) emissions or increase the ability of carbon sinks to absorb GHGs from the atmosphere. Carbon emissions can be reduced by a combination of a) energy conservation and enhanced energy efficiency, b) the adoption of low-carbon energy technology and c) the enhancement of carbon sinks.

Adaptation:

The goal of adaptation to global warming is to reduce the susceptibility of social and biological systems to current climate change and so lessen its effects. Climate change adaptation can be planned, either in anticipation or in response to it, that is, uninvolved with government. According to the IPCC Working Group II, a

strategy for combating global warming should include both adaptation and mitigation. Through experiments, the yield responses of several crops to diverse environments have been clearly established. Identifying the most efficient adaptation strategies might be aided by quantifying these reactions and determining out when agriculture is most susceptible to stress. It is predicted that future output losses will be decreased by crop-level adaptation to climate change, which may entail altering crop cultivars, sowing dates, cultivation techniques and irrigation strategies. Crop production is threatened in some ways by climate change and extreme weather, and measures to protect crop output have been put forward. These include improving crop stress tolerance through crop innovations and restoring farm type, crop or cultivar scale diversity into food systems to promote their resilience.

Geo-engineering

Geo-engineering come into at least three broad categories: 1) lowering atmospheric greenhouse gas levels through large-scale manipulations (e.g., ocean fertilization or afforestation with non-native species); 2) cooling the Earth by reflecting sunlight. Geoengineering could reduce greenhouse gas concentrations, provide choices for mitigating specific climatic consequences, or serve as a last resort if other methods fail to prevent rapid, catastrophic or otherwise unacceptable climate-change impacts. However, research to far have not determined whether large-scale geoengineering procedures would provide the significant benefits or those benefits would exceed the drawbacks significant. Indeed, geoengineering should be approached with caution because changing the Earth system has the potential to have negative and unanticipated consequences. Techniques that remove CO2 straight from the air might have global benefits but could have negative local consequences. Reflecting sunlight would certainly lower the average temperature of the Earth, but it would also alter global circulation patterns, which could have major effects such as shifting storm courses and precipitation patterns. Reflecting sunlight, like accidenta human-caused climate change, would almost probabl have different effects for different governments an peoples, creating legal, ethical, diplomatic and nationa security challenges.

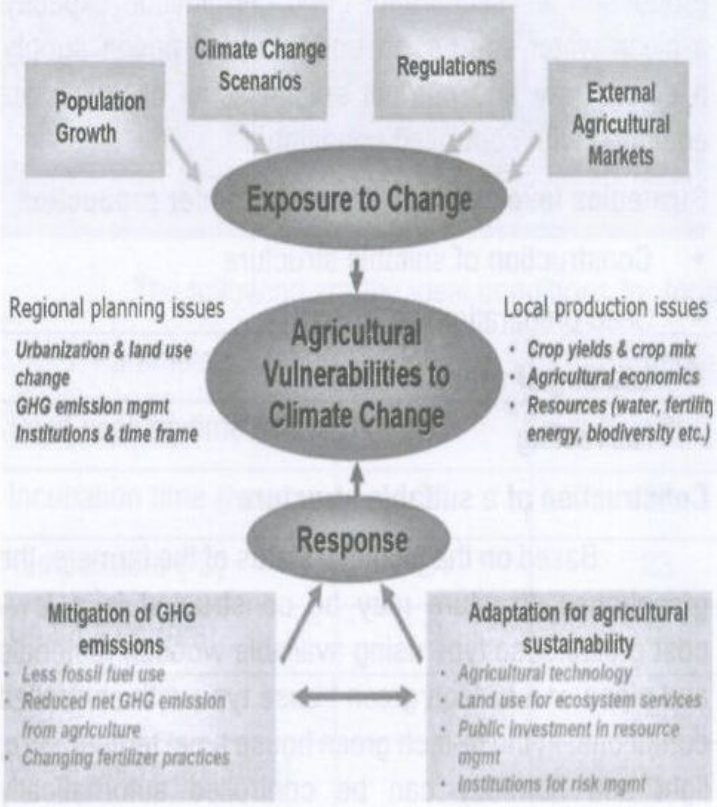
Aerobic Rice Cultivation

Aerobic rice is a novel form of rice that grow in aerobic soil and responds to input. It grows well i nonpuddled and nonsaturated soils with 70% to 100% water-holding capacity throughout the growth season Aerobic rice is a rice variety that combines the drough endurance of upland rice with the yield potential o lowland rice. As a result, aerobic rice has "increase upland rice" yield potential and "enhanced lowland rice drought tolerance. Aerobic rice types may maintain rapi development in soils with moisture content at or belov field capacity, producing yields of 4-6 t/ha with a minima fertilizer application under such soil water conditions. I comparison to lowland rice, aerobic rice can save up t 50% of irrigation water. Aerobic rice is grown in well drained, non-puddled and non-saturated soils with n ponded water. Rice is grown in aerobic soil with the us of external inputs such as supplemental irrigation an fertilizers, with the goal of producing large yields. Th main driving force behind aerobic rice is the efficien use of water. Growing rice like an irrigated upland crop such as wheat or maize, is a fundamental technique t reduce water inputs. Aerobic rice emits 80-85% les methane gas into the atmosphere, helps to protec the environment. Land preparation, no transplantin costs, seed costs and labor costs all contribute to cos savings. In the face of global warming, sustainabl rice production methods are needed to solve wate constraint and environmental safety.

Strategic Knowledge

- According to the current climate assessment an climate risk in Tamil Nadu shows, the bigges limiting factor for crop production is dryne during the crop growing season.

- Rainfall is influenced at the regional level by global climatic forces such as ENSO. Weak El-Nino years (SOI between -5.5 and -10) demonstrated a favorable link with rainfall in Tamil Nadu. At the scale of river basins, EN-Nino/Southern Oscillation (ENSO) affects hydrology as well as rice and other agricultural productivity. This behavior may be helpful for predicting rice crop productivity in a variety of ENSO scenarios and it may also aid in policymakers' decisions regarding water allocation and import or export regulations.
- Due to climate change, paddy irrigation water needs in Tamil Nadu's Cauvery delta region increased by 8 and 14%, respectively in the middle and end of the century.
- Increases in temperature showed a more negative impact on C3 (rice) plants than on C4 (maize) plants.
- System of Rice Intensification (SRI) would aid in maintaining rice harvests in the face of shifting environmental conditions. The SRI method of growing rice results in water savings of about 20% and yield increases of up to 22%.



Conclusion

Because more than half of the population works in agriculture, it is crucial to India's overall economic and social well-being. As a result, several variables, including global warming, rapidly increasing atmospheric levels of carbon dioxide and other GHGs and the area dedicated to the production of food grains, directly affect the nation's agricultural systems. Climate change has the potential to affect access to food, reduce food availability and deteriorate food quality. Lower agricultural output could be caused by, for instance, rising temperatures, altered precipitation patterns, changes in extreme weather events, and decreased water availability. The country will need to increase food production to 300 million tons in order to feed its continuously growing population, which is expected to reach 1.30 billion by 2020. By 2020, the nation's farmers must produce more food grains to meet the growing demand for food. However, since then, there has been a continuous decline in the area under cultivation due to fluctuations in rainfall and temperature patterns. Evidently, as the area under cultivation has shrunk, so have overall production and productivity, demonstrating that the crop season's agricultural cultivation has been significantly impacted by climate change. Along with the variation in the area under cultivation, production and productivity also vary. This shows that even while secure irrigation systems have lessened Rabi crops' vulnerability to climate change, Rabi crops are still affected by climate change.

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