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IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

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INTRODUCTION

Climatic change is any significant alteration to the climate system that occurs over a decade or more. Simply said, large modifications to the temperature, wind, or precipitation patterns that take place over decades are considered climate change. Weather and climate have a huge impact on agricultural production. As our climate continues to change and its effects become more frequent and severe, farmers and agricultural communities around the world will confront greater problems. Crops fail and meadows turn bare in the absence of sufficient rainfall and suitable temperatures. The earth's temperature is increasing as a result of the unchecked growth of greenhouse gas emissions. Because of glaciers melting, more frequent extreme weather events, and other factors, the seasons are changing. The speeding up of climate change, the increase in world population, and economic expansion all pose threats to food security. Because of climate change, agriculture is in significant danger. On the whole, rising temperatures encourage the growth of weeds and pests while decreasing the agricultural yields of targeted crops. The probability of both short-term crop failures and long-term production decreases increases with changes in precipitation patterns. Even while some crops will benefit in certain parts of the world, the overall effects of climate change on agriculture are anticipated to be negative, endangering the security of the world's food supply. Those in underdeveloped countries who are already vulnerable and experiencing food insecurity will probably suffer the most.Farmers may control a number of physical, chemical, and biological processes that take place between the Earth's surface and the atmosphere and that have a variety of effects on air temperature and precipitation by managing croplands and pastures. For this reason, a variety of models are used to estimate the potential effects of climate change in order to take into consideration various future scenarios. There is more trust in the predictions of future climate effect when numerous climate models produce similar results.

CHANGE IN CLIMATE

Future climate change is expected to increase the frequency of heat waves, which will make agriculture increasingly difficult. Heat waves can cause both plants and animals to experience heat stress, which is detrimental to the amount of food that is produced. When the plants are in the blossoming stage, which is a single, crucial moment, extreme heat waves can result in no seeds at all, which is detrimental to

agricultural productivity. Heat stress can cause animals to lose their fertility and productivity. Additionally, it can harm their immune systems and make them more susceptible to infections in general. Along with temperature increases and heat waves, significant changes in rainfall patterns are also anticipated as part of the projected changes in climate. Future droughts are expected to occur more regularly in some areas, while other areas are expected to see more intense downpours and flooding. As a result of rising sea levels, coastal areas may completely lose their agricultural land. Warmer climates could lead to an increase in disease and insect problems, as well as changes in the geographic distribution of some pests. Insects that operate as disease-transmission vectors, for instance, are predicted to travel more polarly in the future, although sheep have not yet been exposed to these diseases.

HOW CLIMATE CHANGE IS AFFECTING AGRICULTURE?

The effects of climate change on agriculture could take many different forms:

After China and the United States, India is the third-largest emitter of greenhouse gases.The International Energy Agency reported that India released 2,299 million tonnes of carbon dioxide (CO2) in 2018.This makes up 7% of the world's GHG emissions.18% of the total emissions across the country come from agriculture and animals.According to a research by the International Maize and Wheat Improvement Centre (CIMMYT), India has the potential to reduce the sector's yearly greenhouse gas emissions by 18%.According to the study, these three actions would be sufficient to offset this drop by 50%:

a. usage of fertiliser effectively
b. implementing zero-tillage
c. control over the water used to irrigate rice fields.

Above a certain temperature range, warming tends to reduce yields because crops mature more quickly and produce less grain as a result. Additionally, plants' ability to absorb and use rainwater is hampered by rising temperatures. Plants lose more moisture from their leaves through transpiration when temperatures rise, hastening soil evaporation. Evapotranspiration is the term used to describe the end result. Due to the expectation that global warming would result in more rainfall, the overall impact of rising temperatures on water availability will be a race between increased evapotranspiration and increased precipitation. Usually, the competition is won by the higher evapotranspiration.

IMPACTS ON CROPS:

According to the Indian Council of Agricultural Research's (ICAR) vulnerability assessment, the overall productivity of rice, irrigated rice, wheat, and maize could decline between 2050 and 2080. Major crops' production will only slightly decline in the coming years, but if farming doesn't adjust to climatic changes brought on by climate change, that productivity decline might reach 10–40% by 2100.Over time, yields of important crops like wheat, rice, oilseeds, pulses, fruits, and vegetables will decline.It might make India a significant importer of pulses, milk, and oilseeds.To compensate for yield changes, adaptation to climate change will require new cropping patterns and appropriate inputs. The country's food security is at jeopardy due to Indian agriculture's vulnerability to the whims of

climate change and the bulk of Indian farmers' limited capacity for adaptation.

Crop productivity may be affected by higher CO2 levels. Some laboratory research suggests that increasing CO2 levels may promote plant growth. But other factors like ozone, water, nutrient scarcity, and temperature fluctuations might prevent these potential yield improvements. For instance, if a crop is subjected to temperatures outside of their typical range or if enough water and nutrients are not available, yield increases may be reduced or stopped. Lower protein and nitrogen levels in alfalfa and soybean plants have been associated with elevated CO2, which results in a loss in quality.

More severe temperatures and precipitation may hinder crop growth. Extreme weather, especially droughts and floods, can harm crops and reduce yields.

In locations where drier soils are caused by warmer summer temperatures, managing drought may be challenging. In certain places, increasing irrigation would be feasible, but in other places, water resources might be constrained, leaving less water available for irrigation when more is needed.

Even though more CO2 can encourage plant growth, it also reduces the nutritional value of most food crops. Due to increased atmospheric carbon dioxide levels, the majority of plant species, including wheat, soybeans, and rice, have reduced protein and essential mineral concentrations. Health risks may result from the direct effects of increased CO2 levels on agricultural nutrition. An additional issue with increased pesticide use is that it puts human health at risk due to rising insect pressures and deteriorating pesticide efficacy.

IMPACTS ON LIVESTOCK:

With livestock making up 40% of the agricultural GDP, developing nations' agricultural sectors rely heavily on it. The majority of the world's land area, about 45%, is used for livestock production, much of it in unfavourable conditions that are unsuitable for other uses. The quantity and quality of products, the consistency of production, and the natural resource basis on which livestock production depends can all be impacted by climate change. Agriculture productivity is significantly influenced by the environment, and climate change is predicted to have a negative impact on systems for raising cattle.

As a result of climate change, heat waves are predicted to occur more frequently and could pose a major threat to cattle. A drought might jeopardise pasture and feed supplies. Drought reduces the amount of high-quality feed that is available to grazing livestock. A longer and more severe drought may occur in some areas due to hotter summers and less precipitation. Drought-related changes in agricultural output may also have an impact on animals that rely on grains.

Climate change may increase the frequency of ailments and parasites that affect animals. Some parasites and diseases may find it easier to survive due to warmer winters and an earlier spring. Increased precipitation might promote the development of diseases that need moisture.

Potential changes in veterinary practises, such as an increase in the use of parasiticides and other therapies for animal health, are anticipated to be implemented to preserve livestock health in response to shifts in pests, parasites, and microbes brought on by climate change. By increasing the possibility that pesticides will reach the food chain or promoting the evolution of pesticide resistance, this may have an effect on the safety, distribution, and consumption of livestock and aquaculture products.

IMPACTS ON FISHERIES:

Overfishing and water pollution are just two of the several challenges that many fisheries already experience. These strains could get harsher due to climate change. Changes in temperature, in particular, could have a big effect.Many aquatic species can migrate northward along the coast or in the ocean, or they can find cooler areas like streams and lakes. However, relocating to new places could put these animals in conflict with other species for resources like food and water.

A few outbreaks of marine diseases have been connected to climatic change. An oyster parasite has been able to spread farther north along the Atlantic coast due to warmer ocean temperatures and greater estuarine salinities.

The timing of reproduction and migration might be impacted by seasonal and temperature changes. Temperature and seasonal changes influence numerous stages of an aquatic animal's lifetime.

The world's oceans are gradually getting more acidic as a result of increases in atmospheric carbon dioxide, in addition to warming (CO2). By weakening their shells, which are made by extracting calcium from seawater, shellfish could suffer from increased acidity. Additionally, the architecture of delicate ecosystems, which some fish and shellfish rely on, are at danger due to acidification.

WHAT STEPS CAN BE TAKEN

Faster adoption will be made possible by a combination of tools and methods for capacity building, field demonstration, extension, and outreach.

Low External Input Systems: To transition our current agricultural production systems from an input-intensive regime to low external input systems, it is necessary to interact with farmers and first present them with alternative techniques before persuading them to adopt them.

As a sustainable substitute for chemical farming, ideas like Low External Input Sustainable Agriculture (LEISA) are gaining more attention.

ZBNF (Zero Budget Natural Farming): It encourages farmers to use inexpensive locally available input and should be promoted to minimise the usage of chemical pesticides and fertilisers.

Small and marginal farmers should be persuaded to switch to alternative packages of practises, their efficacy should be shown, and they should be encouraged to cooperate with Krishi Vigyan Kendras to broaden their reach.

CONCLUSION

Farmers and farming communities around the world will face additional difficulties as our climate continues to change and its effects become more frequent and severe.Accounting for agriculture's carbon footprint is essential, especially if agriculture is included in promises to reduce greenhouse gas emissions. Agriculture is one of the few industries that can both mitigate and sequester carbon emissions. However, there are still issues with the range and variability of estimates as well as the difficulty and unpredictability of accounting for indirect land use change.The ability of agriculture to adapt to climate change will be improved through the use of policies, which will also advance other environmental objectives.All industries will need to contribute to mitigation and adaptation measures in the fight against climate change.By improving the knowledge and abilities of our farmers, it will be possible for agrarian nations to raise productivity without increasing the environmental impact of agriculture.