

A Review on Climate Change and its Impact on Agriculture of Tamilnadu, India

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Abstract

This paper reviews various articles and documents on relationship between climate change and agriculture. The two-way relationship of climate change and agriculture is of great significance in particular to developing countries due to their large dependence on agricultural practice for livelihoods and their lack of infrastructure for adaptation when compared to developed countries. Agricultural activities are affected by climate change affects due to their direct dependence on climatic factors. In high latitude areas with low temperature, increased temperature due to climate change could allow for longer growing season. Agriculture affects climate through emissions of greenhouse gases (GHGs) such as carbon dioxide, methane and nitrous oxide. These emissions come directly from use of fossil fuels, tillage practices, fertilized agricultural soils and livestock manure in large proportion. Conversely, agriculture could be a solution for climate change by the widespread adoption of mitigation and adaptation actions. This happens with the help of best management practices such as organic farming, agroforestry practice and manure management etc. Keywords: Climate Change, Agriculture, crop pattern, greenhouse effect, impact.

1. Introduction

Climate change is any significant long-term change in the expected patterns of average weather of region (or the whole Earth) over a significant period of time. It is about non-normal variations to the climate, and the effects of these variations on other parts of the Earth. These changes may take tens, hundreds or perhaps millions of year. But increased in anthropogenic activities such as industrialization, urbanization, deforestation, agriculture, change in land use pattern etc. leads to emission of green house gases due to which the rate of climate change is much faster. Climate change scenarios include higher temperatures, changes in precipitation, and higher atmospheric CO₂ concentrations. There are three ways in which the Greenhouse Effect may be important for agriculture. First, increased atmospheric CO₂ concentrations can have a direct effect on the growth rate of crop plants and weeds. Secondly, CO₂-induced changes of climate may alter levels of temperature, rainfall and sunshine that can influence plant and animal productivity. Finally, rises in sea level may lead to loss of farmland by inundation and increasing salinity of groundwater in coastal areas.

The greenhouse effect is a natural process that plays a major part in shaping the earth's climate. It produces the relatively warm and hospitable environment near the earth's surface where humans and other life-forms have been able to develop and prosper. However, the increased level of greenhouse gases (GHGs) (carbon dioxide (CO₂), water vapor (H₂O), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) etc) due to anthropogenic activities has contributed to an overall increase of the earth's temperature, leading to a global warming. The average global surface temperature have increased by 0.74°C since the late 19th Century and is expected to increase by 1.4°C-5.8°C by 2100 AD with significant regional variations (IPCC, 2007). The atmospheric CO₂ concentration has increased from 280 ppm to 395 ppm, CH₄ concentration increased from 715 ppb to 1882 ppb and N₂O concentration from 227 ppb to 323 ppb from the year 1750 and 2012. The Global Warming Potential (GWP) of these gases i.e, CO₂, CH₄ and N₂O are 1, 25 and 310 respectively.

2.Litratre Review

Burton et al (2007) adaptive capacity is the potential or ability of a system, region or community to adapt to the impacts of climate change. Other scholars defined adaptation in terms of the actions or strategies that households and communities undertake to enhance resilience of vulnerable systems and reduce climate change associated damages in order to meet their livelihood needs.

Kimball (1983)discussed the higher CO₂ concentrations may also reduce transpiration (i.e. water loss) as plants reduce their stomatal apertures, the small openings in the leaves through which CO₂ and water vapor are exchanged with the atmosphere. The reduction in transpiration could be 30% in some crop plants.

3.Data and Methodology

Tamil Nadu state is classified into seven distinct agro-climatic zones, namely North Eastern Zone, North Western Zone, Western Zone, Cauvery Delta Zone, Southern Zone, High Rainfall Zone, Hilly Zone based on rainfall distribution, irrigation pattern, soil characteristics, cropping pattern and other ecological, social and physical status. The trends in temperature and precipitation in these seven zones were studied with 30-year data, from 2010-11 to 2019-20 by

estimating the linear trend and Mann-Kendall test and it was found that Western Zone had a significant climate variability in terms of temperature and precipitation. Hence, the Western Zone was selected to study the adaptation strategies of farm households with respect to climate variability. The Western Zone encompasses the districts of Coimbatore, Tiruppur, Erode, Dindigul, Theni and Karur. The farmers have access to weather-related information from the Automatic Weather Station (AWS) installed at each block. The farmers were selected at random around 1km from the Automatic Weather Station. From each district, five AWS were selected at random and from around the AWS, 90 technology adopters and 90 non-adopters were selected

at random, making a total of 180 sample farmers. An adoption index was constructed to identify the adopters and non-adopters of climate resilient technologies¹. The respondents were classified as adopters if the adoption index was 50 or above. The primary data on family composition, cropping pattern, income, cost of cultivation, farmer perception and technology adoption were collected through a wellstructured, pre-tested interview schedule.

4. Climate Change – Mitigation and Adaptation in Agriculture

- Assist farmers in coping with current climatic risks by providing value-added weather services to farmers. Farmers can adapt to climate changes to some degree by shifting planting dates, choosing varieties with different growth duration, or changing crop rotations.
- An Early warning system should be put in place to monitor changes in pest and disease outbreaks. The overall pest control strategy should be based on integrated pest management, because it takes care of multiple pests in a given climatic scenario.

- Participatory and formal plant breeding to develop climate-resilient crop varieties that can tolerate higher temperatures, drought and salinity.
- Developing short-duration crop varieties that can mature before the peak heat phase set in.
- Selecting genotype in crops that have a higher per day yield potential to counter yield loss from heat-induced reduction in growing periods.
- Preventive measures for drought that include on-farm reservoirs in medium lands, growing of pulses and oilseeds instead of rice in uplands, ridges and furrow system in cotton crops, growing of intercrops in place of pure crops in uplands, land grading and leveling, stabilization of field bunds by stone and grasses, graded line bunds, contour trenching for runoff collection, conservation furrows, mulching and more application of Farm yard manure (FYM).
- Efficient water use such as frequent but shallow irrigation, drip and sprinkler irrigation for high value crops, irrigation at critical stages.
- Efficient fertilizer use such as optimum fertilizer dose, split application of nitrogenous and potassium fertilizers, deep placement, use of neem, karanja products and other such nitrification inhibitors, liming of acid soils, use of micronutrients such as zinc and boron, use of sulphur in oilseed crops, integrated nutrient management.
- Seasonal weather forecasts could be used as a supportive measure to optimize planting and irrigation patterns.
- Provide greater coverage of weather linked agriculture-insurance.
- Intensify the food production system by improving the technology and input delivery system.
- Adopt resource conservation technologies such as no-tillage, laser land leveling, direct seeding of rice and crop diversification which will help in reducing in the global warming potential. Crop diversification can be done by growing non-paddy crops in rain fed uplands to perform better under prolonged soil moisture stress in kharif.
- Develop a long-term land use plan for ensuring food security and climatic resilience.
- National grid grain storages at the household/ community level to the district level must be established to ensure local food security and stabilize prices.
- Provide incentives to farmers for resource conservation and efficiency by providing credit to the farmers for transition to adaptation technologies.
- Provide technical, institutional and financial support for establishment of community banks of food, forage and seed.
- Provide more funds to strengthen research for enhancing adaptation and mitigation capacity of agriculture.

5. Conclusion

From this extensive review, it is concluded that globally, climate change has relationship with agriculture in one or another way. This relationship becomes strong in developing countries because their livelihood depends on agricultural activities and this activities mostly depend on climatic condition, For instance in Tamilnadu, almost all farm activity is rain fed. In relation, the impact of climate change is very serious in developing counties due to their limited adaptive capacity and lack of technology and also they are the main emitter of noncarbon GHGs from their cattle and farm management mainly from use of synesthetic fertilizers. Those are the main direct emitters. There are also indirect emitters such as land use change; from runoff and leaching of fertilizers; use of fossil fuels for mechanization; transport and agro-chemical and fertilizer production. On the other hand, by the help of the right farming practice agriculture could be the main solution for climate change by mitigation and adaptation response. Within the current and projected situation of climate change globally, only climate change mitigation is not enough so long term solution is important by combining climate change adaptation in agriculture sector. Such practices could be organic agriculture, manure management, agroforestry practice etc. Know a days, the significant relation of climate change and agriculture sector become well known. In recent years, even if the attention is not enough, the significant relation of climate change and agriculture sector becomes acknowledged.

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