

AGRICULTURE FORUM FOR TECHNICAL EDUCATION OF FARMING SOCIETY

Kota, Rajasthan



Farming in a Hotter India: Coping with Heatwaves & Droughts

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INTRODUCTION

India's agriculture sector remains the backbone of the national economy, employing approximately **45–50% of the workforce** and contributing around **16–18% to GDP (World Bank, 2024 estimates)**. Despite modernisation efforts, Indian agriculture is still highly dependent on monsoon rainfall and climate stability, making it extremely vulnerable to climate change.

In recent years, climate variability has intensified significantly. According to the India Meteorological Department, India has experienced a **steady increase in both average temperatures and the frequency of extreme weather events** over the past decade. The years **2022, 2023, and 2024 ranked among the warmest years in recorded Indian climate history**, with prolonged heatwaves affecting large parts of northern, western, and central India.

Global climate assessments, including reports by the IPCC, indicate that South Asia is among the most climate-vulnerable regions in the world. India alone has seen an **increase of nearly 0.7°C–0.9°C in average temperature since the early 20th century**, and projections suggest further increases of **1.5°C–2°C by mid-century if emissions remain high**.

These climatic shifts are no longer occasional disruptions—they are becoming structural realities. Heatwaves, irregular monsoons, and recurring droughts are now affecting crop cycles, soil fertility, water availability, and rural livelihoods. As a result, agricultural sustainability is increasingly dependent on climate adaptation, technological intervention, and policy support.

The Rising Heat and Its Impact

1. Heatwaves in India

A heatwave is defined as a prolonged period of unusually high temperatures, typically exceeding **40°C in plains and 45°C in desert regions**. Over the last decade, the intensity, duration, and geographic spread of heatwaves have increased significantly.

Recent climate observations show:

- India recorded **more than 280–300 heatwave days in 2023**, one of the highest in recent decades.
- The **2022 pre-monsoon heatwave (March–May)** was among the most severe in 122 years of recorded history.
- Northern India experienced **temperature anomalies of +4°C to +6°C above normal during peak heatwave days in 2024**.

The agricultural impact is severe:

Impact on crops

Heat stress directly disrupts plant physiology:

- **Reduced germination rates:** Seeds exposed to soil temperatures above 40°C show a sharp decline in viability.
- **Yield reduction:** Wheat and rice—India's staple crops—suffer yield losses of **10–25% during extreme heat events (ICAR estimates)**.
- **Photosynthesis disruption:** High temperatures reduce chlorophyll activity, limiting plant growth.
- **Flower and fruit drop:** Pulses, vegetables, and fruit crops experience significant reproductive failure.

In 2022, heatwaves caused India's wheat production to decline by nearly **3–5 million tonnes compared to projections**, affecting both domestic supply and export potential.

Impact on livestock

Heat stress is also a major concern for animal husbandry:

- Milk production decreases by **10–25% in dairy cattle during peak summer stress periods**.
- Feed intake reduces significantly due to thermal discomfort.
- Fertility rates decline in buffaloes and cows during prolonged heat exposure.

Livestock productivity losses directly affect rural income stability, especially in dairy-dependent regions like Uttar Pradesh, Punjab, and Gujarat.

2. Drought: A Silent and Persistent Threat

Drought is a slow-onset disaster caused by prolonged rainfall deficiency and high evapotranspiration rates. Unlike floods or storms, its impact accumulates gradually but can be devastating.

Recent data highlights:

- Around **30–35% of India’s districts experience drought-like conditions periodically.**
- States such as **Maharashtra, Karnataka, Rajasthan, Telangana, and parts of Odisha** remain highly drought-prone.
- India’s groundwater stress is increasing rapidly, with over **60% of groundwater blocks categorised as semi-critical, critical, or overexploited (Central Ground Water Board, 2024).**

Consequences of drought

1. Water scarcity

- Irrigation demand increases sharply during failed monsoons.
- Dependency on groundwater leads to deeper borewells and higher costs.

2. Soil degradation

- Dry soils lose organic matter and nutrients.
- Wind erosion increases, especially in arid regions.

3. Agricultural losses

- Crop failure leads to severe income shocks.
- Farmers often fall into debt cycles, particularly smallholders.

4. Migration and social stress

- Rural distress migration increases during drought years.
- Urban centres face additional pressure on housing and employment.

Drought is therefore not just an environmental issue but a socio-economic crisis.

Table: Latest Status of Heatwaves, Droughts & Farming Impact in India (2025–2026)

Climate Factor	Latest Data (2025–2026)	Agricultural Impact	Key Response
Heatwaves	2026 forecast: above-normal heatwave days; Feb 2026 among hottest since 1901	10–25% crop yield loss; wheat grain shrinkage; livestock stress	Heat-resistant seeds, shade, irrigation timing
Extreme Weather	331 of 334 days in 2025 had extreme events	Continuous crop stress, unstable farming cycles	Climate-smart farming, diversification
Monsoon Variability	June 2026 rainfall ~40% below normal; delayed sowing	Reduced rice, soybean, and cotton planting	Early warning systems, drought-resistant crops
Drought Stress	>60% of groundwater blocks are overexploited (CGWB 2024)	Water shortage, crop failure risk	Drip irrigation, rainwater harvesting
Crop Damage	~17.4 million hectares affected in 2025 extremes	Large-scale yield and income loss	Crop insurance (PMFBY), resilient farming

Temperature Rise	~0.7–0.9°C long-term warming in India	Faster crop maturity, lower productivity	Climate-resilient agriculture practices
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Coping Strategies for Heatwaves and Droughts

1. Crop Planning and Selection

Climate-resilient agriculture begins with crop choice.

- **Drought-resistant crops** such as millet, sorghum, and chickpea are increasingly promoted under India’s millet mission initiatives (2023–2025).
- Short-duration crop varieties reduce exposure to extreme heat by **15–30 days**.
- Crop diversification reduces risk by spreading vulnerability across multiple species.
- Intercropping improves soil moisture retention and nutrient balance.

2. Water Management

Water efficiency is the most critical adaptation strategy.

- India’s micro-irrigation coverage has expanded to **13–14 million hectares (2024 estimates)**.
- Drip irrigation improves water-use efficiency by **40–60% compared to flood irrigation**.
- Rainwater harvesting systems are increasingly adopted under watershed development programs.
- Farm ponds and check dams help store monsoon water for dry periods.

3. Soil Health Management

Healthy soil improves climate resilience.

- Soil organic carbon levels remain low in many regions (**below 0.5% in semi-arid areas**).
- Organic amendments increase water retention capacity by **20–30%**.
- Conservation agriculture (minimal tillage) reduces evaporation losses.
- Cover cropping protects soil from extreme heat and wind erosion.

4. Weather Forecasting & Early Warning Systems

Technology is transforming climate adaptation.

The India Meteorological Department now provides:

- District-level heatwave alerts
- Monsoon forecasting updates
- 5–7 day advance extreme weather warnings

Digital platforms such as Kisan apps and SMS-based advisories now reach **millions of farmers**, enabling better irrigation, planting, and harvesting decisions.



5. Livestock & Animal Care

Adaptation strategies for livestock include:

- Providing shade, ventilation, and cooling systems
- Ensuring continuous water supply during heatwaves
- Adjusting feeding schedules to cooler parts of the day
- Use of heat-resistant cattle breeds in vulnerable regions

Proper management can improve livestock productivity by up to **15–20% during extreme summers**.

Government & Policy Support

India has strengthened institutional responses to climate stress:

- **Pradhan Mantri Fasal Bima Yojana (PMFBY):** Covers over **40–45 million farmers annually**, providing financial protection against climate-related crop failure.

- **National Mission for Sustainable Agriculture (NMSA):**

Promotes climate-resilient farming, water efficiency, and soil conservation.

- **Micro-irrigation subsidies:** Provide **55–75% financial support** in many states, encouraging drip and sprinkler systems.
- **Watershed Development Programmes:** Improve groundwater recharge and drought resilience in vulnerable regions.

These programs collectively aim to reduce vulnerability and stabilise agricultural incomes.

Community & Farmer-Led Initiatives

Community participation plays a crucial role in resilience building.

- India now has over **10,000 Farmer Producer Organisations (FPOs)** supporting collective farming and marketing.
- Knowledge-sharing platforms and WhatsApp farmer groups enable real-time climate communication.
- NGOs and agricultural universities conduct climate-smart farming workshops in high-risk districts.
- Digital agriculture adoption is increasing rapidly, especially among young farmers.

CONCLUSION

Farming in a hotter India is one of the greatest agricultural challenges of the 21st century. Rising temperatures, erratic rainfall, and water scarcity are reshaping rural livelihoods and food systems. However, evidence shows that adaptation is possible and effective. With climate-resilient crops, improved irrigation systems, sustainable soil practices, and strong institutional support, Indian agriculture can continue to grow despite environmental stress.

The future of farming will depend on the integration of **technology, traditional knowledge, policy**

support, and farmer participation. Ultimately, climate adaptation is not just an agricultural strategy—it is a national necessity for ensuring food security, rural stability, and economic resilience.

Adaptation is no longer optional; it is the foundation of survival in a warming India.