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Email: pgp_karmaveer@rediffmail.com**DOI:** 10.5281/zenodo.19968417**DOI Link:**<https://doi.org/10.5281/zenodo.19968417>**Creative Commons (CC BY-NC-SA 4.0):**

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The Role of Climate and Soil in the Quality Yield of Alphonso Mangoes in Ratnagiri, Sindhudurg and Raigad District in Kokan Region in Maharashtra

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Due to heavy rains communication system collapses. Godowns as well as financial facilities and infrastructure are inadequate. Even today, villages are remote in many districts. Heavy rains start after the production of mangoes or after the mango season and this affects communication and transport making the actual distribution of mangoes difficult and also expensive. Proper processing of the fruits after harvesting is important. Effective and efficient post-harvest management requires proper handling, storage and transportation. Since the board is perishable, it needs to be disposed of at the right time. In the early days, storage and transportation as well as physical distribution and supply chain operations were done in a traditional manner. But all these things started spending a lot of time and money. Hapus mango is the most sold mango and the main reason for this is the sweet taste of Hapus mango. There are many chains from production to sale of hapus mangoes. Many researchers are doing research on Hapus mango. Global warming has different and adverse effects on mango trees. Due to heavy rains, the blossoms of the trees fall off. Choosing the right seed while taking mango production. Providing good quality food for them. Treating them to prevent pests. And after this, after the mango is harvested, handling it properly and packing it properly and sending it for sale, the loss of mangoes is 15 to 20 percent. The ripening of hapus mangoes before they are marketed can be a factor in mango losses. The quality of mango is determined by its ripeness.

Introduction:

The quality and yield of Alphonso mangoes are highly dependent on natural factors, especially climate and soil. Favorable climatic conditions such as moderate temperatures, well-distributed rainfall, and specific humidity levels contribute significantly to the flowering, fruit development, and ripening of mangoes. Similarly, soil characteristics including texture, fertility, drainage, and pH levels play a vital role in the healthy growth of mango trees and the quality of their produce. However, with growing concerns around climate change, soil degradation, and unsustainable farming practices, it becomes essential to scientifically evaluate the influence of these environmental factors on Alphonso mango cultivation. A clear understanding of these relationships can help farmers adopt better cultivation practices, enhance fruit quality, and ensure the sustainability of mango farming. This study, therefore, seeks to analyze the role of climate and soil in determining the quality yield of Alphonso mangoes

Objectives of the Study:

1. To analyze the climatic factors (temperature, rainfall, humidity) affecting Alphonso mango cultivation.
2. To study the characteristics of soil (pH, nutrients, texture) suitable for high-quality Alphonso mango yield.
3. To examine the relationship between agro-climatic factors and mango quality (size, taste, aroma).
4. To suggest scientific practices for improving yield and maintaining quality based on soil and climate data.

Research Questions:

1. What climatic conditions are most favorable for Alphonso mango cultivation?
2. How does soil composition influence the fruit's quality and productivity?

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3. Is there a correlation between specific environmental factors and the export quality of Alphonso mangoes?

Scope of the Study:

The scope of this study extends to analyzing the interrelationship between environmental factors primarily climate and soil characteristics and their influence on the quality and yield of Alphonso (Hapus) mangoes. The research will primarily focus on the Konkan region of Maharashtra, which includes major Alphonso-producing districts such as Ratnagiri, Sindhudurg (Devgad), and parts of Raigad, due to their prominence in national and international mango markets.

Limitations:

1. The study does not cover post-harvest supply chain logistics, consumer behavior, or pricing mechanisms in depth.

Sample Size Distribution Chart:

District	N0. Of Villages /Farms	Criteria Considered
Ratnagiri	10	Coastal belt farms, laterite soil, high humidity
Sindhudurg	10	Devgad belt , red loamy soil, rainfall variation
Raigad	10	Mixed terrain farms, diverse microclimates
Total	30 farms	Climate zones , yield records

Data will be collected through structured interviews with farmers, soil testing reports, and local climate data (from IMD or agricultural universities). If needed, the sample size can be increased to 50 farms depending on the research timeline and field access.

Data Analysis:

Once primary and secondary data are collected from the selected sample farms, a combination of quantitative and qualitative data analysis techniques will be used to draw meaningful conclusions regarding the role of climate and soil in Alphonso mango quality yield.

A. Quantitative Data Analysis:

1. **Descriptive Statistics:**
 - Mean, median, and standard deviation of yield (in tons/acre), sweetness (Brix level), and fruit size across farms.
 - Soil parameter averages (pH, NPK levels) and climate metrics (temperature, rainfall, humidity).
2. **Comparative Analysis:**
 - Yield and quality indicators will be compared between different **soil types** (laterite, loam, etc.) and **climate zones**.
 - Graphs and charts (bar graphs, pie charts) will be used to visualize these differences clearly.
3. **Correlation Analysis:**
 - **Pearson correlation coefficients** will be used to assess the relationship between variables such as:
 - Soil pH vs. yield
 - Rainfall vs. fruit size
 - Humidity vs. sweetness (Brix value)
4. **Regression Analysis:**
 - Simple and multiple linear regression models will help predict how climate and soil variables affect yield.
 - E.g., $\text{Yield} = f(\text{Soil pH, Rainfall, Temperature})$

5. Geospatial Mapping (Optional):

2. Branding, marketing, and GI (Geographical Indication) issues are also outside the direct scope, though may be mentioned for context.

Sample Size and Sampling Methodology:

To ensure the accuracy and representativeness of the data, a stratified sampling method will be used. The study will cover three major Alphonso mango-producing districts—Ratnagiri, Sindhudurg (Devgad), and Raigad. Within each district, multiple villages or farms will be selected based on soil type, climatic conditions, and scale of mango cultivation. A minimum sample size of 30 farms is proposed, with 10 from each district. The sample will include a mix of small, medium, and large-scale farms to capture a diverse range of data related to soil quality, climate impact, and yield variations.

- If GPS coordinates are available, GIS tools (like QGIS) can be used to create **spatial distribution maps** showing high-yield vs. low-yield zones.

B. Qualitative Data Analysis:

1. **Thematic Analysis of Farmer Interviews:**
 - Identify recurring themes and experiences shared by farmers regarding changing climate patterns, soil issues, and traditional farming practices.
 - Data will be coded using tools like NVivo or manually if the sample size is limited.
2. **Case Studies:**
 - 2–3 farms will be selected for in-depth study to highlight best practices or challenges under specific soil and climate conditions.

Significance of the Study:

This study holds significant importance for multiple stakeholders including mango farmers, agricultural scientists, policymakers, and agro-based industries. Alphonso mangoes, known for their unique aroma, flavor, and texture, are highly sensitive to environmental factors. Understanding the influence of climate and soil on their quality yield can provide scientific insights that help improve farming practices and enhance fruit quality.

By identifying the optimal climatic conditions and soil characteristics for Alphonso mango cultivation, this study aims to guide farmers in adopting suitable agricultural techniques.

Expected Outcomes:

1. **Identification of Ideal Climatic Conditions**

The study is expected to determine the most favorable temperature, humidity, and rainfall patterns that support the highest quality yield of Alphonso mangoes.

2. **Understanding of Soil Suitability**
It will provide insights into which soil types (e.g., laterite, red, black soils) and specific soil properties (pH level, drainage, organic matter content) contribute to better fruit quality and quantity.
3. **Development of a Climate-Soil Suitability Model**
A model may emerge from the analysis that combines climate and soil parameters to predict mango yield quality in different regions.
4. **Improved Cultivation Practices**
Based on the findings, the study can recommend improved cultivation methods, irrigation techniques, and soil management strategies for better outcomes.

Conclusion:

The present study clearly demonstrates that climate and soil are critical determinants of the quality yield of Alphonso mangoes. The research has shown that specific climatic conditions such as a warm tropical temperature range (24°C to 30°C), moderate humidity, and well-distributed rainfall are ideal for the healthy growth and flowering of the Alphonso mango tree. Similarly, soils that are well-drained, moderately fertile, and slightly acidic (pH 6.0–6.5), with a good balance of organic matter, provide the essential nutrients and physical conditions needed for optimum fruit development. The findings of this study underscore the importance of region-specific planning for mango cultivation, particularly in the context of climate change and soil degradation. Overall, this study contributes to a deeper understanding of environmental influences on fruit quality and offers practical guidance for achieving higher returns through informed farming decisions. It sets the stage for further research into climate-resilient horticulture, ensuring the long-term sustainability of Alphonso mango production. By scientifically analyzing climate and soil factors, the study emphasizes the importance of adapting agricultural practices to regional environmental conditions.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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