



Effect of Climate Change on Mango Production in Murshidabad

District, West Bengal

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Abstract

One important and complicated issue affecting our planet is climate change. It describes long-term changes in Earth's climate, including changes in wind patterns, temperature, precipitation, hail, drought, and other factors. Human activities that release greenhouse gases into the atmosphere, including the burning of fossil fuels, deforestation, noxious vehicle fumes and industrial operations, are the main causes of these changes. One of the gases most responsible for global climate change is carbon dioxide (CO₂). Increasing world-wide temperatures, melting polar ice, increasing sea levels, unnatural weather events, ecosystem disruption, and threats to our biodiversity are only a few of the wide-ranging effects of climate change. Because tropical crops are still near their high-temperature optimum and therefore experience high-temperature stress at higher temperatures, tropical regions are generally more affected by climate change. The agriculture sector is also disrupted by the ongoing phenomenon of climate change, which affects seasonal fruits like mangoes. The mango tree is one of the most widely grown and valuable fruits in Murshidabad because of its huge nutritional and economic benefits. The traditional mango variety of Murshidabad in West Bengal, the Nawabs' ancestral homeland, is well known. But the continuous change in climate has had a huge negative impact on mango cultivation in Murshidabad and also in India, due to which mango farmers are currently living in worry. Since mangoes are sensitive to environmental changes, climate change can have a major impact on their production, as warm, tropical, dry, and rainy seasons are ideal for mango cultivation. To address the challenges presented by climate change and restore farmer prosperity, farmers and agricultural researchers are actively working to develop sustainable farming practices and mango varieties.

Keywords: Climate change, Mango farmers, Mango production, Murshidabad.

1. Introduction:

India's national fruit, the mango, is referred to as the "King of Fruits." Among the most significant and well-liked Asian fruits is this one. Each variety of mango has its own distinct flavour, texture, taste, and size. Indian history is firmly rooted in the cultivation of mangoes. Every stage of mango, from the unripe to the ripe stage, has economic aspects. Every component of the mango is used in some way. Mangoes are grown all around India, in backyards, beside field borders, and alongside roadsides, since they are a tropical fruit that grows well there. Farmers get maximum dividends by investing very little money. Mangoes are thought to have originated in Bangladesh, northwest Myanmar, and northeast India.

Later, with human assistance as well as on their own, they expanded across the rest of Asia (Department of Agriculture & Cooperation, 2013). From the beginning of time, they have been nurtured, honoured, and worshipped. West Bengal's major fruit crop, the mango, covers over 97.93 thousand hectares. This makes up about 60% of the entire area planted with fruits (Dutta et al., 2020). At the time of mango production, there is less demand for other crops in the field, so the trend of mango production is strong among the farmers. But in recent times, farmers have faced various losses due to climate change and various natural disturbances. Mango crop models are lacking, which makes it impossible to forecast how climate change will affect the growth and production of mango trees. All economic sectors are impacted by the climate's variability in a number of ways. For example, an anomaly in rainfall affects the intensity and frequency of floods. Murshidabad used to occupy a special place in mango production in West Bengal, but now its level is steadily declining. As a result, new farmers are losing enthusiasm for mango production. Mainly old farmers are enthusiastic about mango cultivation because their manual labour is less, and mango production does not require much physical labour, but the new generation is seen refraining from mango cultivation. Mango farmers have been facing recession every time because of various natural events that happened in the past few decades. All the mango farmers in Murshidabad are economically weak, and it is not possible for them to grow mangoes in a changing climate with modern technology. The types of mangoes famous in West Bengal and Murshidabad are: Bombai, Langra, Himsagar, Kishan Bhog etc.

2. Objectives:

- I. To highlight the effects of climate change on mango production.
- II. To analyse the marketing issues related to Murshidabad District's mango farming.
- III. To provide appropriate recommendations for enhancing the Murshidabad District's mango production.

3. Database and Methodology:

• 3.1 Sources of data:

The majority of the data sources are secondary material that has been gathered from various publications, reports, journals, articles, official documents, edited journals, and a few reliable websites.

• 3.2 Methods and Techniques:

In order to produce this paper, the methodology used was secondary data collection. This paper incorporates a geographical representation of the statistical data together with data from government publications, surveys, and statistics.

4. Study Area:

The study area for this research is the central region of West Bengal, specifically the Murshidabad District, which is made up of 26 C.D. blocks and 7 statutory towns. The district has a total of 2166 villages, 254 gramme panchayats, and 65 census towns. The district is bordered to the north by the Malda District, to the south by the East Bardhaman and Nadia Districts, to the east by Bangladesh, and to the west by the Jharkhand State and Birbhum District. The district is situated along the western bank of the Bhagirathi River. Murshidabad lies approximately in the region between longitudes 87°49'E and 88°44'E and latitudes 23°43'N and 44°52'N. 5316.11 square kilometres make up the entire region (Census of India, 2011).

5. Climate change and Mango Production in Murshidabad:

Climate change has significantly reduced mango productivity. Climate change is increasingly being seen as a reality. Analysing and presenting the anticipated effects of climate change on mango cultivation across the nation will be a laborious task. Irregular weather conditions adversely affect almost every stage of the mango, from the bud stage to the ripe stage. Farmers must be made aware of climate change impacts, variability, and crop productivity as well as available coping mechanisms. All aspects of mango cultivation affected by climate change are discussed below.

5.1 Climate-Related Effects on Mango Trees' Photosynthesis:

Temperature, light, and CO₂ are essential for photosynthesis. This process of photosynthesis also organises the physiological structure of the plant. On the other hand, rising temperatures and CO₂ concentrations have the opposite effect. Increases plant photosynthesis absorption and causes respiratory failure. Photosynthesis is also adversely affected by drought and Vapor Pressure Deficit (VAD), which cause rapid stomatal closure. Mango photosynthesis is likely to be negatively affected by both drought and flooding, as it increases rapidly in response to variations in rainfall. After flooding, respiration, stomatal conductance, and maximal photosynthetic assimilation are drastically reduced. Due to a gradual increase in temperature, mango leaves and buds fall off, and due to excessive sunlight, it directly affects the photosynthesis process.

5.2 Effect on growth of mango tree:

Mango vegetative growth is also impacted by meteorological factors. The temperature of the soil is strongly impacted by the surrounding air and has a direct impact on the vegetative and reproductive growth of mangos. Under rising CO₂ concentrations, the roots would receive more dry matter. Both flooding and drought have a detrimental influence on the vegetative growth of mango plants by slowing down tree growth. Inundated mango trees have a short lifespan of a few days if they can last more than eight months without rain or irrigation. (Normand et al., 2015). Due to extreme drought and low rainfall, both mango yield and tree growth are declining. In many cases various diseases can be seen and attacked by insects on mangoes.

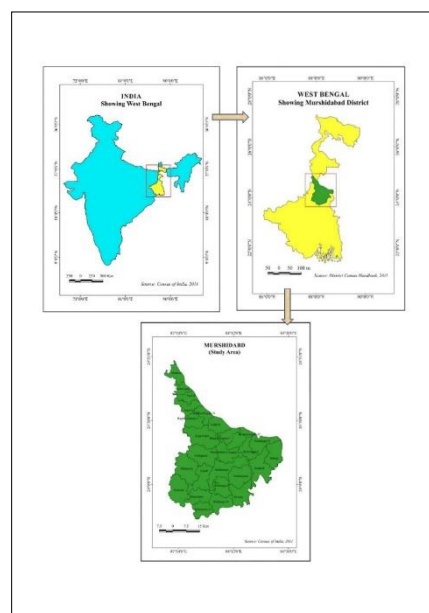


Fig. 1: Location Map of the Study

5.3 Effects on Mangoes and blossoms:

The buds of the mango tree bloom at the end of winter in the months of February and March. So, although mango is a summer fruit, its development starts at the end of winter or spring. Hence, the continuous increase in temperature is having a negative effect on the induction of flowering. Many times, the pollination process of mango trees is disrupted due to stormy and hot winds. Additionally, the size and quantity of flowers per inflorescence are negatively impacted by higher temperatures. Because mango blossoming is the most vulnerable stage to climate change, unfavourable climatic circumstances like rain, humidity, temperature, light, wind, drought, water logging, etc. have a negative impact on the process. Drought and increased Vapour Pressure Deficit (VPD) have a deleterious impact on fruit set and retention. Sometimes during the mango season in April and May, sudden hailstorms occur from the clouds, causing huge damage to mangoes in Murshidabad and its neighbouring districts. Also, there is the problem of fruit dropping without full development due to a lack of rainfall and a continuous increase in temperature due to climate change.

5.4 Effect on quality of mangoes in Murshidabad:

The mango fruit has physiological alterations as a result of high temperatures. Higher internal temperatures in the fruits of the Alphonso mango cause a physiological condition known as "spongy tissue," which results in tissue breakdown and Fruit quality is known to be affected by drought in both positive and negative ways in non-irrigated orchards. (Haldar & Hasan, 2020). According to mango farmers, the quality of their fruit is gradually decreasing every year due to unpredictable weather conditions. Since most of the farmers in Murshidabad are poor and cultivate on other people's land, it is impossible for them to meet the demand in the current market while maintaining the quality of mangoes by using modern technology. As a result, the market demand for their mangoes is continuously decreasing at the national and state levels.

6. Mango cultivation: adaptation to climate change:

- I. Mango farmers in Murshidabad should use more grafting methods. Grafting is a vegetative multiplication technique that produces several plants that are genetically identical to the parent tree. The process of propagating new plants involves using a range of materials, including seeds, cuttings, and other plant parts. Mango trees that have been grafted can bear more fruit and begin to blossom quickly.
- II. It is important to develop specialised methods for managing mango orchards, such as enhancing irrigation systems to use less water, controlling tree canopy and flowering, or planning garden layouts to foster a healthy microclimate for the trees (Normand et al., 2015).
- III. In spite of the unpredictable weather brought on by climate change, producers must constantly expand their ability to investigate innovations and new approaches to producing high-quality mangoes while preserving productivity. Additionally, they must search for a better market that would offer their produced mangoes a higher value (Esperanza et al., 2018).
- IV. The government should fix a fixed market price for mangoes so that the profit is fixed and the farmers do not suffer losses. Loans or financial support should be provided to encourage poor mango farmers. In view of the present time, the government and various private agricultural organisations should pay attention to how to use modern

technology, fertilizer, and storage systems to cultivate mangoes and provide the farmers with value-added climate risk management training.

- V. Farmers should refrain from planting new trees in areas with dense soil, fertilising after the monsoon, providing irrigation, and ploughing the orchard floor in the winter.
- VI. Before starting mango cultivation, farmers should be aware of the weather conditions of the season so that they can take remedial measures in advance in view of the increasing climate changes.
- VII. Various pesticides can be used to protect the mango yield, and the maintenance process needs to be tightened. Adequate water supply should be ensured by farmers.

7. Conclusions:

Climate variability Large-scale changes in the weather pattern have been caused by recurring changes in the earth's climate. It seriously affects the world's water system, the ecosystem, and human health. This has had a detrimental effect on mango cultivation. Mango production is impacted by climate change in the current mango-growing zones. This change in the global climate requires the collective adoption of different management strategies by the entire country. The 2015 Paris conference was organised for this purpose but has not yet succeeded in curbing climate change. Mangos have physiological systems that enable them to survive in a variety of harsh situations. The significant genetic resource diversity is a huge benefit for transferring traditional or contemporary breeding programmes and choosing to face changes in climate. However, the development and productivity of mango trees are negatively impacted by global climate change, which includes extreme heatwaves and droughts. To reduce risk in the mango cultivation and agricultural sectors, farmers must be informed about the expected effects of climate change and made aware of potential mitigation and adaptation strategies. Mango sellers should keep in mind that mango prices are influenced by market conditions. Without adequate market knowledge, farmers cannot benefit from higher mango prices. Therefore, in view of the changing climate, the farmers should focus on modern mango cultivation, and the appropriate mango market environment should be looked at proportionately. A stronger institutional structure and more money for farmer education will enable farmers to better adjust to the changing climate and, in turn, enhance their well-being, which will propel the nation's economic growth.

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