



Changing Climate Scenario and Impact on Agricultural and Horticultural Crops Ecosystem

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Abstract

Climate is the long term weather pattern in a region, typically arranged over 30 years. It is the mean and variability of meteorological variables over a time spanning from months to millions of years. Some of the commonly measured meteorological variables are temperature, humidity, atmospheric pressure, wind and precipitation. The climate of a location is affected by its latitude, longitude, terrain, altitude, land use and nearby water bodies. Climate can be classified into temperature and precipitation. Since 1948, Thornthwaite system incorporates evapotranspiration along with temperature and precipitation. Paleoclimatology is the study of ancient climates. There is a huge difference between climate and weather. Climate is what you expect and weather is what you get. Climate change is the variation in global or regional climates over time. It reflects the change in variability or average state of the atmosphere over time scales. Climate change brings both challenges and opportunities to agriculture for sustaining food and energy supplies while protecting and maintaining the environment and natural resources essential for global food production. The change in climate affects both agricultural and horticultural crops. The agricultural crops enriches humans with abundant carbohydrate, proteins, fat, vitamins and minerals. Similarly horticultural crops provides necessary protein, fibre and essential amino acids to human beings. The increasing world population is putting stress on rising demands for crop production. By 2050, global agricultural production need to be doubled to meet the increasing demands. For food security, increasing crop yield rather than clearing more land for food production is the sustainable way. Evidences from the agricultural researchers indicates that climate variability matters as much to crop production during the crop season. Climate projections have also continued to predict increasing atmospheric carbon dioxide and water vapour along with changes in surface temperature and rainfall patterns. The most imminent climatic changes is an increase in atmospheric temperatures resulting from increased levels of green house gases such as carbon dioxide, methane, ozone, nitrous oxide and chloro fluoro carbons. Because of the increasing concentrations of those radiating or green house gases, there is much concern about future changes in our climate and their direct or indirect effects on agriculture.

Keywords: Climate change, agricultural crops, horticultural crops and temperature.

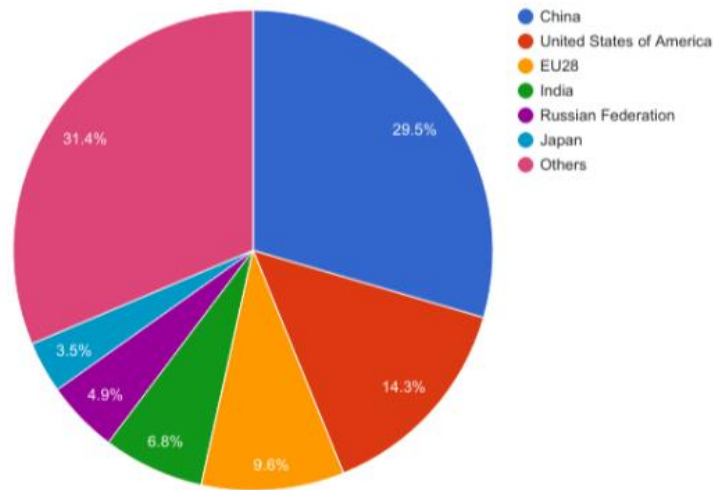
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I. Introduction:

The global warming is nothing but heating of surface atmosphere due to emission of green house gases, thereby increasing global atmospheric temperature over a long period of time. Such changes in surface air temperature and consequent adverse impact on rainfall over a long period of time are known as climate change. There are more significant extreme weather events that will reduce crop yields. Heavy rain, hail storms and flooding can physically damage crops. Extremely wet conditions in the field can delay planting or harvesting. The International Food Policy Research Institutes (IFPRI) Global Food Policy 2022 report has warned that

climate change may push 90 million Indians towards hunger by 2030. It has listed a decline in agricultural production and disruption in the food supply chain, reason for future crisis. The climate change refers to the shift in temperature and weather pattern, mainly caused by human activities, especially the burning of fossil fuels. Drought can harm food production and human health. Flooding can lead to disease spread and damages to ecosystems and infrastructure. Human health issues can increase mortality, impact food availability and limit worker productivity.



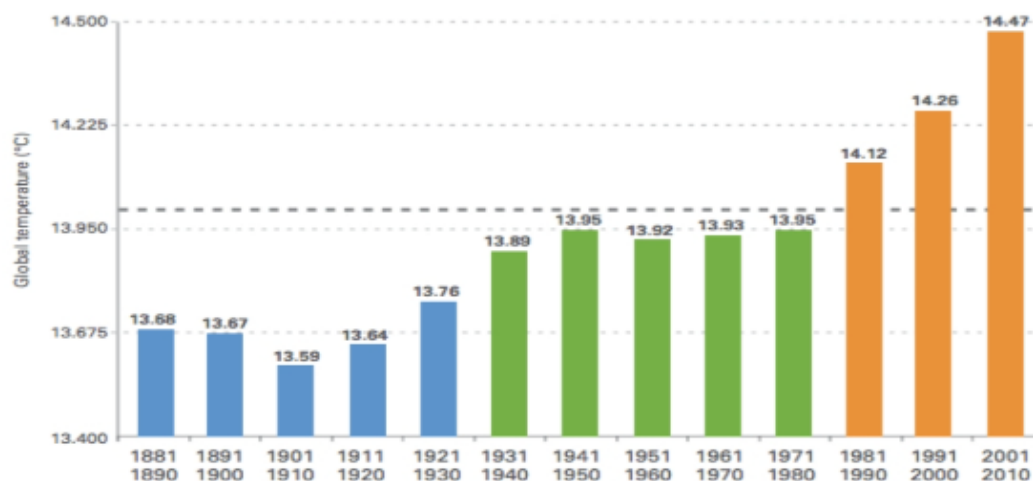
Climate Change:

Climate change refers to any significant change in the measure of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, wind patterns among other effects that occur several decades or longer.



CLIMATE CHANGE IS AFFECTED BY MANY FACTORS:

ABIOTIC FACTORS	BIOTIC FACTORS
1.Ocean Currents	1.Transpiration
2.Solar Radiation	2.Respiration
3.Evaporation	3.Photosynthesis
4.Volcanic Activity	4.Decomposition



Observed Climate Change During The Past Century:

The Intergovernmental Panel on Climate Change (IPCC) reported that each of the past three decades has been successively warmer at the earth's surface than any preceding decade since 1850. The period from 1983 to 2012 was likely the warmest 30 year period of the last 1400 years in the Northern Hemisphere, where such an assessment is possible. The rate of the rise in sea level since the mid 19th century has been larger than the mean rate during the previous two millennia. Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in the number of regions.

Soil Ecology And Plant –Microbe Interactions Under Changing Climate:

The plants and associated microbial interactions are critical factors affecting the growth, survival, yield and nutritional quality of agricultural crops. Although it is believed that rising atmospheric CO₂ concentrations will have a fertilization effect on plants and will enhance the litter turnover and root exudation rate in plants.

Projected Impact Of Climatic Changes On Crop Production:

Climate change is projected to undermine food security. Because of projected climate change by the mid-21st century and beyond for wheat, rice and maize in tropical and temperate regions, climate change without adaptation is projected to affect production negatively for local temperatures increases of 2°C or more above late 20th century levels, although individual locations may benefit. Global temperature increases of about 4°C combined with increasing food demand would pose larger risks to food security globally.

RISING TEMPERATURES:

Changes in temperature and weather patterns will alter areas suitable for farming. The current prediction is that temperatures will increase and precipitation will decrease in arid and semi-arid regions. Crop yields in tropical regions will be negatively affected by the projected moderate increase in temperature expected to occur during the first half of the century. During the second half of the century, further warming is projected to decrease crop yields in all regions including Canada and Northern United States. Many staple crops are extremely sensitive to heat and when temperatures rise over 36°C, soybean seedlings are killed and corn pollen loses its vitality. However, higher winter temperatures and more frost-free days in some regions would result in longer growing seasons.

Example: In 2014, a study found that in Maize, the yields increased between 7 and 17% per decade as a result of higher temperatures in Heilongjiang region of China.

Heat Waves:

In the summer of 2018, heat waves probably linked to climate change greatly reduced average yield in many parts of the world, especially Europe. During the month of August, more crop failures resulted in a rise in global food prices.



Changes In Rainfall:

Droughts and floods contribute to reduction in crop yield. As extreme weather events become more common and more intense, floods and droughts can destroy crops and eliminate food supply, while disrupting agricultural activities and rendering workers jobless. Drought in developing countries exacerbates pre-existing poverty and leads to famine and malnutrition.

HIGHER CROP, GRASS AND FORESTRY YIELDS DUE TO CO₂ FERTILIZATION:

Elevated CO₂ increases crop yields on growth through an increase in photosynthetic rate and decreases water loss as a result of stomatal closing. The CO₂ fertilization effect causes an increase in the rate of photosynthesis while limiting leaf transpiration in plants. This effect varies depending on plant species, air temperature, soil temperature and availability of water and nutrients.

Impact Of Climate Change On Agricultural Crops:

Greater loss expected in rabi. Every 1°C increase in temperature reduces wheat production by 4-5 million tons. Loss only 1-2 million tons if farmers could plant in time. Reduced frequency of frost damage to potato, peas, mustard. Increased droughts and floods are likely to increase production variability. Cereal productivity to decrease by 10-40% by 2100. Increasing temperature would increase fertilizer requirement for the same production targets and result in higher emissions. Increasing sea and river water temperatures are likely to affect fish breeding, migration and harvests. Coral reefs start declining from 2030. Increased water, shelter and energy requirement for livestock, implications for milk production.

Adaptations To Climate Change:

- New varieties: drought/heat resistant
- New farm management practices
- Change in land use
- Watershed Management
- Agri – insurance
- Together is strength. Every individual should involve in resolving the problems associated with climate change
- Reduce emissions of green house gases
- Attempt to develop alternative energies
- Allow emission to continue but prepare for global climate change
- Integrate crop-livestock fishery systems
- Rehabilitate degraded pastures
- Plant agroforestry systems
- Pursue sustainable forestry

HORTICULTURAL CROPS:

Fruits and vegetables are also rich source of vitamins, minerals, proteins, carbohydrates etc which are essential in human nutrition. Hence these are referred to as protective food and assumed great importance in nutritional security of the people. Thus cultivation of horticultural crops play a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people. For horticulture, two of the biggest concerns are related to be,

Scarcity of water for crop production

Potential for increased evapotranspiration

Effect Of Rising Temperature On Horticultural Crops:

1. The production and quality of fresh fruit and vegetable crops can be directly and indirectly affected by high temperatures and exposure to elevated levels of CO₂ and ozone. High temperature affects photosynthesis directly causing alteration in sugars, organic acids and flavonoids contents, firmness and antioxidant activity.
2. Production timing is likely to change. Because of rise in temperature, crops will develop more rapidly and mature earlier. For example- citrus, grape, melons and mangoes will mature earlier by about 15 days.
3. Photosensitive crops such as onions are likely to mature faster leading to small bulb size. Strawberries will have more runners at the expense of fruits.
4. Pollinations will be affected adversely because of higher temperature. Floral aberrations, flower and fruit drop will be occurred frequently.
5. Higher temperature will reduce tuber initiation process in potato, reduced quality in tomatoes because of tip burn and blossom end rot and lead to poor pollination in many crops. In crucifers, it leads to bolting. The requirement of annual irrigation will increase annually. Skin colour disorder of grapes and apples will arise due to high temperature.

Impact Of Climate Change On Interactions Of Pollinators And Onset Of Flowering:

Phenological responses to climate warming may therefore occur at parallel magnitudes in plants and pollinators, although considerable variation in responses across species should be expected. Climate warming may generate temporal mismatches among the mutualistic partners.

Impact Of Climate Change On Quality Of Fruit Crops:

Quality of fruits is hampered by the change in climate due to rise in temperature and precipitation, the size of fruits is reduced considerably and the fruits ripe before the maturity resulting in improper colour of fruits.

Effect Of Climate Change On Chilling Requirements:

The deciduous fruit trees lose their leaves and enter a dormant state in order to survive winter. To end dormancy, bloom and set fruit they require a certain amount of winter cold followed by a certain amount of heat.

Impact Of Co₂ On Horticultural Crops:

The experiments conducted by growing citrus fruit under a CO₂ enriched environment shows a large and sustained increase in the number of fruit produced by orange trees, a small increase in the size of the fruits and vitamin C concentration of the fruit.

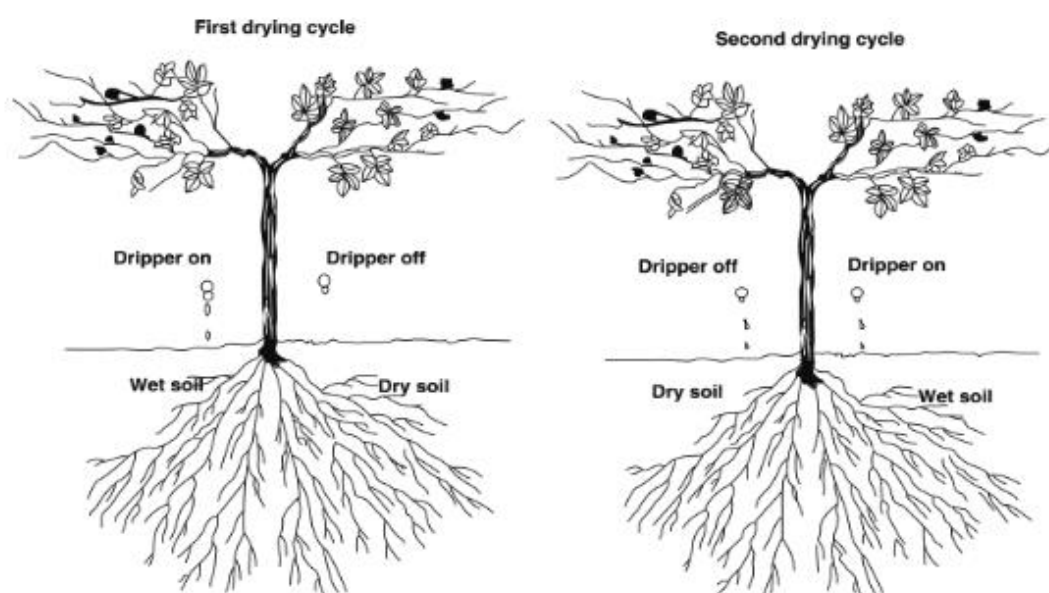
Adaptation To Climate Change:

Development of adverse climate tolerant varieties may take more time but already known agronomic adaptations, crop management and input management practices can be used to reduce the climate related negative impacts on crop growth and production. Some of the simple but effective adaptations strategies include change in the sowing date, use of efficient technologies drip irrigation, soil and moisture conservation measures, fertilizer management through fertigation, change of crops, increase in input efficiency, pre and post harvest management of economic produce can not only minimize the losses but also increase the positive impacts of climate change.

Weather based agro – advisory, input delivery system, development of new land use patterns, community storage facilities for perishable produce of vegetable crops. Annual crops where the adaptation strategies can be realized relatively fast using wide range of cultivars and species, changing planting dates, the rearrangement of orchards requires a consideration of the more long term investments.

Selection of suitable varieties, certain morphological and physiological adaptations have endowed many fruit crops with the capacity to withstand adverse effects of water stress. Pineapple being a CAM plant has remarkable adaptability to different climatic regimes and it has high water use efficiency. In addition to drip irrigation and mulching for production of fruit crops under water limiting conditions, novel irrigation methods, like Partial Root Zone drying (PRO) could be adapted.

Indianraj N and Kumar E (2022) concluded that Climate change alters agricultural production and food systems, and thus the approach to transforming agricultural systems to support global food security and poverty reduction, And Improving food protection by moderate climate change, sustainably use the natural resource, use all products more competently, have less inconsistency and greater constancy in their outputs.



II. CONCLUSION:

Climate change pose a great threat to sustainable development. the expected effects of climate change could seriously compromise the ability of the agriculture sectors to feed the world, and severely undermine progress toward eradicating hunger, malnutrition and poverty. if we cannot able to prevent this condition, then the world will suffer from starvation, hunger etc. so every human bring in this world is responsible of making his or her place hygienic, protecting the environment from harmful conditions.

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