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CLIMATE CHANGE IN JHARKHAND: BLURRING SEASONS, ERRATIC RAIN AND NEW RISK FOR AGRICULTURE

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ABSTRACT

Jharkhand is experiencing significant shifts in its seasonal weather patterns, characterized by blurring of seasons, unseasonal rainfall, sudden thunderstorms, hailstorms, delayed monsoon onset, erratic rainfall distribution and frequent weather fluctuations. As a predominantly rainfed agricultural state, these changes pose severe risks to crop production and farm livelihoods. The present study documents and analyses the changing weather patterns of Jharkhand during 2024–2026, drawing on IMD weather records and district-level rainfall data, to assess agricultural risks and recommend adaptation strategies. The year 2024 recorded light to moderate rainfall with thunderstorms, lightning, hail and gusty winds during March, damaging rabi crops, horticultural plantations and vegetables. May 2024 showed an unstable pre-monsoon pattern influenced by Cyclone Remal. The pre-monsoon season of 2025 received 168.9 mm rainfall against the normal 83.3 mm (103% excess), with 44 thunderstorm days and 14 hail days. The 2025 south-west monsoon recorded 1198.8 mm against the normal 1022.9 mm (17% above normal), with heavy to extremely heavy rainfall on 68 days and thunderstorm on 93 days. The January–February 2026 period showed a 94% rainfall deficit, while March 2026 recorded thunderstorm on 12 days, hail on 7 days and a peak gusty wind of 68 kmph. These patterns indicate that climate change in Jharkhand is showing not only as warming but as increasing atmospheric instability. The agricultural impact includes risk to rice, rabi crops, vegetables and horticultural plantations through delayed sowing, waterlogging, hail damage, drying problems and yield instability. Adaptation strategies include weather-based crop planning, crop diversification, short-duration varieties, rainwater harvesting and real-time agrometeorological advisories.

Keywords **:** Climate change; Jharkhand; thunderstorm; hailstorm; rainfed agriculture; crop diversification; agrometeorological advisory.

Introduction

Climate change is no longer just a tagline for Jharkhand. Its impact is now becoming visible in the form of blurred seasons, unseasonal rain, sudden thunderstorms, hailstorms, delayed monsoon onset, erratic rainfall distribution and frequent weather fluctuations. The state is seeing a slow but visible disturbance in seasonal rhythm. Summers are being interrupted by thunderstorms, rain and hail, while monsoon rainfall is becoming uneven, sometimes deficient during sowing and excessive during transplanting or crop growth.

This is particularly serious for agriculture because farming in Jharkhand is largely rainfed and highly dependent on the timing, amount and distribution of rainfall. The State Action Plan on Climate Change notes that Jharkhand receives about 80–82% of its annual rainfall during the monsoon, only about 6–10% of agricultural area is supported by irrigation and about 40% of the area remains under monocropping. It also identifies heat waves, hailstorms, reduced pre-monsoon convectional rainfall and cold wave/frost as factors restricting agricultural productivity (Govt. of Jharkhand, 2013).

Farmers face both risks: heat stress during dry spells and physical crop damage during thunderstorms, hail, heavy rain or gusty wind. For agriculture, such weather is highly risky. A temporary fall in

temperature may give relief from heat stress, but thunderstorms, hail and gusty winds can damage standing vegetables, fruit crops, maize, pulses and summer crops. Rainfall during March can affect harvesting and drying of rabi crops such as wheat, mustard, chickpea and lentil. In May, repeated thunderstorms may delay land preparation for kharif crops, damage nurseries, increase pest and disease incidence in vegetables and create uncertainty in sowing decisions.

Jharkhand is facing a more complex form of climate stress where warming is occurring along with unstable and unpredictable weather events. The year 2024 was recorded as the warmest year over India since 1901, clearly showing the long-term warming signal (IMD, 2025). However, Jharkhand also showed an important local contrast during the same year. Even in such a warm year, parts of March and May 2024 remained relatively cooler or experienced temporary suppression of day temperature because of rain, thunderstorm, hail, gusty winds and cloud cover. This clearly shows that climate change is not only about continuous rise in temperature; it is also about increasing atmospheric instability and sudden weather shifts.

The present study documents the changing weather patterns and associated agricultural risks in Jharkhand during 2024–2026 and suggests appropriate crop-based adaptation strategies for farmers.

Materials and Methods

The study is based on analysis of district-level and state-level weather data of Jharkhand for the period 2024–2026. Weather data including daily rainfall, thunderstorm frequency, hail occurrence, gusty wind speed and heat wave days were obtained from the India Meteorological Department (IMD) weather bulletins, Agromet Advisory Bulletins, annual reports of AICRPAM and state-level climate reports. Seasonal rainfall data for pre-monsoon, monsoon and winter seasons were compared with long-term normals to compute departure percentages. District-wise rainfall records were used to document event-specific weather impacts. Data for 2025 seasonal summaries and 2026 monthly weather events were compiled from official IMD records and agrometeorological advisories issued for Jharkhand. Agricultural impact assessment was based on crop-weather interaction analysis for the major crops of Jharkhand including rice, wheat, maize, chickpea, lentil, mustard, linseed and vegetables, following established agronomic principles of crop response to temperature, rainfall intensity and weather extremes (Bhadra *et al*., 2016; Mall *et al*., 2006). Adaptation strategies were formulated based on land-situation-specific crop planning frameworks used for rainfed agriculture in Eastern India (Haris *et al*., 2010).

Results and Discussion

Weather Events of 2024

In March 2024, Jharkhand experienced light to moderate rainfall accompanied by thunderstorms, lightning, hail and gusty winds from the 17th to the 20th. Isolated areas in the state were also likely to encounter hailstorms and heavy rainfall. Recorded rainfall amounts included 40 mm in Ramgarh, 30 mm each in Dumka and Hazaribagh and 20 mm each in Gumla, Lohardaga and Ranchi. The strong winds and hail caused damage to plantations, horticultural crops and standing crops.

In May 2024, the pre-monsoon weather was notably erratic. According to IMD weather reports, thunderstorms and gusty winds reaching speeds of up to 40 kmph were observed, with orange alerts issued for certain districts. Widespread rainfall occurred across much of Jharkhand around May 7–8, 2024, excluding areas like Palamu, Garhwa, Latehar and Chatra. Later in the month, Cyclone Remal partially affected Jharkhand, leading to cloud cover and unsettled weather conditions around May 27, 2024.

Weather Pattern of 2025

The pattern continued into 2025 and 2026, strengthening the evidence that Jharkhand's seasons are becoming more disturbed. During the pre-monsoon season of 2025, 168.9 mm rainfall was received against the normal 83.3 mm, which was 103% excess. Rain occurred on 59 days during the pre-monsoon season. At the same time, 44 thunderstorm days and 14 hail days were reported in pre-monsoon 2025. Heat wave to severe heat wave conditions occurred only on two days, 16 and 17 March and no heat wave was recorded in April and May 2025.

The monsoon of 2025 also showed a highly active and unstable pattern. Jharkhand received 1198.8 mm rainfall during the south-west monsoon against the normal 1022.9 mm, which was 17% above normal. Heavy to extremely heavy rainfall occurred on 68 days and thunderstorm occurred on 93 days during the monsoon season. Such rainfall may look favourable in total amount, but when rainfall comes in intense spells, it can cause runoff, erosion, waterlogging and nutrient loss instead of benefiting crops (Misra, 2014).

Weather Variability in 2026

The beginning of 2026 also showed unusual variability. During January and February 2026,

Jharkhand received only 1.5 mm rainfall against the normal 25.4 mm, a 94% deficit. January remained completely dry, while February rainfall was also largely deficient. Such dry winter conditions reduce residual soil moisture and affect rabi crops.

In March 2026, however, the pattern shifted again. The state received 17.1 mm of rainfall over 17 days, reflecting a 16% departure above the normal 14.7 mm. Atmospheric instability was prominent, with thunderstorms recorded on 12 days, hail on 7 days and a peak gusty wind speed of 68 kmph observed at Khunti-AWS on 28 March. The absence of heat wave conditions throughout the month reinforces the observation that the pre-monsoon season remained relatively cooler and disturbed due to recurrent rain, thunderstorm and hail activity.

A cooler March or May does not mean climate change is absent. In fact, it indicates a new form of climate risk. Long-term warming is continuing, but local weather is becoming more unstable. Rain and clouding may temporarily reduce temperature, but the associated thunderstorm, hail, gusty wind and lightning can damage crops within a very short time. Similar patterns of increasing pre-monsoon instability have been observed across the Eastern Indian plateau region (Dash *et al*., 2009; Sahai *et al*., 2015).

Table 1 : Extreme weather events and their agricultural impact in Jharkhand (2024–2026)

Year / Period	Weather Signal	Impact on Agriculture
March 2024	Rain, thunderstorm, lightning, hail and gusty winds over Jharkhand; Ranchi received 20 mm rainfall in one spell	Risk to rabi harvesting, vegetables and standing crops
March 2024	Below-normal maximum temperature over parts of Jharkhand	Maximum temperature anomaly less than -2°C over parts of Jharkhand
18 March 2024	Thunderstorm, lightning and rain	Gumla, Khunti, Lohardaga, Ranchi, Jamshedpur and Simdega affected; wind speed 30–40 kmph
19 March 2024	Rain/thunderstorm spell	Ranchi 2 cm, Ramgarh 4 cm, Dumka and Hazaribagh 3 cm each
19 March 2024 forecast	Thunderstorm, lightning, gusty wind, possible hail/squall	Squall speed likely 50–60 kmph
22 March 2024	Cooling after rain-thunderstorm activity	Maximum temperature came down to 22–24°C in most parts of state
22 March 2024	Heavy local rainfall	82.4 mm at Kanke, near Ranchi
14 May 2024	Thunderstorm/lightning in Kolhan and central Jharkhand	Maximum temperature fluctuated between 34–39°C
27 May 2024	Cyclone Remal influence	Gusty wind 40–50 kmph, light rain, thunderstorm and lightning likely
2025 winter	Rainfall 4.0 mm against normal 25.4 mm, 84% deficit	Less residual moisture for rabi crops
2025 pre-monsoon	Rainfall 168.9 mm against normal 83.3 mm, 103% excess; rain on 59 days	Highly active pre-monsoon weather
2025 pre-monsoon	44 thunderstorm days and 14 hail days	Damage risk to vegetables, orchards, maize, pulses and nurseries
2025 heat wave	Heat wave only on 2 days; no heat wave in April and May	Rain and thunderstorms suppressed summer heat, but increased crop-weather uncertainty
2025 monsoon	Rainfall 1198.8 mm, 17% above normal; heavy to extremely heavy rainfall on 68 days	Runoff, erosion, waterlogging and delayed field operations
2025 monsoon	Thunderstorm on 93 days	Lightning, gusty wind and crop damage risk
Jan–Feb 2026	Rainfall 1.5 mm against normal 25.4 mm, 94% deficit	Moisture stress for rabi crops
March 2026	Rain on 17 days, thunderstorm on 12 days, hail on 7 days, highest gusty wind 68 kmph, no heat wave	Strong evidence of disturbed summer conditions

IMD, Jharkhand newspaper, Mausam

Impact on Agriculture

Agriculture in Jharkhand is highly vulnerable because most farming is rainfed. Many agricultural areas are located on uplands and undulating terrain, where soils are shallow, light-textured and low in water-holding capacity. When rainfall is delayed, sowing is postponed. When rainfall comes suddenly and heavily, much of the water is lost as runoff, along with fertile topsoil and nutrients (Pathak *et al*., 2003).

Rice, the major kharif crop of Jharkhand, is highly susceptible to this climate uncertainty. Delayed monsoon onset disrupts essential operations such as field preparation, nursery raising and transplanting. These delays shorten the crop's growing window, leading to poor tillering, reduced biomass and lower yields. Furthermore, the impacts vary by topography: in upland areas, direct-seeded rice often suffers poor germination if rain ceases after sowing, while in lowlands, sudden heavy rainfall can cause waterlogging and damage young seedlings (Bouman *et al*., 2007).

Rabi crops are also affected. Wheat, chickpea, lentil, mustard and linseed depend on residual soil moisture and limited irrigation. Deficient winter rainfall, as seen in 2025 and early 2026, reduces soil moisture availability. On the other hand, sudden rain and hail during March damaged mature rabi crops, affected harvesting, reduced grain quality and created drying and storage problems.

Vegetables are among the most sensitive crops under this changing climate. Hailstorms and gusty winds damaged tender leaves, flowers and fruits within minutes. Excess rain caused waterlogging, root damage and fungal diseases. Crops such as tomato, brinjal, chilli, okra, cucurbits, cabbage and cauliflower are especially vulnerable when rain and temperature fluctuate rapidly (Kumar *et al*., 2011).

Fruit crops and horticultural plantations also faced risk from strong winds and hail. It was reported during March 2024 that strong wind and hail damaged plantations, horticultural crops and standing crops. It was also advised to provide mechanical support for horticultural crops and staking of vegetables in Jharkhand.

Future Impact

If this pattern continues, the biggest risk for Jharkhand agriculture will be yield instability. Farmers may receive normal or even excess rainfall in a season, but still suffer losses if rainfall comes at the wrong time or in damaging intensity. The traditional agricultural calendar will become less reliable. Sowing, transplanting, fertilizer application, spraying and harvesting will all need to be adjusted according to real-time weather conditions (Aggarwal, 2008; Mall *et al*., 2006).

Adaptation Measures

Farmers should move away from fixed-date farming and adopt weather-based and land-situation-based crop planning. The same crop plan should not be followed for upland, medium land and lowland.

Upland areas: farmers should reduce dependence on long-duration rice. Better options include maize, pigeonpea, blackgram, horsegram, finger millet, sesame, niger, groundnut, cowpea and sweet potato. These crops require comparatively less water and are more suitable where rainfall is uncertain.

Medium lands: short-duration and drought-tolerant rice varieties should be preferred. Farmers can also adopt direct-seeded rice, maize-pulse systems, rice followed by pulses and rice followed by oilseeds. Crop diversification is important because putting the entire area under rice increases risk under delayed or erratic rainfall.

Lowlands: transplanted rice can continue, but farmers should use suitable-duration varieties and maintain drainage channels. Lowlands are better for rice because of higher water retention, but sudden heavy rainfall can still create waterlogging and seedling damage.

Rabi season: farmers should prefer crops that can perform with residual soil moisture or limited irrigation. Chickpea, lentil, mustard, linseed, toria, vegetable pea and wheat under assured irrigation are suitable options. Rabi crop selection should depend on soil moisture status after monsoon withdrawal.

Vegetables: farmers should use raised-bed cultivation, proper drainage, staggered sowing and protected nurseries. In kharif and rainy seasons, okra, cowpea, brinjal, chilli, bottle gourd, bitter gourd, ridge gourd, sponge gourd, cucumber and sweet potato may be promoted in well-drained fields. In rabi, potato, vegetable pea, tomato, cabbage, cauliflower, onion and garlic can be grown depending on irrigation availability.

Farmers should also adopt rainwater harvesting, farm ponds, field bunding, contour bunding, mulching, conservation furrows and drainage channels. Before expected thunderstorm or hail, matured crops and vegetables should be harvested early where possible, harvested produce should be covered with tarpaulin and vegetables should be staked. Hail nets or low-cost protection may be used for high-value vegetables and fruit crops.

Conclusion

For agriculture the risk is no longer only drought or heat. The real challenge is the unpredictable combination of heat, rain, hail, thunderstorm, dry spells and heavy rainfall. Jharkhand's farmers now need climate-resilient agriculture based on short-duration crops, crop diversification, land-situation-specific planning, rainwater harvesting, raised-bed vegetable cultivation, drainage management and real-time agrometeorological advisories. The evidence from 2024 to 2026 clearly shows that seasonal weather in Jharkhand has become more disturbed and agriculturally riskier. Institutional support through weather-based advisories, insurance mechanisms and climate-smart input delivery will be essential to help farmers navigate these increasing uncertainties.

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Competing Interests

The authors declare no competing interests.

Data Availability

All data supporting the findings of this study are included within the article.

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