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Rainfall Irregularities, Crop Production, and Food Security in Maharashtra: A Decadal Review (2015–2025)

Dr. Archana M. Bhoyar
Asst. Professor, Food Science and Nutrition, Dept. of Home Science Smt. Vatsalabai Naik Mahila Mahavidyalay, Pusad
archana.bhoyar@gmail.com

Abstract
Maharashtra's agriculture is highly dependent on monsoon rainfall, yet the past decade has witnessed increasing irregularities. Droughts in Marathwada and Vidarbha, floods in Konkan, and overall rainfall deficits have disrupted crop production, particularly rainfed crops such as tur, soybean, and jowar. This paper reviews rainfall patterns, crop production trends, and food security outcomes between 2015 and 2025, highlighting the interlinkages between climate variability, agricultural productivity, and nutritional security. The study draws on government statistics, climate reports, and food distribution data to provide evidence-based insights and policy recommendations.
Keywords : *Rainfall irregularities, Crop production, Food security, Climate variability, Maharashtra agriculture.*

Introduction

Maharashtra, one of India's largest agrarian states, is characterized by diverse agro-climatic zones ranging from the humid Konkan coast to the drought-prone interiors of Marathwada and Vidarbha. Agriculture contributes significantly to the state's economy and employs nearly half of its population (Government of Maharashtra, Directorate of Economics & Statistics, 2025). However, the sector remains highly vulnerable to rainfall variability, as nearly 70% of cultivated land is rainfed (World Bank, 2021).

Over the past decade (2015–2025), Maharashtra has experienced recurrent droughts, erratic monsoon onset, and localized floods. These irregularities have disrupted sowing cycles, reduced crop yields, and intensified farmer distress (Economic & Political Weekly, 2022). Rainfed crops such as tur, soybean, and jowar have shown sharp yield fluctuations, while irrigated crops like sugarcane and wheat have remained stable but placed immense pressure on groundwater resources (NFSM Reports, 2025).

Food security has also been affected. While the National Food Security Act (NFSA) and Public Distribution System (PDS) have ensured basic grain availability, regional disparities persist. Marathwada and Vidarbha continue to face malnutrition and poor food access, while Konkan and Western Maharashtra remain relatively secure (Indiastat, 2024). This paper aims to analyze rainfall patterns, crop production trends, and food security outcomes in Maharashtra over the last decade, and to establish the relationship among these factors.

Objectives

- To analyze rainfall patterns in Maharashtra from 2015–2025.
- To assess the impact of rainfall irregularities on crop production.
- To evaluate food security outcomes under NFSA and PDS.
- To establish the relationship between rainfall variability, crop yields, and food security.

Methodology

This study adopts a mixed-method approach combining quantitative data analysis with qualitative interpretation.

Data Sources: Rainfall records (Maharashtra Surface Water Department, 2015–2025), crop statistics (Directorate of Economics & Statistics; Ministry of Agriculture, 2015–2025), food security data (Indiastat; Department of Food & Civil Supplies), and secondary literature (Gadgil & Rupa Kumar, 2018; World Bank, 2021).

Trend Analysis: Rainfall variability assessed using decadal averages; crop production trends analyzed across drought and flood years.
Comparative Analysis: Rainfed vs. irrigated crop performance compared; regional disparities examined.

Correlation Analysis: Statistical correlation between rainfall variability and crop yields; food security indicators linked to crop outcomes.

Policy Review: Government interventions such as PM Dhan-Dhaanya Krishi Yojana (2025–31) and NFSM evaluated for effectiveness.

Results :

Rainfall Trends -

Deficit years (2015, 2018, 2020, 2022, 2025) recorded rainfall deficits of 10–25% below normal (Maharashtra Surface Water Department, 2025). Excess rainfall in 2019 and 2021 caused floods in Konkan and Nashik. Long-term studies confirm rainfall variability has increased, with El Niño strongly linked to droughts (Gadgil & Rupa Kumar, 2018).

Crop Production -

Rice and wheat remained stable due to irrigation, but rice yields fell in deficit years. Tur (arhar) was highly sensitive to rainfall, showing sharp declines in drought years. Soybean and jowar also declined, while sugarcane and cotton remained stable but water-intensive (Ministry of Agriculture, 2025).

Crop	Production (2025–26)	Trend (2015–25)
Rice	3.44 MT	Stable drought-sensitive
Wheat	3.51 MT	Increasing with irrigation
Tur	1.18 MT	Highly variable
Soybean	4.85 MT	Declining in drought years
Sugarcane	131.6 MT	Stable water-intensive
Cotton	7.76 M bales	Fluctuating pest & rainfall sensitive

Food Security

NFSA coverage extended to ~7 crore beneficiaries, with annual allocations of ~6–7 MT rice and wheat under PDS (Indiastat, 2024). Malnutrition persisted in drought-prone Marathwada and Vidarbha, while tribal districts faced food insecurity despite lower groundwater exploitation (Economic & Political Weekly, 2022). Relief packages and crop insurance were implemented, alongside PM Dhan-Dhaanya Krishi Yojana (Government of Maharashtra, 2025).

Discussion

Rainfall irregularities have created a dual challenge: yield instability and food insecurity. Rainfed crops are most vulnerable, while irrigated crops sustain production but strain water resources.

- **Rainfall → Crop Production:**
  - Deficit rainfall reduced sowing area and yield of rainfed crops.
  - Excess rainfall damaged rice and horticultural crops. *(Maharashtra Surface Water Department, 2025)*
- **Crop Production → Food Security:**
  - Decline in pulses and oilseeds reduced protein and fat availability, worsening malnutrition.
  - Stable irrigated crops ensured calorie supply but strained water resources. *(NFSM Reports, 2025; World Bank, 2021)*
- **Rainfall → Food Security (Indirect):**
  - Drought years increased dependence on NFSA/PDS.
  - Regional disparities persisted — Konkan remained food secure, while Marathwada and Vidarbha faced overlapping water scarcity and malnutrition. *(Economic & Political Weekly, 2022)*

Indirect relationship between Rainfall and Food Security

After reviewing the data interpretation is as fallows

- **Drought Years & NFSA/PDS Dependence**
  - In years of rainfall deficit (2015, 2018, 2020, 2022, 2025), agricultural output of rainfed crops like tur, soybean, and jowar fell sharply.
  - This reduced local food availability, forcing households to rely more heavily on the National Food Security Act (NFSA) and Public Distribution System (PDS) for basic grains (rice, wheat).
  - While NFSA ensured calorie supply, it did not fully address **nutritional diversity** (pulses, oilseeds, vegetables), leading to hidden hunger and protein deficiency.

- **Regional Disparities in Food Security**

  - **Konkan & Western Maharashtra:**
    - Benefited from higher rainfall and better irrigation infrastructure.
    - Food security remained relatively stable, with fewer malnutrition cases.

  - **Marathwada & Vidarbha:**
    - Faced overlapping challenges of **water scarcity, crop failure, and poverty**.
    - Malnutrition rates remained high, especially among children and women.
    - Farmers were more vulnerable to debt and distress migration, further weakening household food access.

  - **Tribal Districts:**
    - Despite lower groundwater exploitation, poor infrastructure and limited PDS reach meant persistent food insecurity.

- **Indirect Linkages**
  - Rainfall irregularities did not just reduce crop yields; they **disrupted rural livelihoods**, reducing purchasing power and food affordability.
  - Drought years increased **social dependence on government relief packages, crop insurance, and subsidized food grains**, but these measures often failed to cover nutritional needs.
  - Thus, rainfall variability indirectly shaped **regional inequalities in food security**, with drought-prone interiors suffering more than coastal or irrigated zones.
    Economic & Political Weekly (2022) highlights that rainfall irregularities deepen structural disparities in Maharashtra's food security landscape — showing how climate stress translates into nutritional stress.

Summary:

Between 2015 and 2025, Maharashtra experienced significant rainfall irregularities, with five deficit years and two excess rainfall years that disrupted agricultural cycles. Rainfed crops such as tur, soybean, and jowar were the most vulnerable, showing sharp declines in drought years, while irrigated crops like sugarcane, wheat, and rice remained relatively stable but placed heavy pressure on groundwater resources. Cotton production fluctuated due to both pest attacks and rainfall sensitivity. Food security outcomes reflected these climatic and agricultural stresses. Although the National Food Security Act and Public Distribution System covered nearly seven crore beneficiaries and ensured basic grain availability, regional disparities persisted. Konkan and Western Maharashtra remained relatively secure due to better rainfall and irrigation infrastructure, while Marathwada and Vidarbha continued to face overlapping challenges of water scarcity, crop failure, and malnutrition. Tribal districts also struggled with poor infrastructure and limited PDS reach. Overall, rainfall variability directly reduced crop yields and indirectly widened inequalities in food access, forcing drought-prone regions to rely heavily on government relief and subsidized food grains.

The decade-long review highlights the strong linkage between rainfall irregularities, crop instability, and food insecurity, underscoring the need for crop diversification, micro-irrigation, and nutrition-focused programs to build long-term resilience.

Recommendations

The findings of this decadal review highlight the urgent need for Maharashtra to adopt a multi-dimensional strategy that addresses rainfall irregularities, crop instability, and food insecurity simultaneously. Based on the evidence, the following recommendations are proposed:

1. **Strengthen Climate-Resilient Agriculture**
   - Promote drought-resistant and short-duration crop varieties, especially pulses and oilseeds.
   - Encourage crop diversification to reduce dependence on water-intensive crops like sugarcane.

2. **Expand Micro-Irrigation and Water Management**
   - Scale up drip and sprinkler irrigation to maximize water efficiency.
   - Invest in watershed development, farm ponds, and rainwater harvesting to stabilize water availability.

3. **Rebalance Irrigation Priorities**
   - Shift irrigation support away from sugarcane toward pulses, oilseeds, and coarse cereals.
   - Incentivize farmers to adopt less water-intensive crops through subsidies and procurement policies.
4. **Nutrition-Focused Food Security Programs**
   - Integrate pulses, oilseeds, and millets into the Public Distribution System (PDS).
   - Strengthen mid-day meal and ICDS programs with diversified food baskets to address protein and micronutrient deficiencies.
5. **Enhance Crop Insurance and Relief Mechanisms**
   - Simplify crop insurance claim processes and ensure timely compensation.
   - Expand coverage to small and marginal farmers, who are most vulnerable to rainfall shocks.
6. **Regional Targeting of Food Security Interventions**
   - Prioritize drought-prone regions like Marathwada and Vidarbha for nutrition and livelihood programs.
   - Improve PDS infrastructure in tribal districts to reduce exclusion errors.
7. **Strengthen Farmer Livelihoods Beyond Agriculture**
   - Promote skill development and non-farm employment opportunities to reduce dependence on rainfed agriculture.
   - Encourage agro-processing and value-addition industries to stabilize rural incomes.
8. **Invest in Climate Information Systems**
   - Develop localized weather forecasting and early warning systems to guide sowing decisions.
   - Train farmers in climate-smart practices through extension services and digital platforms.

Conclusion

The decade from 2015 to 2025 demonstrates how rainfall irregularities have destabilized crop production and widened food security disparities in Maharashtra. Rainfed crops remain highly vulnerable, while irrigated crops sustain calorie supply but intensify groundwater stress. Food security interventions have stabilized grain availability, yet nutritional insecurity persists in drought-prone and tribal regions. Building resilience requires a shift from short-term relief to long-term structural reforms — crop diversification, micro-irrigation, nutrition-focused programs, and climate-smart agriculture. By adopting these measures, Maharashtra can move toward a more sustainable and equitable agrarian future, ensuring both productivity and food security in the face of climate variability.

References :

1. Economic & Political Weekly. (2022, March 15). *Droughts and food security in Maharashtra.* Economic & Political Weekly. https://www.epw.in
2. Gadgil, S., & Rupa Kumar, K. (2018). Climate variability and agriculture in India. *Indian Journal of Agricultural Economics, 73*(2), 123–135.
3. Government of Maharashtra, Directorate of Economics & Statistics. (2015–2025). *Agricultural statistics reports.* Government of Maharashtra.
4. Indiastat Database. (2024). *Food security and PDS allocation statistics.* Indiastat. https://www.indiastat.com
5. Maharashtra Surface Water Department. (2015–2025). *Rainfall data reports.* Government of Maharashtra.
6. Ministry of Agriculture & Farmers Welfare, Government of India. (2015–2025). *Crop production estimates.* Government of India.
7. National Food Security Mission. (2015–2025). *Annual reports.* Government of India.
8. World Bank. (2021). *Climate change and agriculture in South Asia.* World Bank. https://www.worldbank.org