Managing El Niño Risks in Indian Agriculture

Impacts and Standard Operating Procedures

Prepared by

ICAR

Indian Council of Agricultural Research

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Building Climate Resilience through Preparedness and Sustainable Agricultural Practices.

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सत्यमेव जयते

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FOREWORD

India's agriculture remains highly dependent on the southwest monsoon making it particularly vulnerable to climatic fluctuations associated with the El Nino. Updated forecasts from the India Meteorological Department (IMD), the World Meteorological Organization (WMO) and other leading global centres indicate a high likelihood of moderate to strong El Nino conditions persisting throughout the Southwest Monsoon season of 2026. It is generally associated with below-normal monsoon rainfall, increased frequency of dry spells and heightened risks to agricultural production, water resources and rural livelihoods in many parts of India. Therefore, timely preparedness, location-specific contingency planning, efficient water management and climate-resilient agricultural practices will be critical to minimizing potential adverse impacts during the 2026 monsoon season.

In this context, the Indian Council of Agricultural Research (ICAR) through its network of Research Institutes across the country has been actively engaged in developing location-specific technologies and contingency strategies to minimize the adverse impacts of climate aberrations. Timely advisories, climate-resilient crop varieties, efficient water management practices, alternate cropping options and risk mitigation measures form the cornerstone of our efforts to safeguard agricultural production during El Nino years.

This technical bulletin entitled "Managing El Niño Risks in Indian Agriculture: Impacts and Standard Operating Procedures" brings together scientific knowledge, historical perspectives, vulnerability assessments and practical contingency measures for major crops and farming systems across different agro-climatic regions of the country. The publication serves as a valuable resource for policymakers, researchers, extension personnel, development agencies and farming communities in planning and implementing proactive interventions to reduce climate-related risks.

I hope this bulletin will contribute significantly to strengthen climate resilience in Indian agriculture and support informed decision-making at all levels during the critical years of El Nino. I congratulate Dr. Rajbir Singh, DDG (AE) and the multi-disciplinary, multi institutional team for their dedicated efforts in bringing out this comprehensive publication.

(M. L. Jat)

Dated the 22nd June, 2026
New Delhi

Preface

India's agriculture feeds more than 1.4 billion people, and its fortunes remain deeply intertwined with the South-West Monsoon. Nearly half of the country's net cultivated area is rainfed, making any departure from normal rainfall a matter of national food security. Among the various climate phenomena that influence monsoon behaviour, El Nino has emerged as one of the most significant due to its frequent association with deficient rainfall, prolonged dry spells, drought conditions, and consequent impacts on crop, livestock, and allied agricultural sectors. The increasing frequency and intensity of climate-related uncertainties underscore the need for systematic preparedness and timely interventions to safeguard agricultural production and farmers' livelihoods.

The present document is prepared in response to growing concerns over the likely influence of an emerging El Nino event on India's agricultural sector. The current forecasts from the India Meteorological Department, the World Meteorological Organisation and major global modelling centres indicates the development of a moderate to strong El Nino in the equatorial Pacific and is expected to intensify through the South-West Monsoon season of 2026. IMD's Long-Range Forecast projects seasonal rainfall at 90 per cent of the Long Period Average for the country as a whole with an 84 per cent probability of below-normal or deficient conditions. Particularly vulnerable are the Monsoon Core Zone districts of India, where the bulk of rainfed cultivation is concentrated.

The report is being developed by ICAR in coordination with IMD, MNCFC, ICAR-CRIDA, AICRPAM, ATARIs, and State Agricultural Universities (SAUs). It first offers a comprehensive scientific assessment of current El Nino conditions, rainfall outlook, real-time monitoring indicators, and the historical impact of El Nino events on the productivity of major *kharif* crops across Indian districts. It then translates that evidence into a structured Standard Operating Procedure (SOP) for the 315 risk prone districts located in jurisdiction of Krishi Vigyan Kendras (KVKs) spread across the country, guiding them through every phase of the monsoon, from pre-season preparedness and delayed onset monsoon to mid-season drought response and terminal drought contingencies.

KVKs play a pivotal role in agricultural extension systems. They are district-level frontline institutions of ICAR to bridge the gap between research and the farm. During El Nino induced stress conditions, their responsibilities extend from disseminating weather-based agro-advisories and demonstrating drought-resilient technologies to facilitating seed supply, promoting water harvesting, and ensuring that national contingency plans reach the last field in the last village. The SOP described in this report enables them to act with precision, speed, and coordination across diverse agro-ecological settings, guided by the principle, "Anticipate the Risk, Adapt the Practice, and Act in Time."

We hope this document will serve as a comprehensive resource for KVKs/ATARIs, SAUs, State Agriculture and allied sectors, district administration and other agencies engaged in safeguarding Indian agriculture from El Nino induced climatic stress. By planning, climate-resilient technologies, and location-specific interventions, it aims to reduce production risks, enhance resource-use efficiency, strengthen resilience, and contribute to sustainable agricultural development.

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Place: New Delhi
Date: 24th June 2026

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Background

India's agriculture remains highly dependent on the South-West Monsoon. Variability in monsoon rainfall due to climate change and phenomena such as El Niño often results in drought conditions, adversely affecting crop production, livestock, water resources, and rural livelihoods. Nearly half of India's net cultivated area is under rainfed which is vulnerable to rainfall deficits and prolonged dry spells. Historical evidence indicates the potential impact of El Niño on Indian agriculture. During the year 1991-92, when monsoon rainfall was 91 percent of Long Period Average (LPA), kharif production declined by 7 percent. During the strong El Niño year of 2015-16, monsoon rainfall declined to 86 percent of LPA, resulting in reduced agricultural output by 5 percent, compared to the normal rainfall year of 2013-14. Although, the relationship between El Niño and monsoon performance is not always direct, the phenomenon increases uncertainty and necessitates preparedness.

Role of KVKs

Krishi Vigyan Kendras (KVKs) are district-level frontline agricultural extension system established by the Indian Council of Agricultural Research (ICAR) to serve as a bridge between agricultural research institutions and farming communities. With a network of 731 KVKs spread across the country, they form one of the world's largest grassroots agricultural extension systems. KVKs play a pivotal role in strengthening the resilience of farming communities against droughts, delayed monsoons, erratic rainfall, and other climate-related challenges. Through technology assessment, demonstration, and dissemination, KVKs contribute significantly to sustainable livelihood security for farmers. In view of KVKs' unique inter-connecting network with grassroot extension system and line departments across the country, they will play a pivotal role to mitigate the El Nino impact in agriculture sector.

The Standard Operating Procedure (SOP) for KVKs to Manage El Niño-Induced Weather Conditions

The standard operating procedure begins operation at the national level, ICAR Headquarters (DDG Extension & Natural Resource Management) through the El Niño Monitoring and Management Cell functions as the central coordinating and decision-support platform. The Cell consolidates information received from IMD, MNCFC, CRIDA, AICRPAM, and other relevant agencies to assess emerging risks and formulate strategic responses. Policy support and institutional convergence are ensured through close coordination with the Department of Agriculture and Farmers Welfare (DA&FW) and the Department of Agricultural Research and Education (DARE). DA&FW facilitates alignment of contingency measures with ongoing government schemes, supports resource mobilization, and promotes dissemination of advisories through national agricultural platforms and state departments. DARE provides strategic direction for research prioritization, innovation, and inter-institutional collaboration, thereby strengthening the

scientific foundation of advisory services and ensuring the availability of validated technologies for climate risk management.

The most critical component of the entire framework is the network of Krishi Vigyan Kendras (KVKs), which serve as the frontline extension mechanism for implementing El Niño mitigation strategies. KVKs act as the primary interface between scientific institutions and farming communities. Based on advisories and contingency plans received through the ICAR system, KVKs conduct awareness campaigns, frontline demonstrations, farmer trainings, field visits, diagnostic surveys, and stakeholder consultations. They promote climate-resilient crop planning, alternative cropping systems, moisture conservation technologies, efficient water management practices, integrated nutrient management, pest and disease surveillance, fodder security measures, and livestock management interventions. KVKs also facilitate dissemination of advisories through mobile messaging, social media platforms, farmer groups, community radio, local institutions, and digital extension tools.

An equally important function of KVKs is the collection of field-level feedback regarding weather impacts, crop performance, emerging challenges, and adoption of recommended practices. This feedback is communicated to ATARIs, SAUs, ICAR institutes, and policy makers, enabling continuous refinement of advisories and contingency plans. Such two-way information flow strengthens the responsiveness, relevance, and effectiveness of the advisory system and ensures that interventions remain aligned with farmers' needs and local realities.

Following rA robust action plan for KVKs is designed keeping in view different abberations that may arise during the season. This includes delayed onset, early -season, mid-season and late-season drought. The roles and responsibilities of different stake holders to deal with different situations is defined. The information flow, triggering points for actions, monitoring and implementation of different stakeholders is elaborated in the action plan.

Following are the action plan matrix to be followed by the KVK for effectively managing the El Nino

1. **Pre-Monsoon Preparedness**

A robust action plan for KVKs is designed keeping in view different aberrations that may arise during the season. This includes delayed onset, early -season, mid-season and late-season drought. The roles and responsibilities of different stake holders to deal with different situations is defined. The information flow, triggering points for actions, monitoring and implementation of different stakeholders is elaborated in the action plan.

The first step in drought management is “preparedness” before the onset of the monsoon. KVKs in collaboration with other ICAR institutes and SAUs may assess vulnerability at block level to identify drought-prone blocks, rainfed farming areas, water-scarce villages, dominant cropping systems, and vulnerable livestock populations. Seed preparedness is equally important and require utmost attention. Promotion of climate resilient crops and crop varieties with advanced information to farmers suggesting alternative options under delayed rainfall situations is required to be given to farming community. Water conservation measures will be given top priority. For this, farm ponds, check dams, percolation tanks, rainwater harvesting structures, and desilting of water bodies through

farmer participatory and community mobilisation will be promoted aggressively. Sensitisation about the judicious use of every drop of harvested water will be reserved for life-saving irrigation during critical crop growth stages. Simultaneously, capacity development on climate-resilience, drought proofing, rain water harvesting, soil moisture conservation, micro-irrigation, and integrated nutrient management is planned and given top priority before the monsoon season.

2. Managing Delayed Monsoon Conditions

When monsoon onset is delayed by one to two weeks, farmers will be advised to continue with normal crops using short-duration varieties. Suitable technologies like seed treatment, increased seed rate, closer spacing and ridge-and-furrow planting techniques will be encouraged. If delays extend to two to four weeks, agro-advisories on replacing long-duration crops with drought-tolerant crop alternatives such as pearl millet, finger millet, green gram, black gram, cowpea, and sesame will be communicated and demonstrated. Besides, intercropping options involving pulses and oilseeds will help reduce production risks. In cases, where monsoon delay exceeds four weeks, emphasis will shift towards cultivation of millets, pulses, and fodder crops. Further, sensitisation about community nurseries, direct seeding, and fodder banks will be establishment of fodder bank to support farmers and livestock owners. Alternatively, efforts will be made for availability of good quality seeds of climate resilient short duration varieties in sufficient quantities.

3. Mid-Season Drought Management

Mid-season drought occurs when crops are established but rainfall suddenly ceases affecting crop growth and development. To cope up such situations, KVKs will promote moisture conservation practices such as inter-cultivation, mulching, earthing-up, and dust mulching, foliar sprays of nutrients which help alleviate moisture stress. Wherever possible, life-saving irrigation will be provided using farm ponds and community reservoirs.

4. Terminal Drought Management

Terminal drought generally coincides with reproductive stages and often led to severe yield reductions. In such situations, KVKs will recommend applying life-saving irrigation, wherever possible, along with foliar nutrient applications, and prioritization of catch crops in case of crop failures. Severely affected crops can be harvested as fodder.

5. Strengthening Farmers' Preparedness and Adaptive Capacity

KVKs functioning under the administrative control of ICAR and their respective host institutions across the states, will play a pivotal role in enhancing the preparedness and adaptive capacity of farming communities to cope with drought situations. KVKs will undertake FLDs on drought-resilient technologies, including drought-tolerant and short-duration crop varieties, moisture conservation practices, seed priming, dry sowing, and life-saving irrigation techniques to improve farm resilience under water-stress conditions. In addition, capacity-building programmes on contingency crop planning, crop diversification, efficient water-use practices, and drought-proofing technologies will be organized. Skill development programmes on fodder conservation, feed and fodder management, and livestock care during drought conditions will also be conducted to strengthen the resilience of both crop and livestock production systems, thereby minimizing drought-induced losses.

6. Seed and Planting Material Production

KVKs are strengthening seed availability through farmer-participatory seed production, seed hubs, and community seed banks to ensure timely availability of quality seeds and planting materials of drought-tolerant, short-duration, and climate-resilient crop varieties. Special emphasis will be placed on varieties suitable for delayed sowing and moisture-stress conditions. During terminal drought, crop failure, or re-sowing situations, KVKs will facilitate the timely supply of seeds for contingency, catch and opportunity crops, along with technical guidance on their cultivation.

7. Soil and Water Conservation

KVKs will take-up large scale promotion of rainwater harvesting, farm ponds, and conservation agriculture practices, while providing soil health-based nutrient advisories to improve moisture conservation and resource-use efficiency. Water harvesting to be promoted through campaigns with a slogan – "Khet ka Pani Khet Mein" and "Gaon ka Pani Gaon Mein".

8. Advisory and Information Dissemination Services

KVKs can disseminate weather-based customized and contextualized agro-advisories to address crop contingency plans through Digital platforms like Kisan Sarathi, Bharat VISTAAR, social media handles, and farmer meetings, while organizing field days and Kisan *Goshthis* to promote drought-coping technologies.

9. Custom Hiring Centres (CHCs)

Existing CHCs to provide local access to farm machinery at affordable rental basis particularly small and resource-poor farmers, without the burden of outright purchase.

10. Propagation of Forecast

The All India Coordinated Research Project on Agro-meteorology (AICRP-AM) is monitoring the progress of southwest monsoon 2026, compiling daily rainfall status at met sub-division level and appraising to the ICAR headquarters. These reports can be accessed at http://www.cropweatheroutlook.in/crida/amis/Archivies/DRS_2026.jsp. ICAR-CRIDA is daily monitoring the overall crop situation of the country through its network centres under AICRP on Dryland Agriculture, AICRP-AM on Agro-meteorology and NICRA, and disseminating weather-based advisories twice a week (Tuesday and Friday), in consultation with state line departments. This information will be communicated to all KVKs for dissemination among farmers. The release of state-specific agro-advisories will help farmers to make timely and informed farm management decisions, leading to improved productivity and reduced weather-related risks.

11. Promotion of contingency Cropping plan

ICAR-CRIDA is conducting interface meetings with State Agriculture Departments to sensitize stakeholders on the potential impacts of El Niño and appropriate adaptation strategies, including contingency crop planning for managing mid-season and terminal droughts. So far, meetings have been organized with 12 states, namely Bihar, Karnataka, Telangana, Andhra Pradesh, Maharashtra, Rajasthan, Assam, Punjab, Gujarat, Uttar Pradesh, and West Bengal. Based on rainfall forecasts, about 320 districts have been identified as potentially vulnerable to rainfall deficits, and district-specific contingency crop plans are being prepared for these areas. In addition, updated District Agriculture Contingency Plans (DACPs) for 514 districts have already been developed and shared with

the respective State Departments for timely implementation. KVKs and State department of agriculture are working closely to implement contingent measures to increase adaptive capacity of farmers to mitigate adverse impact of El Nino induced drought condition.

12. Balanced fertilisers and natural farming

Soil test-based balanced nutrient management, including the use of organic manures, bio-inputs, and green manuring, will be promoted to improve soil health, enhance moisture retention, and increase crop resilience under drought conditions. Natural farming practices will also be integrated into the campaign to support sustainable resource management and reduce the adverse impacts of moisture stress.

13. **Collaborative and Convergence Programmes**

The KVK network will facilitate convergence with ongoing Central and State Government schemes, ensuring effective coordination among stakeholders and providing last-mile delivery of drought management interventions, technologies, and support services to farming communities.

- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)**: To promote micro-irrigation, water-use efficiency, and "Per Drop More Crop" demonstrations supporting drought-proofing.
- **Rainfed Area Development (RAD):** Under National Mission for Sustainable Agriculture (NMSA) – basis for FLDs on integrated farming systems and in-situ moisture conservation.
- **National Food Security Mission (NFSM)** and **Sub-Mission on Seed and Planting Material (SMSP):** Support for production and distribution of drought-tolerant/short-duration seed varieties.
- **Soil Health Card Scheme**: Nutrient management advisories disseminated by KVKs to improve moisture retention and input efficiency.
- **Gramin Krishi Mausam Sewa (GKMS):** District-specific weather-based agro-advisories under the GKMS programme in collaboration with IMD and ICAR to support timely farm decisions during drought and erratic monsoon conditions.
- **Viksit Bharat–Guarantee for Rozgar and Ajeevika Mission, Gramin (VB-GRAM G):** Provide convergence for water harvesting structures, farm ponds, and land development works.
- **Pradhan Mantri Fasal Bima Yojana (PMFBY)**: KVKs will create farmer awareness on crop insurance as a drought risk-mitigation tool.
- **National Pest Surveillance System (NPSS):** An AI-powered initiative designed to monitor pest infestations, predict outbreaks, and provide farmers with real-time, localized crop health advisories, ultimately helping farmers to prevent crop epidemics and minimize yield loss

Expected outcome

Through the above programmes, KVKs serve as the critical last-mile link between research institutions and farming communities, ensuring that scientifically validated drought-coping technologies and contingency plans reach the field in a timely and effective manner, thereby strengthening farmer resilience against below-normal monsoon and drought conditions.

The guiding principle for KVKs

"Anticipate the Risk, Adapt the Practice, and Act in Time."

कार्यकारी सारांश

भारतीय कृषि में एल नीनो जोखिम प्रबंधन: प्रभाव एवं मानक संचालन प्रक्रिया (SOP)

भारत की कृषि दक्षिण-पश्चिम मानसून पर अत्यधिक निर्भर है। जलवायु परिवर्तन तथा एल नीनो जैसी घटनाओं के कारण मानसूनी वर्षा में होने वाली अनिश्चितता प्रायः सूखे की स्थिति उत्पन्न करती है, जिससे फसल उत्पादन, पशुधन, जल संसाधनों तथा ग्रामीण आजीविका पर प्रतिकूल प्रभाव पड़ता है। भारत का लगभग आधा शुद्ध बुवाई क्षेत्र वर्षा आधारित है, जो वर्षा की कमी एवं लंबे शुष्क अंतरालों के प्रति अत्यधिक संवेदनशील है। ऐतिहासिक आंकड़े दर्शाते हैं कि एल नीनो का भारतीय कृषि पर महत्वपूर्ण प्रभाव पड़ सकता है। वर्ष 1991-92 में, जब मानसूनी वर्षा दीर्घकालिक औसत (LPA) का 91 प्रतिशत रही, तब खरीफ उत्पादन में 7 प्रतिशत की कमी दर्ज की गई। इसी प्रकार, 2015-16 के प्रबल एल नीनो वर्ष में मानसूनी वर्षा घटकर LPA के 86 प्रतिशत तक रह गई, जिसके परिणामस्वरूप सामान्य वर्ष 2013-14 की तुलना में कृषि उत्पादन में लगभग 5 प्रतिशत की गिरावट आई। यद्यपि एल नीनो और मानसून के बीच संबंध हमेशा प्रत्यक्ष नहीं होता, फिर भी यह कृषि क्षेत्र में अनिश्चितता बढ़ाता है और पूर्व तैयारी की आवश्यकता को रेखांकित करता है।

कृषि विज्ञान केंद्रों (KVKs) की भूमिका

कृषि विज्ञान केंद्र (KVKs), भारतीय कृषि अनुसंधान परिषद (ICAR) द्वारा स्थापित जिला स्तरीय अग्रिम पंक्ति विस्तार संस्थान हैं, जो कृषि अनुसंधान संस्थानों और कृषक समुदाय के बीच सेतु का कार्य करते हैं। देशभर में 731 कृषि विज्ञान केंद्रों का नेटवर्क विश्व की सबसे बड़ी जमीनी कृषि विस्तार प्रणालियों में से एक है। केवीके सूखा, विलंबित मानसून, अनियमित वर्षा तथा अन्य जलवायु संबंधी चुनौतियों के प्रति कृषकों की अनुकूलन क्षमता एवं लचीलापन बढ़ाने में महत्वपूर्ण भूमिका निभाते हैं। प्रौद्योगिकी मूल्यांकन, प्रदर्शन तथा प्रसार के माध्यम से ये किसानों की सतत आजीविका सुरक्षा में महत्वपूर्ण योगदान देते हैं। अपने व्यापक नेटवर्क तथा राज्य कृषि विभागों एवं अन्य हितधारकों के साथ समन्वय के कारण, केवीके एल नीनो के कृषि क्षेत्र पर पड़ने वाले प्रभावों को कम करने में केंद्रीय भूमिका निभाएंगे।

एल नीनो जनित मौसमीय परिस्थितियों के प्रबंधन हेतु कृषि विज्ञान केंद्रों की मानक संचालन प्रक्रिया (SOP)

यह मानक संचालन प्रक्रिया (**SOP)** राष्ट्रीय स्तर पर आईसीएआर मुख्यालय (उप महानिदेशक – कृषि प्रसार एवं प्राकृतिक संसाधन प्रबंधन) के अंतर्गत स्थापित एल नीनो निगरानी एवं प्रबंधन प्रकोष्ठ (**El Niño Monitoring and Management Cell)** से संचालित होती है**,** जो एक केंद्रीय समन्वय एवं निर्णय-सहायता मंच के रूप में कार्य करता है। यह प्रकोष्ठ भारतीय मौसम विज्ञान विभाग (**IMD),** मॉनिटरिंग एवं एनालिसिस ऑफ क्रॉप्स प्रोग्राम (**MNCFC),** केंद्रीय शुष्कभूमि कृषि अनुसंधान संस्थान (**CRIDA),** अखिल भारतीय समन्वित कृषि मौसम विज्ञान अनुसंधान परियोजना (**AICRPAM)** तथा अन्य संबंधित संस्थाओं से प्राप्त सूचनाओं का समेकन कर संभावित जोखिमों का आकलन करता है और रणनीतिक प्रतिक्रियाएँ तैयार करता है।

नीतिगत समर्थन एवं संस्थागत अभिसरण सुनिश्चित करने के लिए यह प्रकोष्ठ कृषि एवं किसान कल्याण विभाग (**DA&FW)** तथा कृषि अनुसंधान एवं शिक्षा विभाग (**DARE)** के साथ घनिष्ठ समन्वय बनाए रखता है। **DA&FW** आकस्मिकता (**Contingency)** उपायों को विभिन्न सरकारी योजनाओं के साथ जोड़ने**,** संसाधनों की उपलब्धता सुनिश्चित करने तथा राष्ट्रीय कृषि प्लेटफॉर्मों एवं राज्य स्तरीय विभागों के माध्यम से परामर्शों (**Advisories)** के प्रसार में सहायता प्रदान करता है। वहीं **DARE** अनुसंधान प्राथमिकताओं**,** नवाचारों तथा विभिन्न संस्थानों के

बीच सहयोग को रणनीतिक दिशा प्रदान करता है, जिससे परामर्श सेवाओं का वैज्ञानिक आधार सुदृढ़ होता है और जलवायु जोखिम प्रबंधन के लिए प्रमाणित तकनीकों की उपलब्धता सुनिश्चित होती है।

इस संपूर्ण व्यवस्था का सबसे महत्वपूर्ण घटक कृषि विज्ञान केंद्रों (**KVKs)** का नेटवर्क है, जो एल नीनो से उत्पन्न चुनौतियों के समाधान हेतु अग्रिम पंक्ति की विस्तार (**Extension)** प्रणाली के रूप में कार्य करता है। **KVKs** वैज्ञानिक संस्थानों और कृषक समुदाय के बीच एक प्रमुख सेतु की भूमिका निभाते हैं। आईसीएआर प्रणाली के माध्यम से प्राप्त परामर्शों एवं आकस्मिकता योजनाओं के आधार पर **KVKs** जागरूकता अभियान, अग्रिम पंक्ति प्रदर्शन (**Frontline Demonstrations),** किसान प्रशिक्षण, क्षेत्र भ्रमण, निदानात्मक सर्वेक्षण तथा विभिन्न हितधारकों के साथ परामर्श आयोजित करते हैं।

KVKs जलवायु-सहिष्णु फसल नियोजन, वैकल्पिक फसल प्रणालियों, नमी संरक्षण तकनीकों, कुशल जल प्रबंधन पद्धतियों, समेकित पोषक तत्व प्रबंधन, कीट एवं रोग निगरानी, चारा सुरक्षा उपायों तथा पशुधन प्रबंधन हस्तक्षेपों को बढ़ावा देते हैं। इसके अतिरिक्त वे मोबाइल संदेशों, सोशल मीडिया प्लेटफॉर्मों, किसान समूहों, सामुदायिक रेडियो, स्थानीय संस्थाओं तथा डिजिटल विस्तार साधनों के माध्यम से कृषि परामर्शों का व्यापक प्रसार सुनिश्चित करते हैं।

KVKs की एक अन्य महत्वपूर्ण भूमिका क्षेत्र स्तर से मौसमीय प्रभावों, फसल प्रदर्शन, उभरती समस्याओं तथा अनुशंसित तकनीकों को अपनाने की स्थिति से संबंधित फीडबैक एकत्र करना है। यह फीडबैक कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थानों (**ATARIs),** राज्य कृषि विश्वविद्यालयों (**SAUs),** आईसीएआर संस्थानों तथा नीति-निर्माताओं तक पहुँचाया जाता है, जिससे परामर्शों एवं आकस्मिकता योजनाओं का निरंतर परिष्करण संभव हो पाता है। इस प्रकार की द्वि-दिशात्मक सूचना प्रणाली परामर्श सेवाओं की उत्तरदायित्व क्षमता, प्रासंगिकता और प्रभावशीलता को सुदृढ़ बनाती है तथा यह सुनिश्चित करती है कि सभी हस्तक्षेप किसानों की आवश्यकताओं और स्थानीय परिस्थितियों के अनुरूप हों।

KVKs के लिए एक सुदृढ़ कार्ययोजना (**Action Plan)** तैयार की गई है, जिसमें मौसम के दौरान उत्पन्न होने वाली विभिन्न प्रकार की असामान्य परिस्थितियों (**Aberrations)** को ध्यान में रखा गया है। इनमें मानसून के आगमन में विलंब (**Delayed Onset),** प्रारंभिक मौसमीय सूखा (**Early-Season Drought),** मध्य मौसमीय सूखा (**Mid-Season Drought)** तथा अंतिम मौसमीय सूखा (**Late-Season Drought)** जैसी स्थितियाँ शामिल हैं।

इन परिस्थितियों से प्रभावी ढंग से निपटने हेतु विभिन्न हितधारकों की भूमिकाएँ एवं जिम्मेदारियाँ स्पष्ट रूप से परिभाषित की गई हैं। कार्ययोजना में सूचना प्रवाह (**Information Flow),** कार्रवाई प्रारंभ करने के संकेतक बिंदु (**Trigger Points),** निगरानी व्यवस्था तथा विभिन्न हितधारकों द्वारा किए जाने वाले क्रियान्वयन तंत्र का विस्तार से वर्णन किया गया है।

एल नीनो की परिस्थितियों का प्रभावी प्रबंधन सुनिश्चित करने हेतु **KVKs** द्वारा अनुसरण किए जाने वाले कार्ययोजना मैट्रिक्स (**Action Plan Matrix)** निम्नलिखित हैं।

1. मानसून पूर्व तैयारी

सूखा प्रबंधन का प्रथम चरण मानसून आगमन से पूर्व तैयारी है। केवीके, आईसीएआर संस्थानों एवं राज्य कृषि विश्वविद्यालयों के सहयोग से ब्लॉक स्तर पर संवेदनशील क्षेत्रों की पहचान करेंगे। इसमें सूखा-प्रवण क्षेत्र, वर्षा आधारित कृषि क्षेत्र, जल-संकटग्रस्त गांव, प्रमुख फसल प्रणालियां एवं संवेदनशील पशुधन आबादी शामिल

होगी। जलवायु-सहिष्णु फसलों एवं किस्मों का प्रचार-प्रसार, वैकल्पिक फसल विकल्पों की अग्रिम जानकारी, बीज उपलब्धता सुनिश्चित करना तथा जल संरक्षण संरचनाओं जैसे खेत तालाब, चेक डैम, परकोलेशन टैंक, वर्षा जल संचयन संरचनाओं एवं जलाशयों के गहरीकरण को बढ़ावा दिया जाएगा। साथ ही, वर्षा जल संरक्षण, मृदा नमी संरक्षण, सूक्ष्म सिंचाई एवं समेकित पोषण प्रबंधन पर क्षमता निर्माण कार्यक्रम आयोजित किए जाएंगे।

2. विलंबित मानसून की स्थिति का प्रबंधन

- **1–2 सप्ताह की देरी**: अल्पावधि किस्मों के साथ सामान्य फसलों की खेती जारी रखने की सलाह।
- **2–4 सप्ताह की देरी**: लंबी अवधि वाली फसलों के स्थान पर बाजरा, रागी, मूंग, उड़द, लोबिया एवं तिल जैसी सूखा-सहिष्णु फसलों को अपनाने की सलाह।
- **4 सप्ताह से अधिक देरी**: मोटे अनाज, दलहन एवं चारा फसलों को प्राथमिकता; सामुदायिक नर्सरी, प्रत्यक्ष बुवाई तथा चारा बैंक की स्थापना को बढ़ावा।

3. मध्यावधि सूखा प्रबंधन

फसल स्थापना के बाद वर्षा रुक जाने की स्थिति में नमी संरक्षण उपाय जैसे अंतर-खरपतवार नियंत्रण, मल्चिंग, मिट्टी चढ़ाना, धूल मल्चिंग एवं पोषक तत्वों के पर्णीय छिड़काव को बढ़ावा दिया जाएगा। जहां संभव हो, खेत तालाबों एवं सामुदायिक जलाशयों से जीवन रक्षक सिंचाई प्रदान की जाएगी।

4. अंतिम चरण (टर्मिनल) सूखा प्रबंधन

फसल की प्रजनन अवस्था में सूखे की स्थिति में जीवन रक्षक सिंचाई, पर्णीय पोषण, वैकल्पिक फसलों का चयन तथा गंभीर रूप से प्रभावित फसलों को चारे के रूप में उपयोग करने की सलाह दी जाएगी।

5. किसानों की तैयारी एवं अनुकूलन क्षमता को सुदृढ़ करना

केवीके सूखा-सहिष्णु तकनीकों, अल्पावधि किस्मों, नमी संरक्षण, बीज प्राइमिंग, सूखी बुवाई तथा जीवन रक्षक सिंचाई पर अग्रिम पंक्ति प्रदर्शन (FLDs) आयोजित करेंगे। इसके अतिरिक्त, आकस्मिक फसल योजना, फसल विविधीकरण, जल उपयोग दक्षता एवं सूखा-रोधी तकनीकों पर प्रशिक्षण कार्यक्रम संचालित किए जाएंगे।

6. बीज एवं रोपण सामग्री उत्पादन

किसान सहभागिता आधारित बीज उत्पादन, बीज हब एवं सामुदायिक बीज बैंक के माध्यम से गुणवत्तायुक्त एवं जलवायु-सहिष्णु बीजों की उपलब्धता सुनिश्चित की जाएगी। पुनर्बुवाई एवं आकस्मिक परिस्थितियों हेतु बीज उपलब्ध कराने की व्यवस्था भी की जाएगी।

7. मृदा एवं जल संरक्षण

वर्षा जल संचयन, खेत तालाब, संरक्षण कृषि तथा मृदा स्वास्थ्य आधारित पोषण प्रबंधन को बढ़ावा दिया जाएगा। "खेत का पानी खेत में" तथा "गांव का पानी गांव में" जैसे जन-अभियानों को प्रोत्साहित किया जाएगा।

8. परामर्श एवं सूचना प्रसार सेवाएं

केवीके मौसम आधारित स्थानीयकृत कृषि परामर्शों का प्रसार किसान सारथी, भारत विस्तार, सोशल मीडिया, किसान गोष्ठियों एवं क्षेत्रीय प्रदर्शनों के माध्यम से करेंगे।

9. कस्टम हायरिंग सेंटर (CHCs)

लघु एवं सीमांत किसानों को सस्ती दरों पर कृषि यंत्र उपलब्ध कराने हेतु कस्टम हायरिंग केंद्रों का उपयोग किया जाएगा।

10. मौसम पूर्वानुमान का प्रसार
आईसीएआर-क्रिडा एवं एआईसीआरपी-एएम द्वारा तैयार मौसम आधारित कृषि परामर्शों को सप्ताह में दो बार किसानों तक पहुंचाया जाएगा, जिससे वे समय पर कृषि प्रबंधन संबंधी निर्णय ले सकें।

11. आकस्मिक फसल योजना (Contingency Crop Plan)
संभावित वर्षा कमी वाले जिलों के लिए जिला कृषि आकस्मिक योजनाओं (DACPs) के कार्यान्वयन में केवीके एवं राज्य कृषि विभाग मिलकर कार्य करेंगे।

12. संतुलित उर्वरक उपयोग एवं प्राकृतिक खेती
मृदा परीक्षण आधारित पोषण प्रबंधन, जैविक खाद, जैव-इनपुट, हरी खाद एवं प्राकृतिक खेती को बढ़ावा देकर मृदा स्वास्थ्य एवं नमी संरक्षण में सुधार किया जाएगा।

13. अभिसरण एवं समन्वित कार्यक्रम

- केवीके निम्नलिखित योजनाओं के साथ अभिसरण सुनिश्चित करेंगे:
- प्रधानमंत्री कृषि सिंचाई योजना (PMKSY)
- राष्ट्रीय सतत कृषि मिशन (NMSA)
- राष्ट्रीय खाद्य सुरक्षा मिशन (NFSM)
- मृदा स्वास्थ्य कार्ड योजना
- ग्रामीण कृषि मौसम सेवा (GKMS)
- प्रधानमंत्री फसल बीमा योजना (PMFBY)
- राष्ट्रीय कीट निगरानी प्रणाली (NPSS)
- अन्य राज्य एवं केंद्र प्रायोजित कार्यक्रम
-

संस्थागत व्यवस्था
आईसीएआर मुख्यालय में स्थापित एल नीनो मॉनिटरिंग एवं प्रबंधन प्रकोष्ठ राष्ट्रीय स्तर पर समन्वय एवं निर्णय समर्थन मंच के रूप में कार्य करेगा। यह प्रकोष्ठ आईएमडी, एमएनसीएफसी, क्रिडा तथा अन्य संस्थानों से प्राप्त सूचनाओं का विश्लेषण कर रणनीतिक निर्णय तैयार करेगा।

अपेक्षित परिणाम
उपरोक्त कार्यक्रमों के माध्यम से कृषि विज्ञान केंद्र अनुसंधान संस्थानों एवं किसानों के बीच एक प्रभावी अंतिम कड़ी (Last Mile Link) के रूप में कार्य करेंगे, जिससे वैज्ञानिक रूप से प्रमाणित सूखा प्रबंधन तकनीकों एवं आकस्मिक योजनाओं का समयबद्ध प्रसार सुनिश्चित होगा तथा किसानों की जलवायु अनिश्चितताओं एवं सूखे के प्रति अनुकूलन क्षमता सुदृढ़ होगी।

मार्गदर्शक सिद्धांत: "सटीक पूर्वानुमान, बेहतर तैयारी, सामूहिक कार्रवाई — सूखा प्रबंधन की कुंजी।"

Detailed Report

Managing El Nino Risks in Indian Agriculture: Impacts and Standard Operating Procedure

The Indian Summer Monsoon Rainfall (ISMR) is a complex atmospheric phenomenon, usually occurs from June to September, is a substantial aspect of the global monsoon system. It is distinguished by strong winds blowing from the southwest over the northern Indian Ocean (NIO) and the subcontinent of South Asia. ISMR contributes about 75 % of India's annual precipitation, rendering it essential for the agriculture sector, as nearly half of the total cultivated area depends on rainfall. Any delay, deficiency, or irregularity in monsoon rainfall can significantly affect the overall agricultural production. Monsson rains significant impact the region's agriculture, water resources management, and overall socioeconomic conditions. Although the inter-annual variability is limited, with a standard deviation of 10 % of the mean, the variability in ISMR substantially affects the nation's economy, as agriculture contributes about 19.9 % to the total Gross Domestic Product (GDP).

Overview of El Nino

The term El Niño refers to a warming of the ocean surface, or above-average sea surface temperatures (SST) in the central and eastern Equatorial Pacific Ocean. Reverse of it, known as La Nina, refers to below-average sea surface in that region. The pattern shifts back and forth irregularly every two to seven years, bringing predictable changes in ocean temperature and disrupting the normal wind and rainfall patterns across many parts of the globe including India. The SSTs are monitored over four zones over the eastern Equatorial Pacific Ocean (Figure 1). These regions are known as Nino 1+2 (0-10S, 90W-80W), Nino 3 (5N-5S, 150W-90W), Nino 3.4 (5N-5S, 170W-120W) and Nino 4 (5N-5S, 160E-150W). The most commonly used region is Niño 3.4, and the standard threshold has been a positive SST departure from normal greater than or equal to 0.5°C for averaged for three consecutive months.

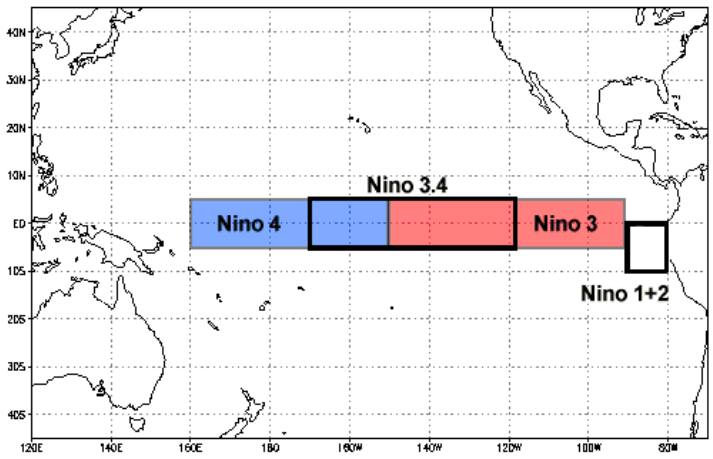


Figure 1. Nino Regions

El Nino is further classified into Weak, Moderate and Strong El Nino based on SST anomaly over Nino 3.4 regions with anomalies of 0.5 to 1, 1.0 to 1.5 and > 1.5 Degrees Celsius, respectively.

Relationship of El Nino with Indian Summer monsoon rainfall

Historically, many of the El Nino events have been observed to adversely impact the monsoon rainfall over India. In general, Indian SW monsoon is weaker than normal during the El Niño years. During the period 1951-2025, there were 17 El Niño years; and during 8 of these years Indian Summer Monsoon Rainfall (ISMR) was deficient (below normal by 10% or more) indicating an inverse but no one to one association between El Niño and ISMR. However, many of the other El Nino years received on the lower side of average, if not in deficient category(Figure 2).

The impact of El Niño on rainfall are not evenly distributed over time and space. The impacts have been observed to be significantly adverse during latter half of the monsoon season, particularly in September, indicating more frequent and severe water stress during terminal stages of the crops (Table 1). Geographically, the western half from country – northwest, west, and peninsular India are impacted more than the eastern parts. A composite of monsoon rainfall of the El Nino years (Figure 3) shows a clear east-west divide in monsoon deficiency across the country.

Also, the impactsare not uniformly distributed over the four monsoon months. During the month of June, rainfall deficiency has been higher over northern and central parts of the country. Rainfall deficiency during July is observed over South Peninsula, in addition to northwest, west and north India. Whereas, the deficiency is more prominent over western India and South Peninsula during August, it spreads over to entire northwest, west and central India also during the month of September.

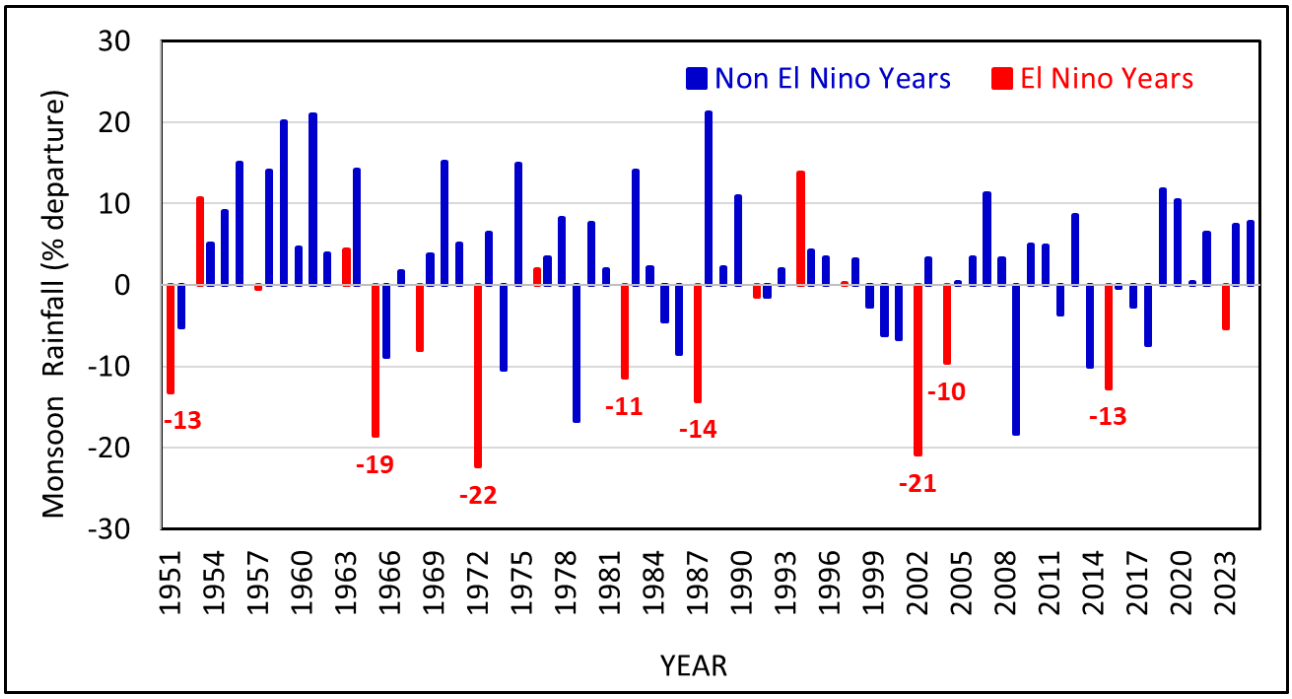


Figure 2. All India Southwest Monsoon Rainfall during El Nino and Non-El Nino years. Values of Rainfall anomaly for deficient years (anomaly -10% or lower) have been given

Table 1. Southwest monsoon Rainfall Anomalies (parentage departure from LPA) during El Niño years

Southwest monsoon Rainfall (parentage departure from LPA) during El Niño years						El Nino strength
YEAR	JUN	JUL	AUG	SEP	JJAS	
1951	-3.1	-11	-13.2	-26.6	-13.2	Weak El Nino
1953	-1.8	14.5	17.6	6.2	10.7	Weak El Nino
1957	-6.6	9	7.1	-21.6	-0.5	Moderate El Nino
1963	1	-8.4	24.6	-1.5	4.4	Weak El Nino
1965	-30.1	-4	-24.6	-22.5	-18.6	Moderate El Nino
1968	-10.5	10	-16	-23.3	-8	Weak El Nino
1972	-26.2	-27.2	-13.8	-23.2	-22.3	Moderate El Nino
1976	-4.8	4	15.1	-14.9	1.9	Weak El Nino
1982	-17.4	-17.8	8.3	-24.9	-11.4	Moderate El Nino
1987	-21.1	-21.5	-4.6	-10.3	-14.3	Moderate El Nino
1991	11.1	-1.2	2	-19.1	-1.4	Weak El Nino
1994	22.9	25.1	12.2	-11.3	13.9	Weak El Nino
1997	3.8	1.5	3.2	-10.2	0.2	Strong El Nino
2002	2.3	-50.6	-4.4	-19	-20.9	Weak El Nino
2004	0.6	-13.4	-0.8	-26.6	-9.6	Weak El Nino
2015	14	-14.4	-21.6	-22.6	-12.7	Moderate El Nino
2023	-7.5	12.8	-36.1	13.1	-5.3	Weak El Nino

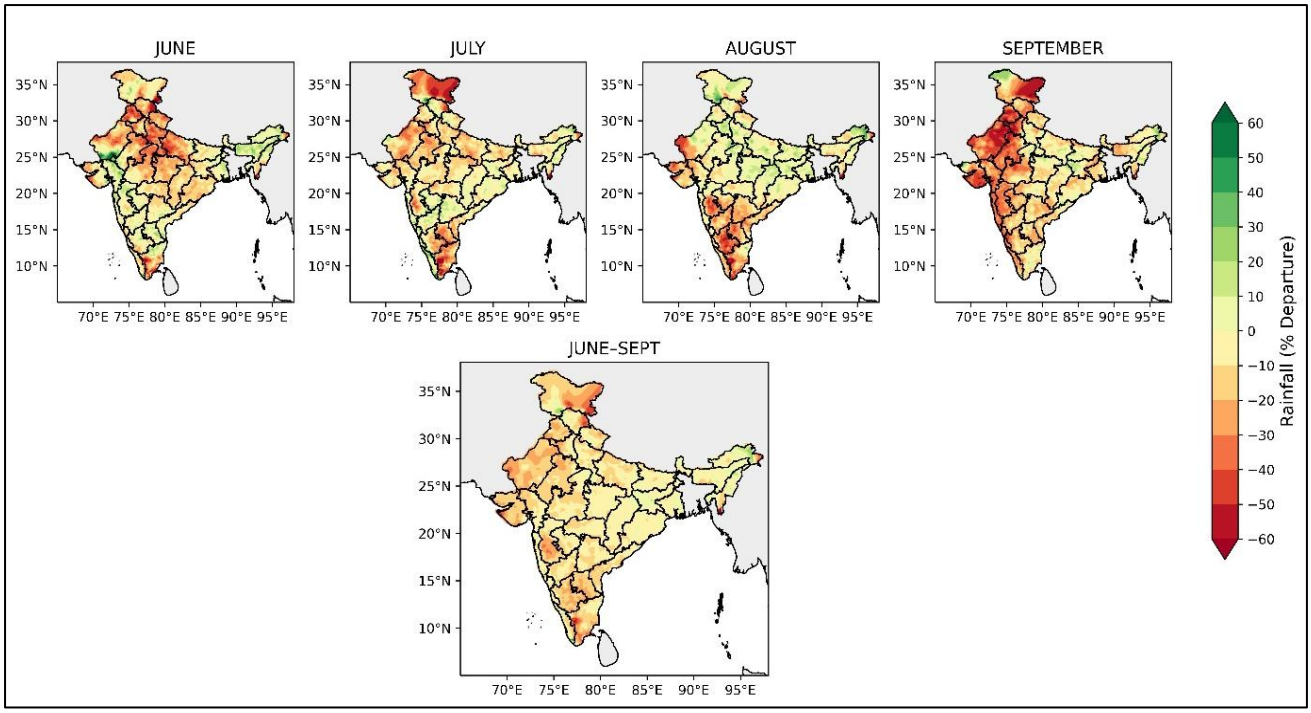


Figure 3. Composite rainfall of monsoon months and the season as a whole during El Nino years

Current El Nino conditions and outlook for the Monsoon 2026

The updated information from India Meteorological Department (IMD) and the World Meteorological Organisation (WMO) suggest that currently, El Niño conditions are present over the equatorial Pacific Ocean and are expected to strengthen further during the Southwest Monsoon season. The atmosphere has responded to the warming sea surface temperatures, and the coupled ocean–atmosphere system now exhibits characteristics consistent with El Niño conditions. Forecasts from the Monsoon Mission Coupled Forecast System (MMCFS) of India indicate a further strengthening of El Niño conditions during the Southwest Monsoon season. During May 2026, sea surface temperatures (SSTs) were generally above average across the equatorial central and eastern Pacific Ocean. Positive SST anomalies persisted over the far eastern Pacific, the Maritime Continent, and parts of the western Pacific. Above-average SSTs were also observed across the tropical and extratropical regions of both the North and South Pacific Oceans (Fig. 4a, b).

Forecast of three-month seasonally averaged SST anomalies over the Pacific Ocean indicates that positive SST anomalies are likely to prevail over the central equatorial Pacific Ocean during June–August (JJA), 2026. Thereafter, from July–September (JAS), 2026 onwards, positive SST anomalies are expected to strengthen and expand across the central and eastern equatorial Pacific Ocean. All members of the MMCFS are in close agreement in predicting El Nino conditions during the monsoon season 2026 (Figure 5). Accordingly, the probability forecasts also indicate 100% probability of moderate to strong El Niño conditions during the southwest monsoon season (Figure 6)

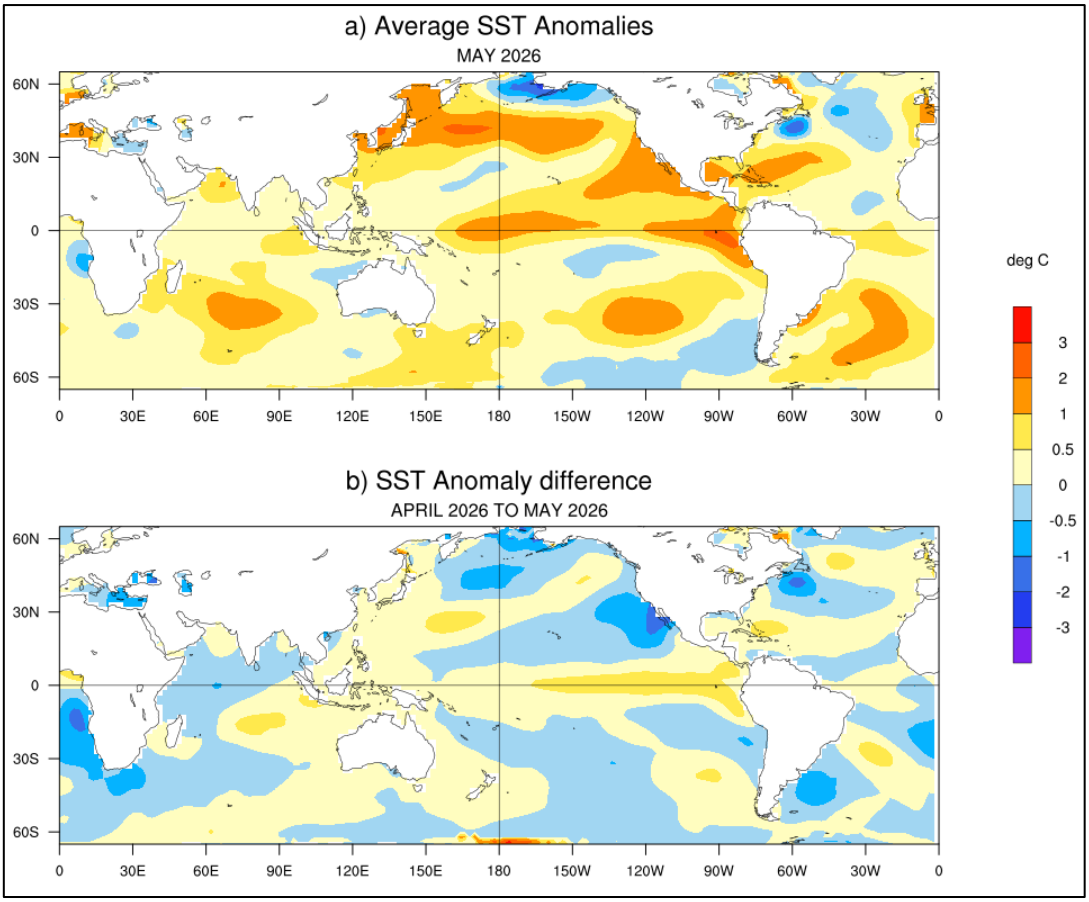


Figure 4. Sea surface temperature (SST) anomalies (deg. C) during May 2026 (a) and changes in the SST anomalies (deg C) from April 2026 to May 2026 (b).(https://imdpune.gov.in/cmpg/Product/Enso.php)

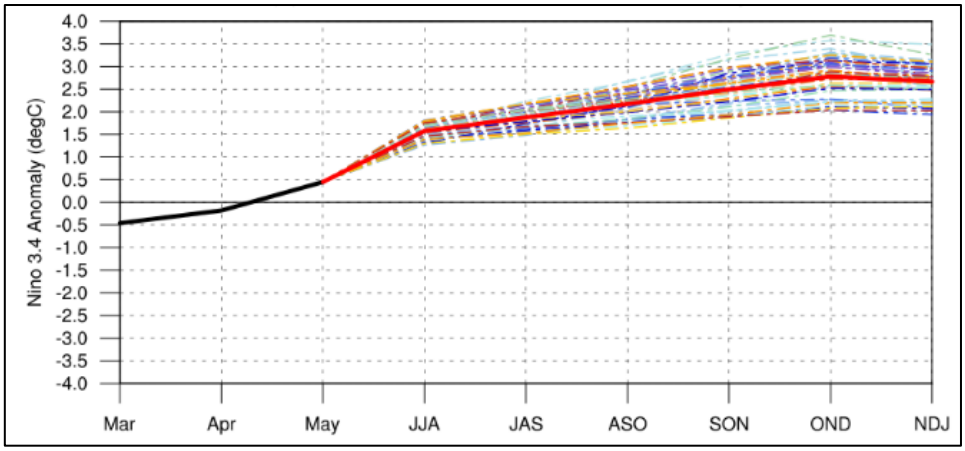


Fig.5: Forecast of Niño 3.4 SST(https://imdpune.gov.in/cmpg/Product/Enso.php)

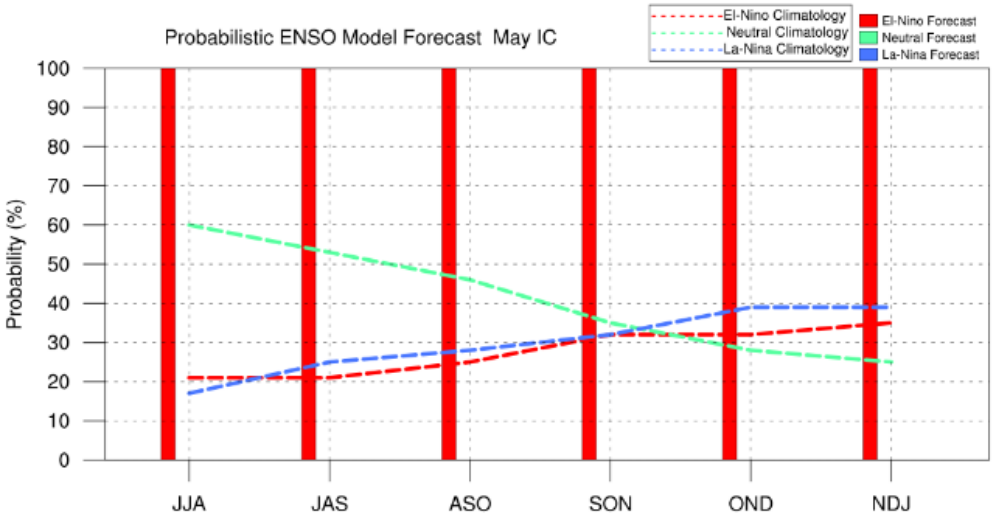


Fig 6. Probability forecast along with climatological probabilities of Niño 3.4 during different 3 month periods, 2026(https://imdpune.gov.in/cmpg/Product/Enso.php)

Forecasts from other global centres including NOAA, ECMWF and the WMO are in close agreement with the forecasts issued by IMD – all indicating a strong El Nino during monsoon 2026.The WMO, in its press release dated 02 June, 2026 has stated that 'Fueled by unusually warm ocean waters in the tropical Pacific, El Niño conditions are developing and are set to influence global temperature and rainfall patterns, increasing the risk of extreme weather over the coming months.' The WMO El Niño/La Niña update indicates an 80% likelihood of an El Niño event during June–August 2026. Probabilities for this to continue until at least November are near or above 90%. Though some uncertainty remains about El Niño peak strength and timing, most forecast models suggest it will be at least moderate – and possibly strong (https://wmo.int/news/media-centre/wmo-prepare-el-nino).

Rainfall outlook for Monsoon 2026:

IMD in itsLong-Range Forecast for Monsoon Season 2026, dated 29 May 2026, has predicted below normal rainfall for most parts of the country outside northeast India (Annexure 1). Highlights of this forecast are as follows:

- Quantitatively, the southwest monsoon seasonal rainfall over the country as a whole is likely to be 90% of the Long Period Average (LPA) with a model error of ±4%, indicating that below normal rainfall is most likely over the country as a whole during the monsoon season (June to September), 2026.
- The southwest monsoon seasonal (June to September, 2026) rainfall is most likely to be normal over Northeast India (94-106% of LPA) and below normal over Central & South Peninsular India (<94% of LPA) and over Northwest India (<92% of LPA).
- The southwest monsoon seasonal rainfall over the Monsoon Core Zone (MCZ) consisting of most of the rainfed agriculture areas in the country is most likely to be below normal (<94% of LPA).
- During June to September 2026, below-normal seasonal rainfall is most likely over most parts of the country, except some areas over Northwest and northeast India, eastern parts of south peninsula and adjoining areas of east-central India and isolated pockets of East India, where normal to above normal rainfall is likely.

The five category probability forecasts for the Seasonal (June to September) rainfall over the country as a whole during 2026 suggests 84% probability for below normal or less rainfall for the country as a whole. Probabilities of rainfall to be in different categories over the country as a whole are given inthe Table 2 below.

Table 2. Five category probability forecasts for the Seasonal (June to September) rainfall over the country as a whole during 2026

Category	Range (% LPA)	Forecast Probability (%)	Climatological Probability (%)
Deficient	< 90	**60**	16
Below Normal	> 90 - 95	**24**	17
Normal	96 - 104	14	33
Above Normal	> 105 - 110	2	16
Excess	> 110	0	17

Forecast for the Spatial Distribution of Rainfall over the Country during monsoon season, 2026: The spatial distribution of probabilistic forecasts for tercile categories (above normal, normal, and below normal) of seasonal rainfall (June to September, 2026) is depicted in Figure 7. It indicates that below-normal seasonal rainfall is most likely over most parts of the country, except some areas over Northwest & Northeast India, eastern parts of peninsular India and adjoining areas of east-central India and isolated pockets of East India, where normal to above normal rainfall is likely.

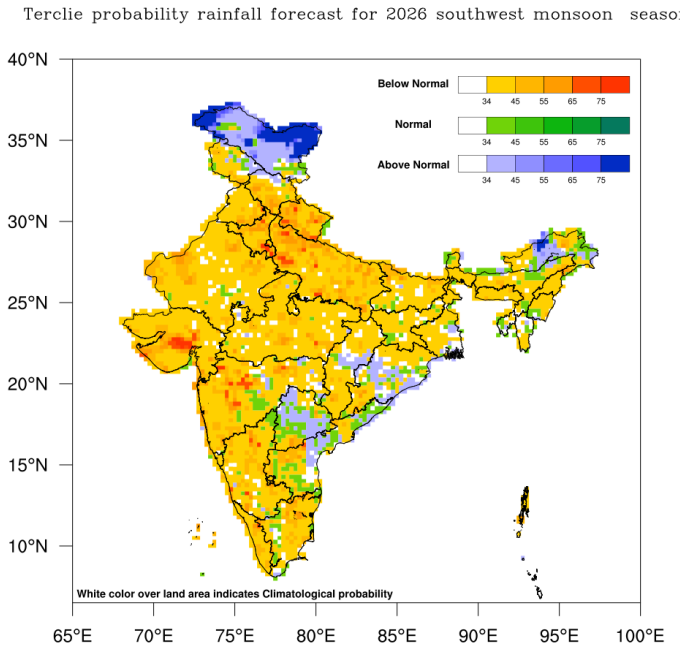


Figure 7. Most likely categories and probability forecast of tercile* categories (below normal, normal, and above normal) of rainfall over India during southwest monsoon season (June-September), 2026. The white shaded areas within the land region represent no signal from the model.(*Tercile categories have equal climatological probabilities, of 33.33% each).

Forecast for the Monsoon Rainfall over the four Homogenous regions of the country and Monsoon Core Zone (MCZ) during Monsoon Season, 2026: The tercile category forecasts for the four broad homogenous regions and MCZ (Figure 8) for the monsoon seasonal (June-September) rainfall during 2026 are given in Table 3 below. The table shows that probability of rainfall is highest to be in 'Below Normal' category in the 'Monsoon Core Zone' and in 'Northwest, Central and South Peninsula'. The MCZ which spans most of the rainfed agriculture land including parts of MP, Maharashtra, Gujarat, Jharkhand, and Chhattisgarh - carries a 43% below-normal probability, indicating heightened risk to agriculture in the largely rainfed zone spread across central parts of the country.

Forecasts for the four broad homogenous regions and MCZ for the monsoon seasonal (June-September) rainfall during 2026.

Region	Below Normal Range	Below Normal Prob (%)	Normal Prob (%)	Above Normal Prob (%)
Northwest India	**< 92% LPA**	**46**	**33**	**21**
Central India	**< 94% LPA**	**43**	**33**	**24**
South Peninsula	**< 94% LPA**	**45**	**34**	**21**
Northeast India	**< 94% LPA**	**33**	**35**	**32**
Monsoon Core Zone (MCZ)	**< 94% LPA**	**43**	**33**	**24**

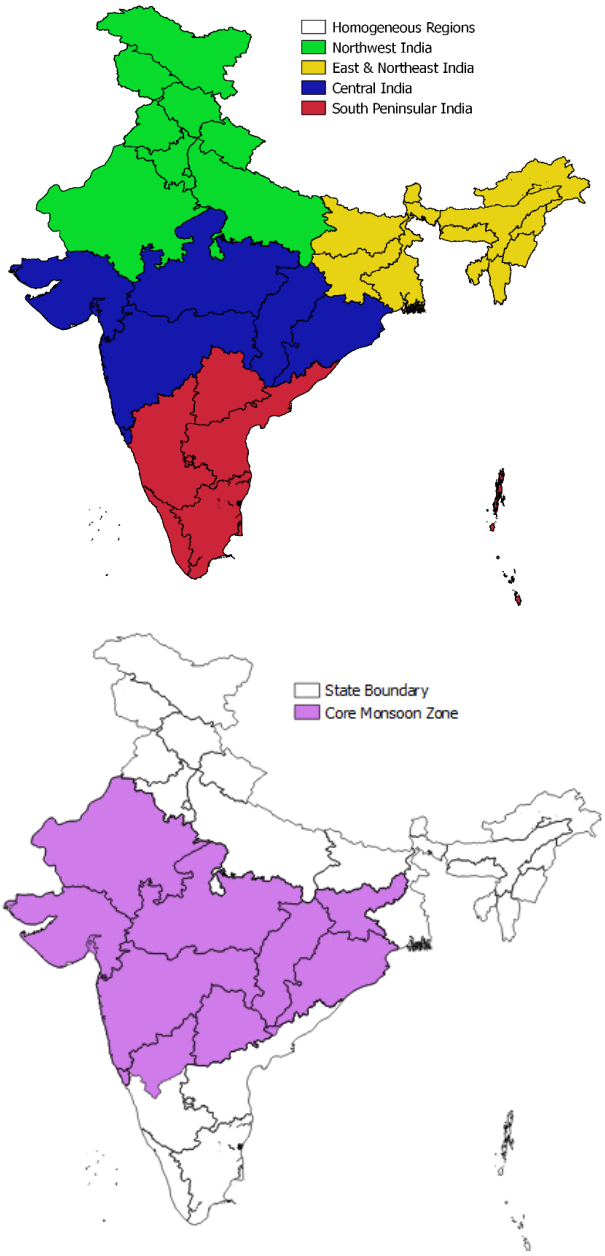


Figure 8. Geographical areas of different homogeneous regions and Monsoon Core Zone

Below-normal rainfall may lead to challenges for agriculture, water availability, hydropower generation, and ecosystem sustainability, along with increased risks of drought, heat stress, and pressure on drinking water resources. To minimize these impacts, strategies can include efficient water resource management, promotion of water conservation practices, contingency planning for agriculture, strengthening drought monitoring, use of early warning services of IMD, and enhancing preparedness measures in sectors that are particularly vulnerable to rainfall deficits.

Extended Range Forecast and short to medium range forecasting services of IMD: IMD also regularly prepares and provides extended range forecasts (7–day averaged forecasts for the next four weeks) for rainfall, maximum temperatures, and minimum temperatures over the country. These forecasts are updated every week on Thursday. These forecasts are based on the Multi-model Ensemble Dynamical Extended Range Forecasting System, which is currently operational at IMD. The forecasts are available through following page of IMD website.

https://mausam.imd.gov.in/imd_latest/contents/extendedrangeforecast.php

The extended range forecast is followed by short to medium range forecasts issued daily based on various very high resolution Global and Regional Models. The forecasts are available through IMD website; https://nwp.imd.gov.in/gfsproducts_cycle00_mausam.php

Onset and advancement of southwest (SW) Monsoon: The SW Monsoon set in over Keralam on 04 June – within normal range of +/- 7 days of the average date of 01 June. As on 20 June, the SW monsoon has covered entire Keralam, Goa, Andhra Pradesh and Tamilnadu& Pudduchery; many parts of Karnataka; and some parts of Maharashtra and Telangana. In eastern parts of the country, the SW monsoon has covered entire northeast; West Bengal& Sikkim; and some parts of Odisha, Jharkhand and Bihar. Monsoon current, however, has remained week so far. The country as a whole has received 41% deficient rainfall till 20 June, 2026 (actual rainfall 54.4 mm against normal rainfall of 92.8 mm). Meteorological Sub-division wise actual and normal rainfall along with departure from normal for the period 01 to 20 June, 2026 are given in Annexure 2. Out of 741 districts for which data were available at IMD website, a total of 496 districts have received deficient or large deficient rainfall since 01 June. No rainfall has been received in 9 districts so far.

Impact of El Nino on Rainfall at District level

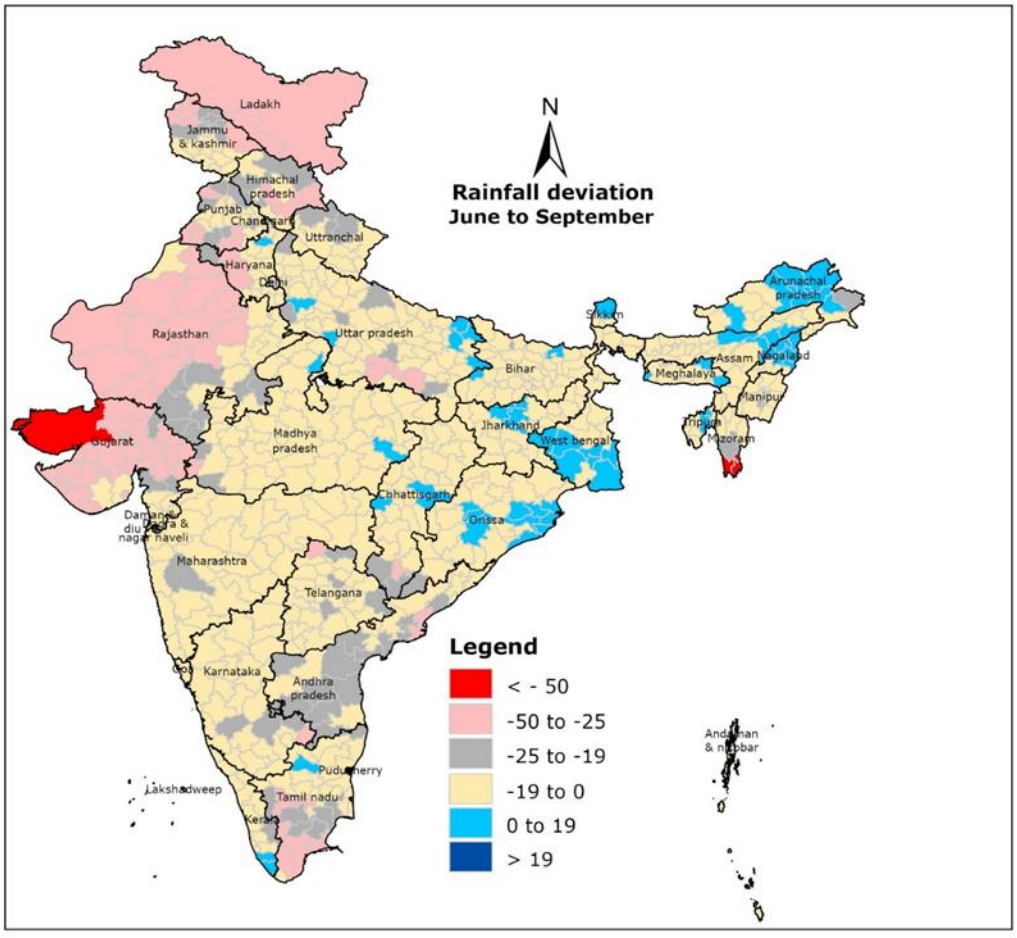
An analysis was made to assess the impact of El Nino on rainfall at district level using IMD's grid level data. El Nino years of moderate strength to very strong events recorded form 1961 were considered for the study. Analysis was carried out for each grid and then weighted average at the district considering about 722 districts.

Median deviation for each district was estimated for the whole season i.e June-September and for each month. Based on the quantum of median deviation districts were categorized under the category of Severe drought (more than 50% median deficit), moderate drought (25 to 50 deficit), mild drought (19 to 25%), normal rainfall with –ve bias (up to 19% deficit), normal rainfall with +ve bias (up to 19% above normal rainfall), excess rainfall (more than 19% of normal rainfall).

During the season i.e June-Sep, about 152 districts observed to had median deficit rainfall of more than 19% across the country. During June and September months, 399 and 415 districts respectively across the country were having a median deficit rainfall of more than 19%. For the months of July and August, the number of districts having median deficit of more than 19% were 286 and 206 respectively. Distribution of districts across deficit categories during different months is given below.

Deficiency category	June	July	Aug	Sep	June to Sep
Severe drought (<=-50)	69	36	18	120	3
Moderate drought (-25 to -50)	263	169	134	214	70
Mild drought (-19 to -25)	67	81	54	81	79
Normal (-ve 0 to -19)	252	324	363	232	506
Normal + 0 to 19	65	109	151	73	64
Excess >19	6	3	2	2	0

Figure 9: Spatial distribution of districts categorized into deficit/surplus during June-Sep month and for each month are given below.



State-wise Priority districts likely to be impacted by El Nino

State	< 25% irrigation (High Priority)	25-50% irrigation (Medium Priority)	>50% irrigation (Low Priority)	Total number of districts
Andhra Pradesh	1	2	-	3
Arunachal Pradesh	4		-	4
Assam	8	2	2	12
Bihar	-	4	8	12
Chhattisgarh	10	2	-	12
Goa	-	2	-	2
Gujarat	1	6	16	23
Haryana	-	-	5	5
Himachal Pradesh	5	4	1	10
Jammu & Kashmir	4	1	-	5
Jharkhand	2	7	3	12
Karnataka	3	10	8	21
Kerala	7	2		9
Madhya Pradesh	4	3	34	41
Maharashtra	22	-	-	22
Manipur	5	-	-	5
Meghalaya	1	6	4	11
Mizoram	1	-	-	1
Nagaland	6	4	1	11
Orissa	6	2	-	8
Puducherry	1	-	2	3
Punjab	-	-	3	3
Rajasthan	2	7	17	26
Sikkim	1	-	-	1
Tamil Nadu	1	10	12	23
Tripura	1	1	-	2
Uttar Pradesh	-	1	8	9
Uttaranchal	9	-	4	13
West Bengal	6	-	-	6
Total no. of districts	**111**	**76**	**128**	**315**

Details of names of districts in each state provided in Annexure III

Real-Time monitoring of El Nino and its Impacts

Continuous monitoring of various aspects throughout the season is crucial for different tactical and strategic decisions during the season. Responsibilities of monitoring of these aspects in the countries are entrusted to different agencies. These are the IMD (for rainfall),

Central Water Commission (for reservoir level), Mahalanobis National Crop Forecast Centre (for soil moisture and crop situation). Monitoring mechanism of these agencies is described in brief in the following section.

Rainfall Monitoring (IMD): Rainfall in the country is monitored by IMD at District, Meteorological Sub-divisions, State, and country level using a network of more than 8000 rainfall stations across the country. Rainfall statistics are prepared by IMD at daily, weekly, monthly and seasonal time-scales. The statistics on Actual, Normal and Percent Departure from Normal are updated by IMD every day and are available through following URL in the IMD website:

https://mausam.imd.gov.in/responsive/rainfallinformation.php?msg=C

Departures of cumulative rainfall from 01 June to 20 June over different meteorological sub-divisions and the daily rainfall and accumulated rainfall over the country as whole (since 01 June) are given in Figure 9 below.

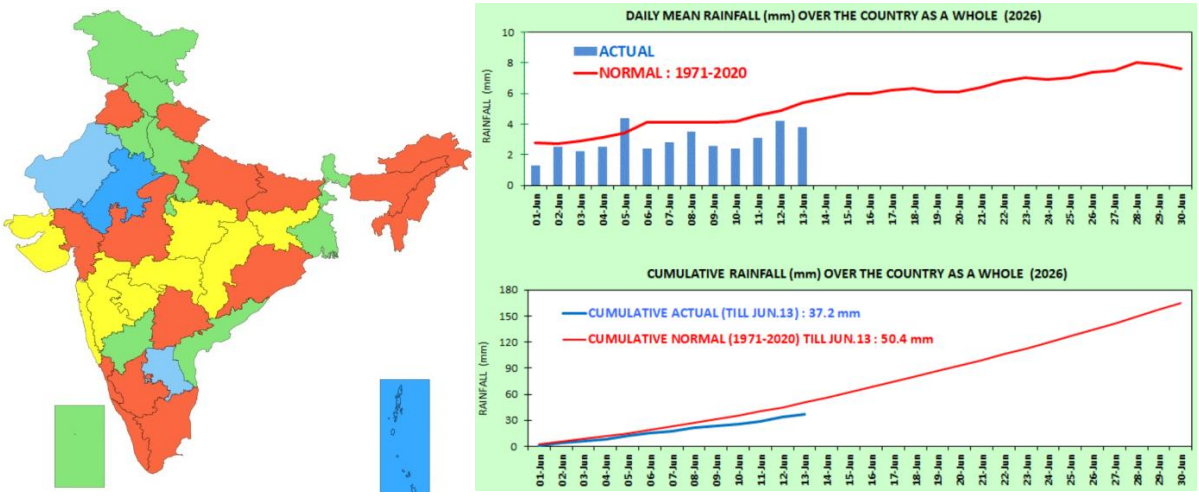


Figure 10. Departures of accumulated rainfall (01 June to 20 June, 2026) over different districts (top left), meteorological sub-divisions (top right), states (bottom left); and daily mean & cumulative rainfall over the country as a whole (bottom right).

Reservoir Monitoring (CWC): The Central Water Commission (CWC) monitors the live storage capacity of 166 major reservoirs across India. As of 18 June, the overall storage position is less than the corresponding period of last year in the country as a whole but is better than the Normal storage during the corresponding period. Live storage on 18 June, 2026 stood at approximately 50.457 billion cubic metres (BCM), which is 27.49% of their total capacityof 183.565 BCM. The current storage is lower than the 58.249 BCM recorded during the corresponding period last year, though it remains above the decadal average of 44.646 BCM.

Southern and eastern India have reported the weakest storage levels, with reservoirs in both regions operating at less than one-fourth of their capacity. The total live storage for northern,

western, central, southern and eastern regions stand at 29.21%, 29.20%, 33.77%, 21.34% and 20.89% of total live storage capacity of these reservoirs (https://rsms.cwc.gov.in/frameWork/web/bulletin-report-page).

Drought Monitoring and Crop Impact Assessment (MNCFC): An El Niño event frequently destabilizes the Indian southwest monsoon, translating into deficient rainfall, delayed sowing, and agricultural droughts. The Mahalanobis National Crop Forecast Centre (MNCFC), under the Ministry of Agriculture and Farmers Welfare (MoA&FW) transforms raw meteorological information into actionable, agricultural intelligence to mitigate climate-induced riskslеveraging space technology, geospatial analytics, and advanced digital platforms.The centre employs a multi-tiered, indicator-based approach that aggregates satellite-based indictors and meteorological data along with hydrological inputs, based on the Drought Manual 2020 guidelines to deliver drought intelligence. Following satellite-based indicators are being generated regularly and are being presented in the weekly Crop Weather Watch Group (CWWG) meetings of MOA&FW throughout the year:

- **Normalized Difference Vegetation Index (NDVI):** Assesses near real-time vegetation vigour and canopy greenness. The districts/blocks with drop in crop health can be isolated by comparing current indices against previous years.
- **Land Surface Wetness Index (LSWI):** Monitors to evaluate surface moisture anomalies, helping detect severe surface drying relative to historical baselines and track early signs of agricultural drought.
- **Root Zone Soil Moisture (RZSM) Anomalies:** Tracks the percentage deviation of deep soil moisture against a historical average. This provides early warnings for subsurface moisture deficits before they manifest as visible crop damage on the surface.

Early season soil moisture situation estimated using SMAP satellite derived image and current soil moisture status as percentage deviation from the average soil moisture status of 2016-2025, is depicted in Figure 10 below. Vegetation condition (NDVI) and soil moisture status (LSWI) for the current year (25 May-09 June) and their and the differences from their values for the corresponding values of last year are given in Figures 11 and 12 below.

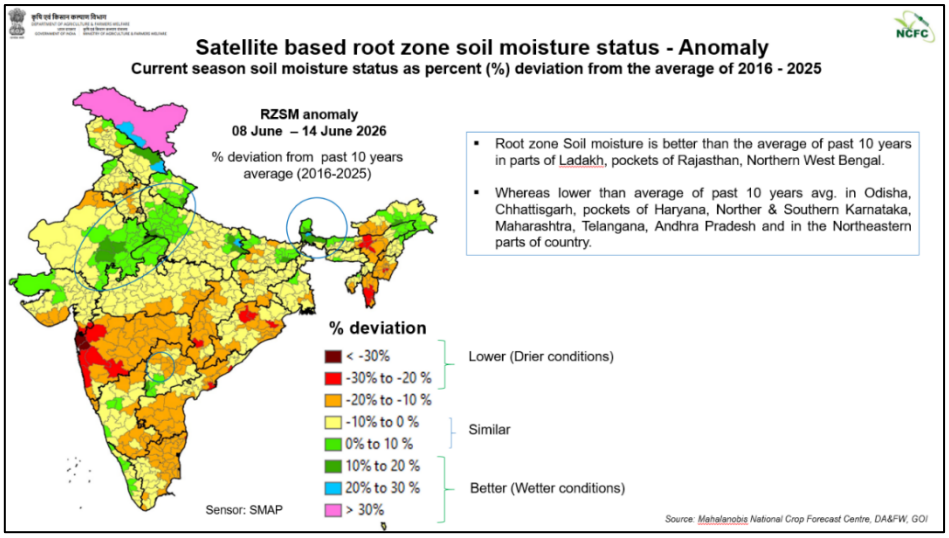


Figure 11. Satellite based Root Zone Soil moisture status during 08 June to 14 June 2026

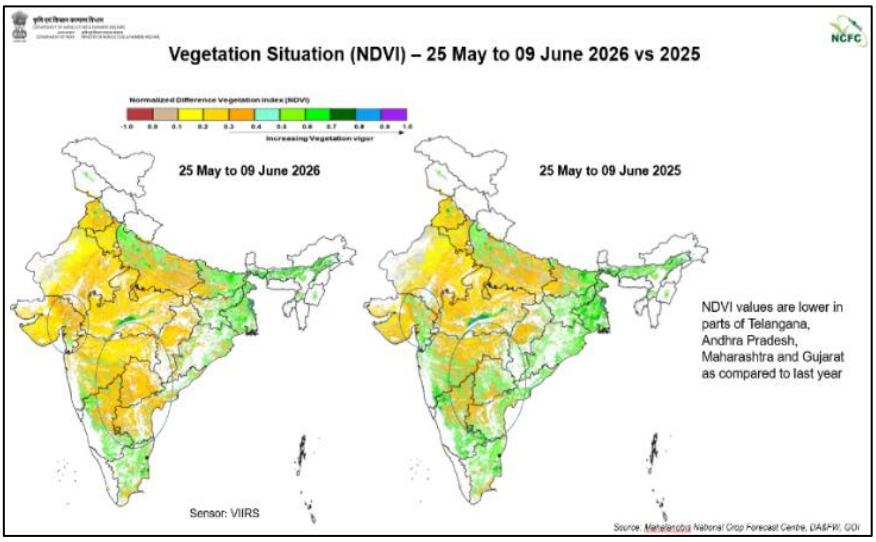


Figure 12. Satellite based vegetation indicator (NDVI) during 25 May to 09 June 2026

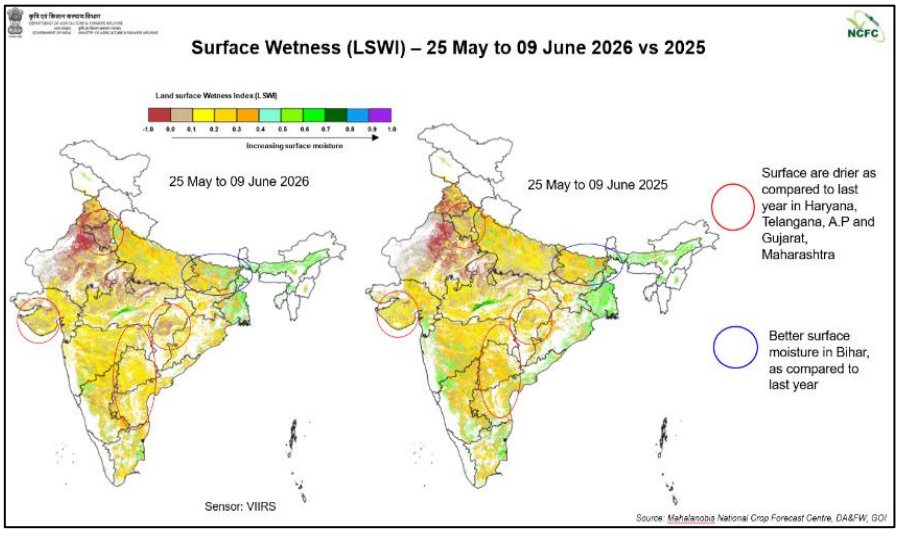


Figure 13. Satellite based soil moisture indicator (NDVI) during 25 May to 09 June 2026

Vulnerability Mapping and Risk Zonation: Identification of vulnerable districts has been carried out by integrating IMD South-West Monsoon seasonal forecast with ground-level irrigation data to enable targeted risk mitigation and impact management. Surface irrigation coverage - command area boundary of major and medium irrigation projects was used from the National Water Informatics Centre (NWIC) for computing % of agriculture land under surface irrigation. By isolating districts that exhibit both a high probability of below-normal rainfall (> 30%) and low irrigation coverage (< 50%) - 342 vulnerable districts susceptible to El Niño-induced stress, were identified

In second approach, to identify highly vulnerable districts - the total net irrigated area percentage provided by the Directorate of Economics and Statistics (DES) Land Use district level statistics for the year 2023-24 was used. However, the net irrigation coverage of three states were not available. Irrigation coverage of these three states were taken from surface irrigation coverage of major and medium irrigation projects. Further by applying the above criteria i.e. districts that exhibit both a high probability of below-normal rainfall (> 30%) and low irrigation coverage (< 50%) – 226 highly vulnerable districts, susceptible to El Niño-induced stress, were identified.

Fig

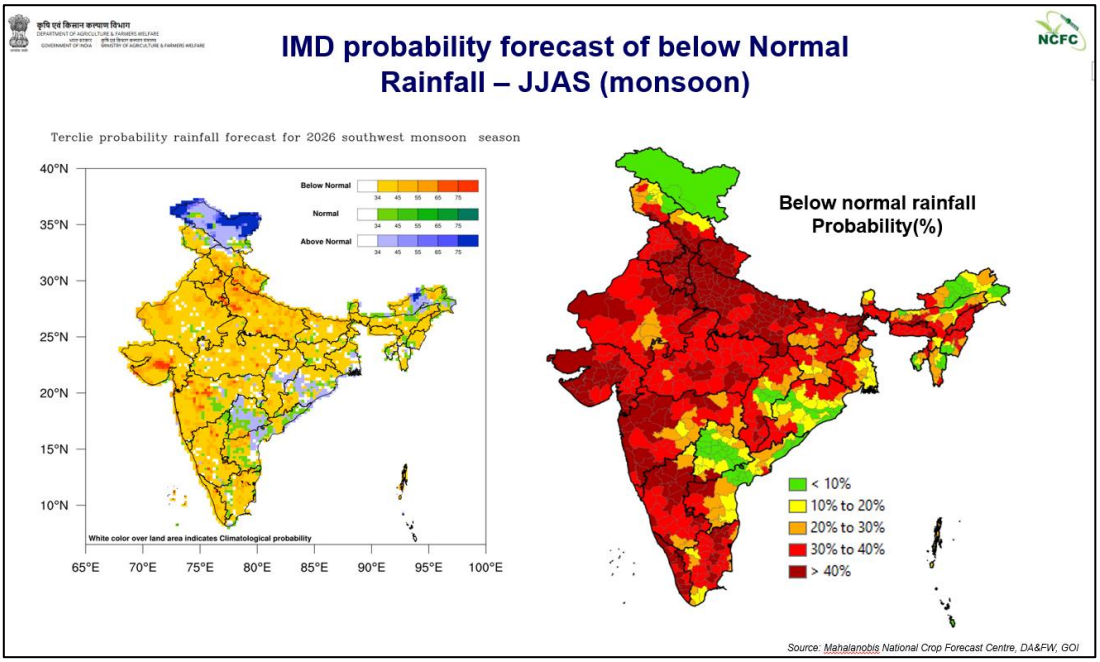


Figure 14: District aggregated IMD below normal probability Forecast for South West Monsoon 2026

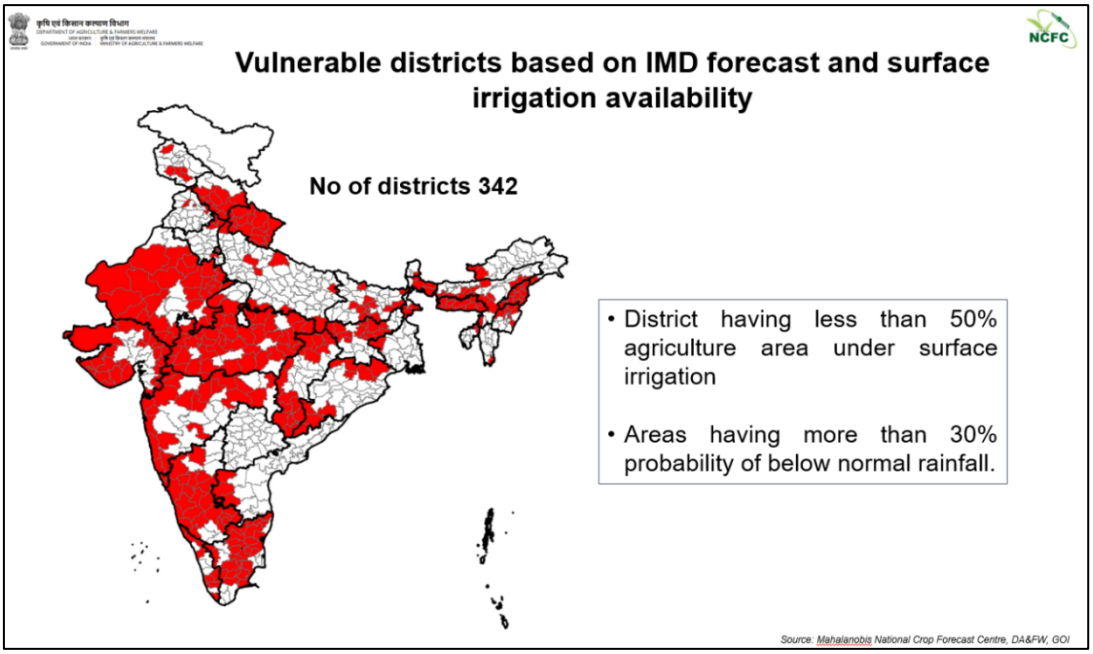


Figure 15: Vulnerable districts identified based on IMD below normal probability Forecast and Surface command area

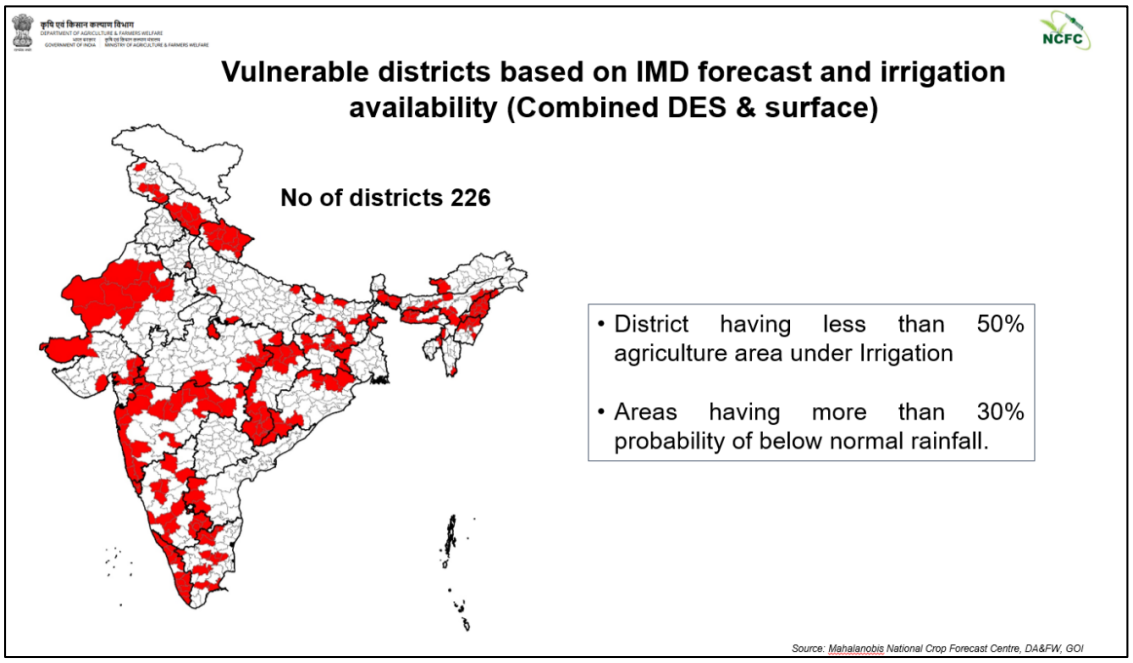


Figure 16: Vulnerable districts identified based on IMD below normal probability Forecast and total irrigation status based on DES land use statistics 2023-24.

Historical Drought Frequency mapping

MNCFC also tracks long-term historical timelines (such as the 14-year period from 2011 to 2024) of official drought declarations by individual states to identify chronic, high-frequency drought regions like Rajasthan, Karnataka, Andhra Pradesh, and Maharashtra. This frequency map indicates past historical anomalies. It also corroborates - data from the severe El Niño year of 2015 and moisture stress (LSWI/NDVI deviations) observed against past crisis

periods, allowing policy stakeholders to anticipate spatial behaviors of current El Niño cycles.

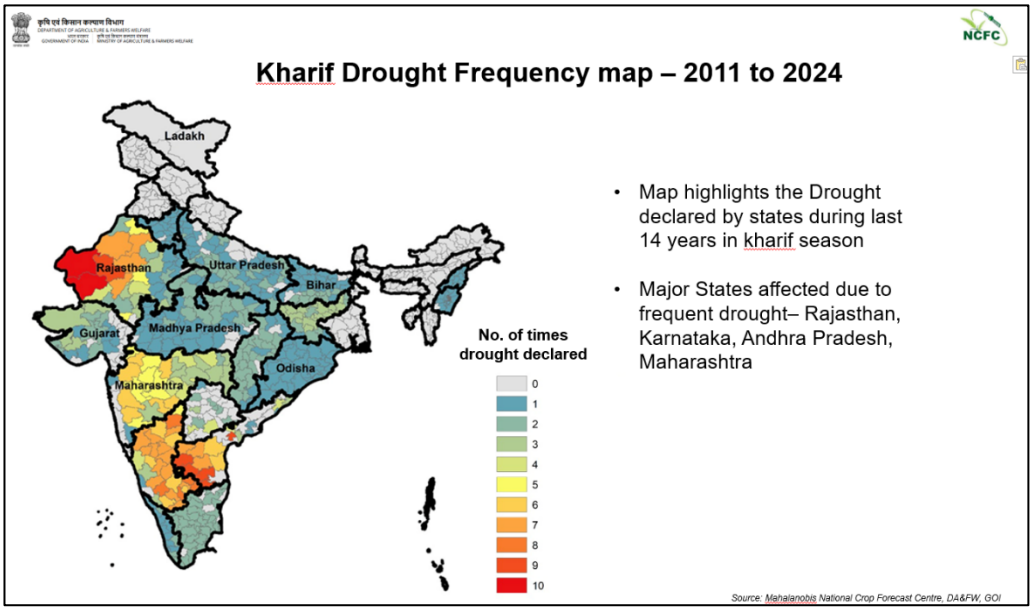


Figure 17: Drought Frequency maps (as declared by state government) – 2011-12 to 2024-25 (Data source: Draft Drought Crisis Management Plan, 2025)

Integration with Krishi-Decision Support System (Krishi-DSS)

Further, MNCFC has developed Krishi Decision Support System (Krishi-DSS) which is a flagship digital initiative of the Department of Agriculture & Farmers Welfare, Government of India. It is a web portal and designed to strengthen evidence-based agricultural planning and decision-making. It integrates information from multiple sources which include satellite data, weather forecasts, soil moisture, hydrology, crop statistics, and field datasets. This unified system provides a comprehensive view of the agricultural landscape across the country. Krishi-DSS has a dedicated module namely crop weather watch and drought monitoring where various drought related indicators i.e., rainfall deviations, SPI, dry spells, temperature data, remote sensing based Normalized Difference Vegetation Index (NDVI) & Land Surface Wetness Index (LSWI), soil moisture, IMD weather forecast, weather warnings and reservoirs storages etc., are integrated in near real time basis (https://krishi-dss.gov.in/krishi-dss/)

Beyond monitoring, Krishi-DSS also provides predictive and diagnostic capabilities wherein dedicated module for drought vulnerability mapping has been integrated. The module estimates a Composite Vulnerability Index at the district and sub-district level, using long-term time-series weather and remote sensing data. Moreover, the platform integrates IMD's Gram Panchayat & District-level weather forecasts along with weather warnings for localized hazards, including heatwaves, cold waves, hailstorms, and heavy rainfall, ensuring last-mile disaster preparedness.

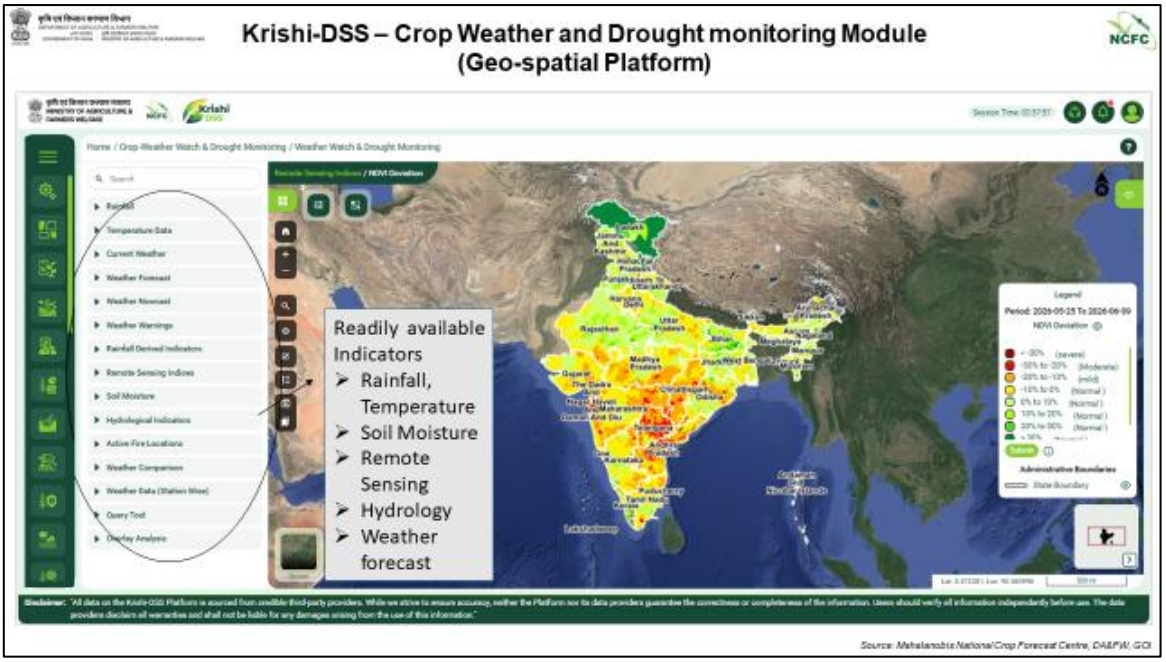


Figure 18: Snapshot of Crop Weather Watch & Drought Monitoring module of Krishi-DSS

In conclusion, MNCFC and the Krishi- DSS platform provide a critical operational framework for translating large-scale climate signals, such as El Niño, into actionable intelligence. By integrating satellite data, weather forecasts, and decision-support tools, the system enables timely, data-driven interventions that enhance agricultural resilience, reduce climate-related risks, and support a proactive approach to sustainable food and livelihood security in India.

Impact of Historical El Nino events on productivity of major *Kharif* Crops

Analysis of previous three El Nino events (2002, 2004 & 2009)on the impact of different crops provided some insights on the districts and crops where the impact varied.

Rice

Rice was found to be one of the most vulnerable crops to El Niño-induced rainfall variability. A significant positive relationship was observed between monsoon variability and rice yield variability, indicating the strong dependence of rice productivity on seasonal rainfall. At the national level, rice productivity declined by approximately 16.8% during the severe El Niño year of 2002. Yield reductions were also observed during 2004 and 2009, although the magnitude varied across regions. District-level analysis showed widespread impacts across eastern, central and southern India, particularly in rainfed rice-growing regions. Delayed monsoon onset, prolonged dry spells and moisture stress during reproductive stages emerged as the primary causes of productivity decline.

Maize

Maize productivity exhibited a strong response to monsoon variability despite significant technological improvements achieved over the years. National-level analysis indicated yield reductions of approximately 16.8% during 2002 and about 18.3% during 2009. Moisture

stress during tasselling and grain filling stages adversely affected kernel development and final grain yield. Rainfed maize-growing regions in Madhya Pradesh, Karnataka, Maharashtra, Bihar and Jharkhand showed substantial vulnerability to El Niño conditions. The crop displayed considerable year-to-year variability, emphasizing its sensitivity to rainfall distribution during the monsoon season.

Pearlmillet

Pearlmillet is generally regarded as a drought-tolerant crop; however, severe and prolonged rainfall deficits during El Niño years significantly affected its productivity. Among the four crops studied, Pearlmillet experienced the highest yield decline, with productivity reductions approaching 39.3% during the 2002 El Niño event and 30.2% during 2009. The adverse impact was particularly evident in the arid and semi-arid regions of Rajasthan, Haryana and parts of central India. Although Pearlmillet can withstand moderate moisture stress, severe drought conditions during critical growth stages substantially reduce tillering, ear formation and grain development.

Sorghum

Sorghum exhibited comparatively lower sensitivity to El Niño than rice and maize. Its deeper rooting system and greater water-use efficiency provided some resilience against rainfall deficits. Nevertheless, productivity losses were observed during major El Niño years, particularly in 2009. Sorghum-growing districts in Maharashtra, Karnataka, Rajasthan and Madhya Pradesh experienced notable reductions in yield due to prolonged moisture stress.

District-wise vulnerability Assessment of different Crops

A comprehensive district-level vulnerability assessment was carried out using yield anomalies greater than 10% during El Niño years. Districts experiencing yield reductions exceeding 10% in all three El Niño years (2002, 2004 and 2009) were classified as highly vulnerable, while districts showing similar reductions in any two of the three El Niño years were classified as vulnerable.

The assessment revealed substantial differences among crops:

- Rice: 77 districts were identified as highly vulnerable, while 103 districts were classified as vulnerable.
- Maize: 65 districts were identified as highly vulnerable and 36 districts as vulnerable.
- Pearlmillet: 36 districts were highly vulnerable and 11 districts were vulnerable.
- Sorghum: 36 districts were highly vulnerable and 34 districts were vulnerable.

The large number of highly vulnerable districts under rice and maize indicates the extensive geographical spread of El Niño impacts on these crops. Highly vulnerable rice-growing districts were concentrated in eastern India, central India and parts of southern India, whereas maize vulnerability was prominent in central and western India. Pearlmillet and sorghum vulnerability was concentrated primarily in semi-arid regions of Rajasthan, Haryana, Gujarat, Madhya Pradesh and Maharashtra. The identification of these vulnerable districts provides an important basis for prioritizing investments in climate-resilient technologies, drought preparedness programmes and district-specific contingency planning.

The recurring impact of El Niño on crop productivity highlights the importance of integrating climate information into agricultural planning. Seasonal climate forecasts and El Niño early warning systems can support timely decisions regarding crop choice, sowing dates, varietal selection and water resource management. The vulnerable districts identified through this analysis should receive priority attention for the development of climate-resilient agriculture. Long-term adaptation measures may include development of drought-tolerant varieties, enhancement of irrigation infrastructure, promotion of rainwater harvesting and groundwater recharge, and strengthening of integrated farming systems. Short-term contingency measures should focus on alternate crop planning, life-saving irrigation, precision nutrient management and weather-based agro-advisory services.

El Niño remains one of the most significant climatic risks affecting Indian agriculture. The associated reduction and uneven distribution of monsoon rainfall lead to substantial declines in the productivity of major kharif crops. Rice and maize emerged as the most vulnerable crops, while Pearlmillet and sorghum, despite their inherent drought tolerance, also experienced considerable yield losses under severe El Niño conditions.

The district-level analysis demonstrated that 77 rice districts and 65 maize districts consistently suffered yield reductions exceeding 10% during all three recent El Niño years, highlighting the need for targeted adaptation interventions. The identification of highly vulnerable and vulnerable districts provides a scientific basis for climate-informed agricultural planning, contingency preparedness and investment prioritization. Strengthening climate services, weather-based agro-advisories and climate-resilient production systems will be critical for

Risk Analysis: Crop and Region Matrix

Rainfall sensitivity of major Kharif crops (based on 2026 seasonal forecast)

Crop	Water Sensitivity	Critical Period	2026 Risk Level	Kind of Risk
Paddy / Rice	Very High	Transplanting (Jun- Jul)	HIGH - Deficient rainfall + heat stress in MCZ & C. India	Prevented sowing; yield shortfall via CCE
Soybean	High	Flowering (Jul-Aug)	HIGH - C. India (MP, Maharashtra) below-normal MCZ	Mid-season adversity; yield loss claims
Kharif Pulses (Tur/Moong/Urad)	Moderate-High	Podding (Aug-Sep)	ELEVATED - MCZ + NW India deficit	Drought / water stress claims
Groundnut	Moderate	Pegging/Pod fill (Jul- Sep)	ELEVATED - Gujarat, Rajasthan, AP below normal	Prevented sowing + yield shortfall
Maize	High	Silking/Tasseling (Jul- Aug)	HIGH - Heat + water stress	Mid-season adversity; heat-

			combination risk	stress yield loss
Pearlmillet (Bajra)	Low-Moderate (drought tolerant)	Ear emergence (Aug- Sep)	LOWER - More resilient; still watch NW India deficit	Risk reduced but not negligible in extreme drought

State-Level Risk

Based on IMD forecast spatial distribution the following state-level risk zonation is provided for PMFBY portfolio management

Risk Zone	States	Forecast Signal	Dominant Risk
ZONE 1 CRITICAL	Madhya Pradesh, Maharashtra (Vidarbha, Marathwada), Telangana, Karnataka (N. Karnataka), Rajasthan (South/SE)	Strongly below normal; MCZ deficit; above-normal heat	Prevented sowing; drought; mid-season adversity
ZONE 2 HIGH	East Uttar Pradesh (rainfed), Bihar (rainfed), Chhattisgarh, Odisha, Andhra Pradesh, Jharkhand	Below normal; above-normal heatwave days	Yield shortfall (paddy, pulses, maize); heat stress
ZONE 3 MODERATE	Haryana, Punjab, West Uttar Pradesh (irrigated - lower PMFBY exposure), Himachal Pradesh, Tamil Nadu, Kerala (late recovery possible with +IOD)	Below normal Jun; potential IOD-aided recovery Jul- Aug	Localised losses
ZONE 4 LOWER	Northeast India (Assam, Meghalaya, Sikkim, Arunachal, Manipur, Mizoram, Nagaland, Tripura), West Bengal (Sub-Himalayan), Parts of Odisha, Coastal Andhra Pradesh and Telangana	Near-normal (94-106% LPA)	Localised flood risk possible

Upcoming Forecast Updates

- IMD Extended Range Forecasts: **Updated every Thursday** - 7-day average for next 4 weeks. Available at: https://mausam.imd.gov.in
- IMD Short-to-Medium Range (1- 7 days): **Updated daily** - Available at: https://nwp.imd.gov.in
- IRI ENSO Monthly Update: **~15th of each month** - Available at: https://iri.columbia.edu/our-expertise/climate/enso/current/
- WMO GSCU: **Monthly** - Available at: https://wmo.int

Standard Operating Procedure (SOPs) for KVKs in Mitigating El Niño-Induced Impacts

The increasing frequency and intensity of climate variability, particularly El Niño events, pose significant challenges to Indian agriculture through delayed monsoon onset, prolonged dry spells, reduced rainfall, heat stress, declining soil moisture, and increased vulnerability of crops and livestock. To minimize these adverse impacts and enhance the resilience of farming systems, a coordinated Standard Operating Procedure (SOP) has been developed for Krishi Vigyan Kendras (KVKs) under the ICAR extension framework (Fig. 1). The SOP establishes a systematic mechanism for converting climate and weather intelligence into actionable agro-advisories and contingency interventions at the grassroots level.

The operational framework follows a continuous cycle of Monitor → Analyze → Plan → Advise → Disseminate → Feedback → Refine, ensuring a dynamic, science-based, and farmer-centric response system for managing El Niño-induced risks across diverse agro-ecological regions. The process begins with the India Meteorological Department (IMD), which serves as the primary source of weather and climate intelligence. IMD provides short, medium, and extended-range weather forecasts, seasonal rainfall outlooks, and warnings on extreme weather events. During El Niño years, these forecasts become particularly important for identifying potential rainfall deficits, temperature anomalies, heat waves, and dry spells well in advance. Such early warnings provide the foundation for preparedness planning and enable timely interventions by research, extension, and development agencies.

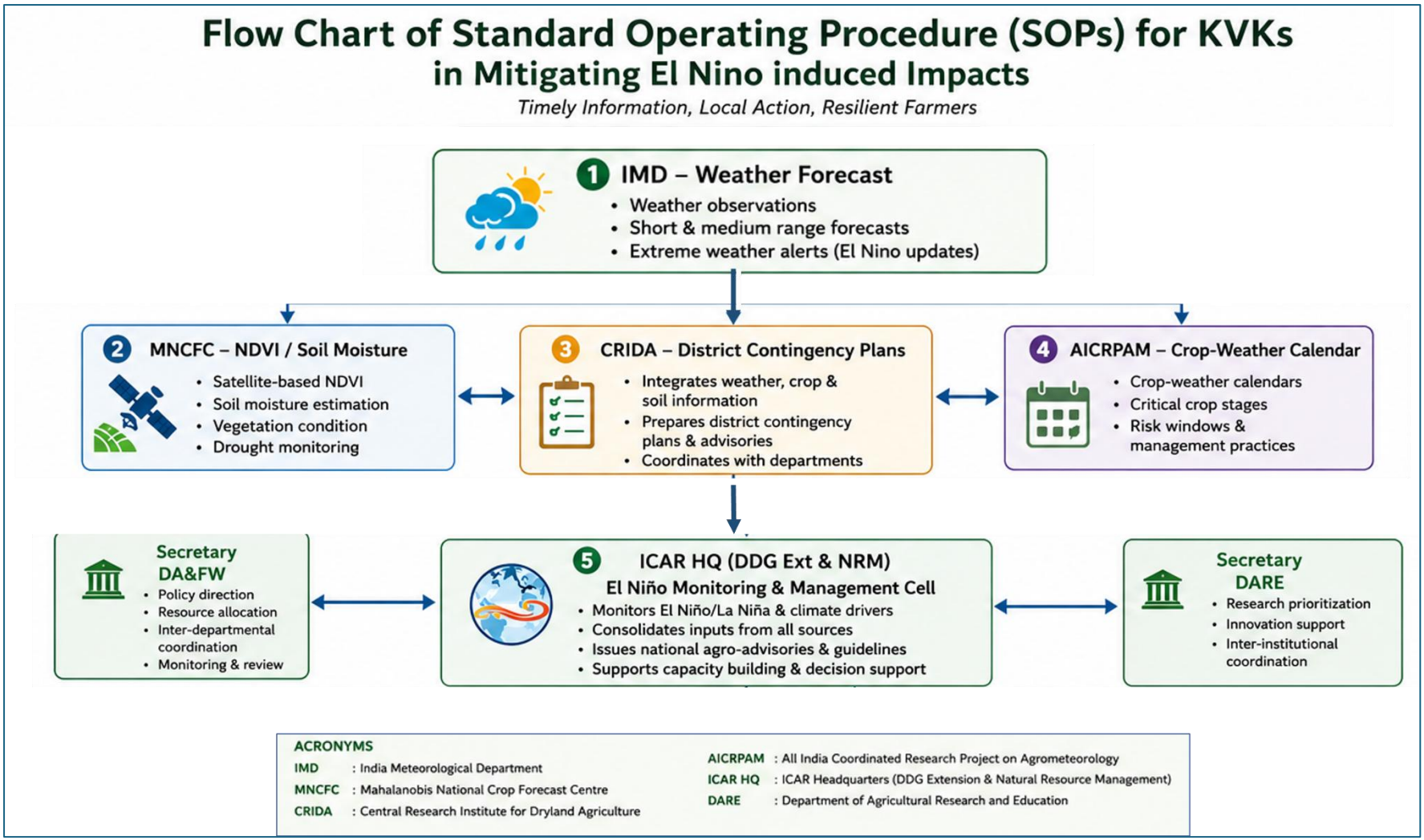
To complement weather forecasts, the Mahalanobis National Crop Forecast Centre (MNCFC) provides satellite-based monitoring of crop and natural resource conditions. Through assessment of vegetation indices (NDVI), soil moisture status, crop health, and drought progression, MNCFC generates real-time information on emerging stress conditions. These spatial assessments help identify vulnerable districts and regions, facilitating prioritization of resources and targeted interventions for drought mitigation and crop protection.

The weather and resource information generated by IMD and MNCFC is integrated by the Central Research Institute for Dryland Agriculture (CRIDA), which plays a pivotal role in contingency planning. CRIDA develops district-specific contingency plans designed to address different rainfall and drought scenarios. These plans include recommendations on alternative crops and varieties, revised sowing windows, moisture conservation practices, supplemental irrigation strategies, fodder management, and other adaptive measures. By providing scientifically validated contingency options, CRIDA helps farming communities cope with delayed monsoon onset, intermittent dry spells, and seasonal rainfall deficits commonly associated with El Niño conditions.

Simultaneously, the All India Coordinated Research Project on Agrometeorology (AICRPAM) contributes crop-weather intelligence by developing crop-weather calendars and stage-specific management recommendations. These advisories identify critical crop growth stages vulnerable to moisture and temperature stress and provide guidance on crop management

Flow Chart of Standard Operating Procedure (SOPs) for KVKs in Mitigating El Nino induced Impacts

Timely Information, Local Action, Resilient Farmers

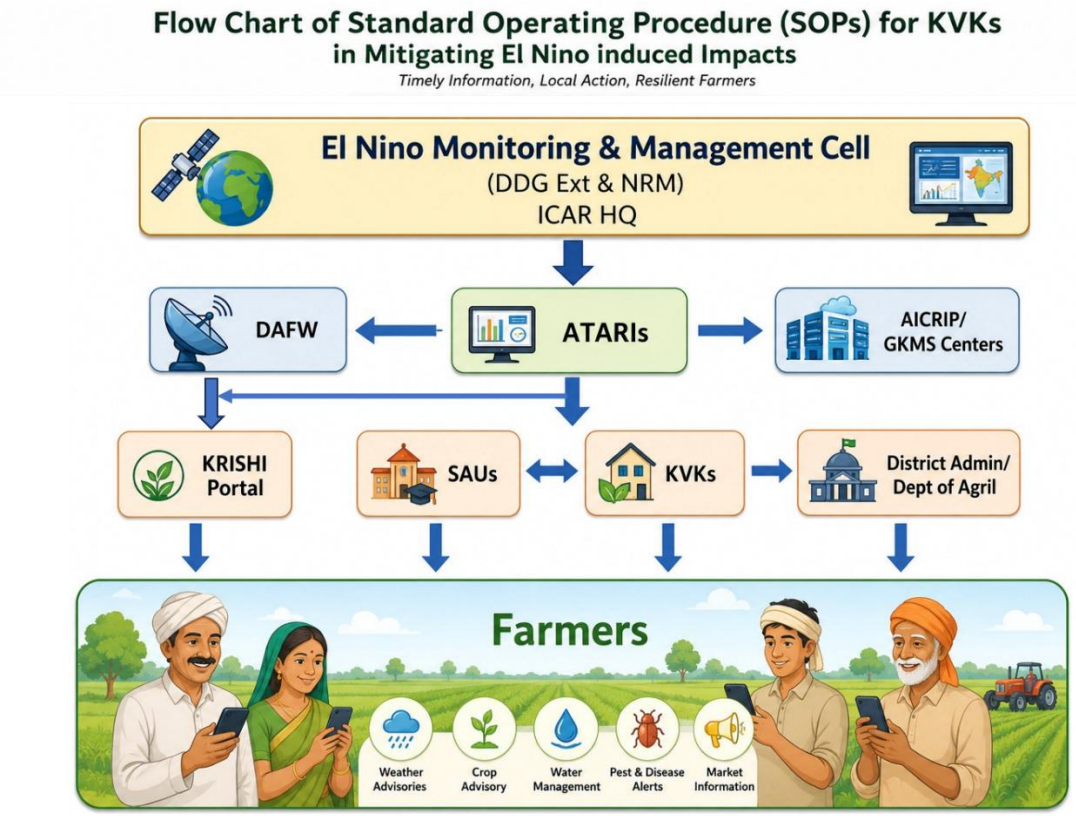


ACRONYMS

IMD	: India Meteorological Department
MNCFC	: Mahalanobis National Crop Forecast Centre
CRIDA	: Central Research Institute for Dryland Agriculture
AICRPAM	: All India Coordinated Research Project on Agrometeorology
ICAR HQ	: ICAR Headquarters (DDG Extension & Natural Resource Management)
DARE	: Department of Agricultural Research and Education

practices to reduce climatic risks. The integration of crop-weather relationships into advisory services enhances the precision and effectiveness of recommendations provided to farmers.

At the national level, the ICAR Headquarters (DDG Extension & Natural Resource Management) through the El Niño Monitoring and Management Cell functions as the central coordinating and decision-support platform. The Cell consolidates information received from IMD, MNCFC, CRIDA, AICRPAM, and other relevant agencies to assess emerging risks and formulate strategic responses. Based on scientific evidence and field realities, it develops national-level advisories, preparedness guidelines, mitigation strategies, and operational directives for implementation through the ICAR extension network. The Cell also facilitates inter-institutional coordination, monitoring, capacity building, and knowledge sharing to ensure a unified response to El Niño-induced challenges.
Policy support and institutional convergence are ensured through close coordination with the Department of Agriculture and Farmers Welfare (DA&FW) and the Department of Agricultural Research and Education (DARE). DA&FW facilitates alignment of contingency measures with ongoing government schemes, supports resource mobilization, and promotes dissemination of advisories through national agricultural platforms and state departments. DARE provides strategic direction for research prioritization, innovation, and inter-institutional collaboration, thereby strengthening the scientific foundation of advisory services and ensuring the availability of validated technologies for climate risk management.



The implementation of national advisories at the regional level is facilitated by the Agricultural Technology Application Research Institutes (ATARIs). ATARIs adapt and contextualize advisories according to regional agro-climatic conditions and farming systems. They provide technical guidance to KVKs, monitor field implementation, facilitate capacity building programmes, and ensure effective communication between research institutions and extension agencies. Their role is critical in translating broad national recommendations into region-specific action plans.

At the state level, State Agricultural Universities (SAUs) provide scientific and technical backstopping for the advisory system. Through research, validation, and refinement of climate-resilient technologies, SAUs support KVKs with locally relevant recommendations. Their expertise helps ensure that advisories are technically sound, location-specific, and responsive to emerging field challenges. SAUs also contribute to technology assessment, demonstration, and dissemination efforts aimed at enhancing resilience under climatic stress.

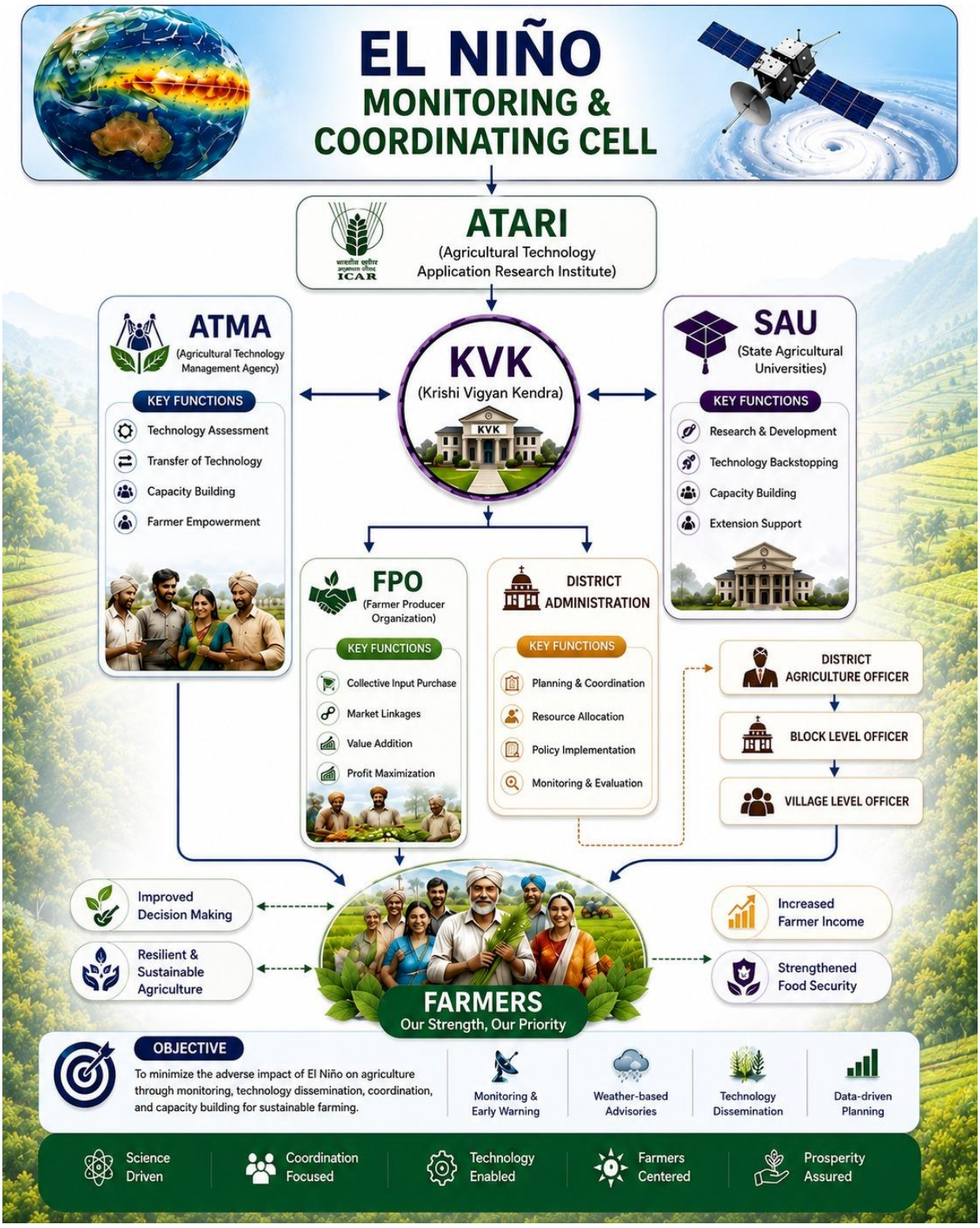
The Gramin Krishi Mausam Sewa (GKMS) Centres and AICRP Centres generate location-specific agrometeorological advisories by integrating weather forecasts with crop, livestock, fisheries, and natural resource management information. These advisories address operational farm decisions related to sowing, irrigation, nutrient management, pest and disease management, livestock care, and weather-based risk mitigation. Their timely dissemination enables farmers to optimize resource use and reduce losses arising from adverse weather conditions.

At the district level, the District Administration and Department of Agriculture play a crucial role in coordinating implementation and ensuring last-mile delivery of advisories. Through convergence of schemes, mobilization of extension personnel, facilitation of input supply, organization of awareness programmes, and support for contingency measures, these institutions help translate advisories into actionable outcomes. Their active involvement ensures that relief, adaptation, and resilience-building measures reach vulnerable farming communities in a timely manner.

The most critical component of the entire framework is the network of Krishi Vigyan Kendras (KVKs), which serve as the frontline extension mechanism for implementing El Niño mitigation strategies. KVKs act as the primary interface between scientific institutions and farming communities. Based on advisories and contingency plans received through the ICAR system, KVKs conduct awareness campaigns, frontline demonstrations, farmer trainings, field visits, diagnostic surveys, and stakeholder consultations. They promote climate-resilient crop planning, alternative cropping systems, moisture conservation technologies, efficient water management practices, integrated nutrient management, pest and disease surveillance, fodder security measures, and livestock management interventions. KVKs also facilitate dissemination of advisories through mobile messaging, social media platforms, farmer groups, community radio, local institutions, and digital extension tools.

An equally important function of KVKs is the collection of field-level feedback regarding weather impacts, crop performance, emerging challenges, and adoption of recommended practices. This feedback is communicated to ATARIs, SAUs, ICAR institutes, and policy makers, enabling continuous refinement of advisories and contingency plans. Such two-way information flow strengthens the responsiveness, relevance, and effectiveness of the advisory system and ensures that interventions remain aligned with farmers' needs and local realities.

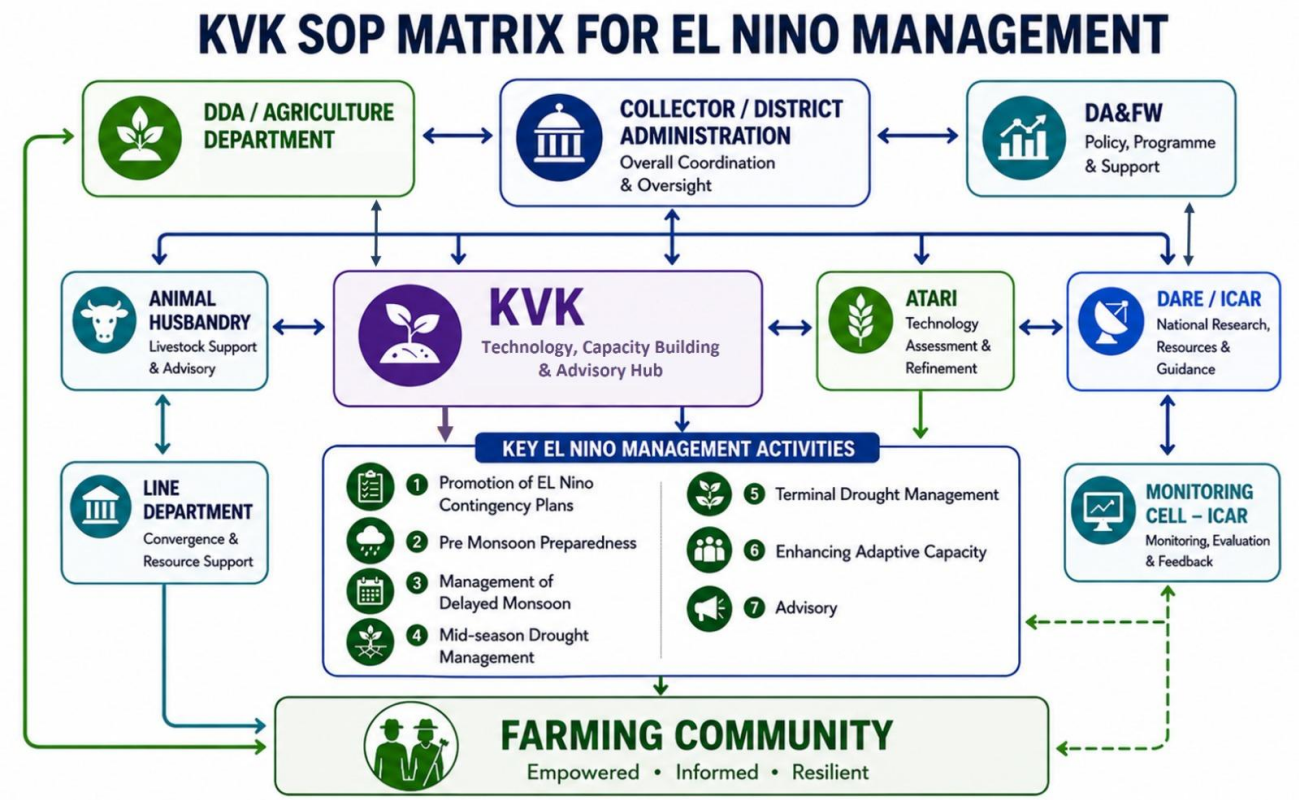
The coordinated functioning of these institutions creates a robust and integrated climate risk management framework capable of delivering timely, location-specific, and actionable agro-advisories to farmers. By combining weather forecasting, satellite-based monitoring, contingency planning, scientific research, policy support, extension services, and field-level implementation, the SOP enhances preparedness and adaptive capacity across the agricultural sector. The ultimate outcome is improved decision-making on crop planning, sowing, irrigation scheduling, nutrient management, pest and disease management, livestock care, and resource conservation. Through proactive planning and timely interventions, the SOP helps reduce production risks, minimize economic losses, improve productivity, strengthen climate resilience, and safeguard livelihoods during El Niño-induced climatic stress.


EL NIÑO
MONITORING &
COORDINATING CELL
ATARI
(Agricultural Technology Application Research Institute)
ICAR
ATMA
(Agricultural Technology Management Agency)
KEY FUNCTIONS
Technology Assessment
Transfer of Technology
Capacity Building
Farmer Empowerment
KVK
(Krishi Vigyan Kendra)
KVK
SAU
(State Agricultural Universities)
KEY FUNCTIONS
Research & Development
Technology Backstopping
Capacity Building
Extension Support
FPO
(Farmer Producer Organization)
KEY FUNCTIONS
Collective Input Purchase
Market Linkages
Value Addition
Profit Maximization
DISTRICT ADMINISTRATION
KEY FUNCTIONS
Planning & Coordination
Resource Allocation
Policy Implementation
Monitoring & Evaluation
DISTRICT AGRICULTURE OFFICER
BLOCK LEVEL OFFICER
VILLAGE LEVEL OFFICER
Improved Decision Making
Resilient & Sustainable Agriculture
FARMERS
Our Strength, Our Priority
Increased Farmer Income
Strengthened Food Security
OBJECTIVE
To minimize the adverse impact of El Niño on agriculture through monitoring, technology dissemination, coordination, and capacity building for sustainable farming.
Monitoring & Early Warning
Weather-based Advisories
Technology Dissemination
Data-driven Planning
Science Driven
Coordination Focused
Technology Enabled
Farmers Centered
Prosperity Assured

KVK Action Plan to deal with El Nino 2026

hase	El Niño Management Stage	KVK Actions & Interventions	Frequency	Key Stakeholders
1.	**Monsoon Onset Monitoring & Delayed Monsoon Response** *(June–July)*	• Real-time rainfall monitoring • Dissemination of weather-based advisories • Promotion of short-duration varieties • Seed treatment • Promotion of natural farming • Awareness on PMFBY • Promotion and demonstration of community & staggered nurseries	Daily/ Weekly/ Fortnightly/ as the case may be	KVKs, IMD, State Departments, FPOs, Cooperatives, Farmers & Farmers Groups
2.	**Mid-Season Drought Management & Crop Stress Response** *(July–September)*	• Soil moisture conservation (mulching, intercultural, conservation furrows, ridge-furrow systems) • Foliar nutrition & life-saving irrigation • Pest and disease surveillance • Fodder crop promotion & livestock health advisories • Monitoring crop stress through field visits and digital tools	Weekly/ Fortnightly/ as the case may be	KVKs, Agriculture & Animal Husbandry Department, Water User Associations, FPOs, Farmers
3.	**Terminal Drought & Harvest Management** *(Late August – October)*	• Lifesaving irrigation during reproductive stages • Foliar nutrient sprays • Promotion of catch and opportunity crops • Fodder harvesting from failed crops • Fodder, hay & silage making	Weekly/ Fortnightly/ as the case may be	KVKs, State Departments, Cooperatives, Farmers & Farmers Groups

4.	**Mechanization & Support Services** *(Throughout Season)*	• Promotion of climate-resilient technologies • Facilitation of quality planting materials • Facilitate Custom Hiring Centre services • Community water management & promote MIS • Linkage with PMKSY, NFSM, NMSA and other schemes • Support for fodder banks.	Weekly/ Fortnightly/ as the case may be	KVKs, Seed Hubs, FPOs, Cooperatives, Farmers & Farmers Groups
5.	**Digital Advisory, Forecast Dissemination & Decision Support** *(Throughout Season)*	• Communication of weather forecasts • Dissemination of agro-advisories through Kisan Sarathi, Bharat VISTAAR, WhatsApp groups, SMS, social media, community radio, field days & Kisan Goshtis • Contingency plans, pest and disease alerts.	Daily/ Weekly/ Fortnightly/ as the case may be	DAFW, IMD, ICAR Institutes, KVKs, State Departments, Media, Farmers & Farmers Groups
6.	**Capacity Building & Climate Resilience Enhancement** *(Throughout Season)*	• Demonstration of drought-resilient varieties & technologies • Contingency crop planning • Water conservation and enhance water productivity • Promotion of natural farming, • Fodder conservation & livestock management • Promotion of risk reduction technologies & diversified farming systems	Weekly/ Monthly	KVKs, ICAR Institutes, SAUs, ATMA, NGOs, FPO, Farmers & Farmers Groups
7.	**Institutional Coordination, Monitoring & Rapid Response** *(Throughout Season)*	• Weekly review meetings • Hotspot identification and tracking • Coordination with El Nino coordination cell • Convergence with state and district agencies • Mid-course corrections, if any	Weekly/ Fortnightly/ as the case may be	ICAR, ATARIs, KVKs, State Departments, District Administration, ATMA, Allied Agencies



A robust action plan for KVKs is designed keeping in mind different contingent stations that may arise during the season. This includes delayed onset, early -season, mid-season and late-season drought situations. The roles and responsibilities of different stake holders to deal with different situations is defined. The information flow, triggering actions, monitoring and implementation if or different stakeholders is elaborated in the action plan. KVK action points elaborated in much details here under:

Early-Season Strategy (Delayed Onset of Monsoon)

When the monsoon is delayed by 2 to 6 weeks, KVK SOPs advise changing the primary crop choice and altering nursery management.

- **Crop Diversification**: Shift from water-intensive crops to low-water-consuming crops
- **Short-Duration Varieties**: Switch to short-duration or drought-tolerant crop cultivars.
- **Staggered Nurseries:** Establish community nurseries with tube-well irrigation to keep seedlings ready for transplanting as soon as rainfall occurs.
- **Direct Seeded Rice (DSR):** Promote Direct Seeded Rice using localized farm machinery to bypass the water-heavy transplanting phase.
- **Sowing Discipline:** Advise farmers via KVK Agromet Advisory Bulletins to delay sowing until the soil receives at least 75–100 mm of cumulative rainfall to ensure adequate deep soil moisture.

Mid-Season Strategy (Long Dry Spells / Deficit Rainfall)

If the monsoon sets in normally but is followed by consecutive dry weeks during the vegetative growth phase, the focus shifts to preserving the standing crop.

- **In-situ Moisture Conservation**: Construct conservation furrows and increase field bund heights to retain every drop of rainfall within the farm boundary.
- **Crop Thinning:** Intervene mechanically to reduce the plant population by 25–30% in rainfed areas, lowering moisture competition among standing crops.
- **Mulching practices:** Apply crop residue, straw, or plastic mulch to reduce evaporation losses from the soil surface.
- **Foliar Nutrition:** Spray 2% Potassium Nitrate (KNO_3) or 2% Urea during breaks in rain to induce drought tolerance and keep the vegetative canopy viable.
- **Deferred Fertilization:** Stop the top-dressing of nitrogenous chemical fertilizers until there is sufficient moisture in the soil.

Terminal-Season Strategy (Early Withdrawal of Monsoon)

- Early cessation of rains severely impacts the crop grain-filling stage and prevents the ground from storing residual moisture for subsequent seasons.
- **Life-Saving Irrigation**: Utilize harvested rainwater from farm ponds via micro-irrigation systems to support crops through the critical reproductive stage.
- **Fodder Conversion**: If the grain yield is entirely unviable, harvest the standing biomass early to use as green fodder for livestock protection.
- **Rabi Advance Action Plan:** Prepare fields early to utilize late September or October showers for sowing low-water Rabi crops using residual soil moisture.

Cross-State Institutional Execution Matrix

KVKs utilize a robust tech-dissemination structure to ensure on-ground compliance with these SOPs:

Action Component	Implementation Protocol	Institutional Anchor
Early Warning System	Bi-weekly (Tuesday & Friday) block-level localized agromet advisory generation.	IMD District Agromet Units (DAMUs) at KVKs.
Mass Reach	SMS text alerts via the mKisan portal and localized WhatsApp networks.	KVK Extension Experts & ATMA workers.
Input Logistics	Pre-positioning of alternative contingency seeds and custom hiring of machinery.	State Agriculture Departments & KVK Hubs.
Risk Mitigation	Enrolling affected farmlands under Pradhan Mantri Fasal Bima Yojana (PMFBY).	Common Service Centres (CSCs) & Banks.

Annexure-I

Districts having all the El Niño years (2002, 2004 & 2009) having >10 per cent decrease in yield and Districts having either of two years having >10 per cent decrease in yield for rice, sorghum, Pearlmillet and maize.

(a) Rice

State	Districts having all the years (2002, 2004 & 2009) having > 10 per cent decrease in yield	Districts having either of two years having > 10 per cent decrease in yield
Andhra Pradesh	Adilabad, Karimnagar, Medak, Nizamabad, Warangal	Mahaboobnagar, Visakhapatnam, Vizianagaram
Arunachal Pradesh	Tirap	Lohit
Assam	Darrang	Barpeta, Tinsukia
Bihar	Bhojpur, Darbhanga, Jehanabad, Jamui, Kisanganj, Madhubani, Nalanda, Purnia, Samastipur, Saran, Sitamarhi, Supaul	Araria, Aurangabad, Bhagalpur, Begusarai, Buxar, Gaya, Gopalganj, Khagaria, Katihar, Madhepura, Munger, Nawadah, PashchimChamparan, Patna, PurbaChamparan, Saharsa, Vaishali
Gujarat	Dahod, Panchmahal, Vadodara	Bharuch, Gandhinagar, Navsari, Dang, Valsad
Haryana		Jind
Himachal Pradesh		Kangra, Mandi
Jammu & Kashmir		Baramulla, Rajouri
Chhattisgarh	Bastar, Bilaspur, Dantewada, Dhamtari, Durg, Jashpur, Kanker, Kawardha, Korba, Raigarh, Rajnandgaon, Surguja	Janjgir, Koriya, Mahasamund, Raipur
Jharkhand	Dumka, Hazaribag, PurbiSinghbhum	Garhwa, Giridih, Gumla, Pakur, PashchimiSinghbhum
Karnataka		Belgaum, Dharwad, Haveri, Kolar, Udupi, UttaraKannada
Madhya Pradesh	Chhindwara, Gwalior, Harda, East Nimar, Katni, Panna, Rewa, Seoni, Shahdol, Sheopur, Tikamgarh, Umaria	Balaghat, Chhatarpu, Damoh, Hoshangab, Raisen,Sidhi
Maharashtra	Chandrapur, Gadchirol, Gondiya	Bhandara, Nagpur, Nandurbar, Nashik, Pune, Raigad, Ratnagiri, Sangli
Meghalaya		West Garo, West Khasi
Odissa	Balangir, Bargarh, Deogarh, Kalahandi, Malkangiri, Nabarangapur, Nayagarh, Nuapada, Rayagada, Sambalpur, Sonepur	Angul, Bhadrak, Bolangir, Balasore, Dhenkanal, Ganjam, Jajpur, Jharsuguda, Kandhamal, Keonjhar, Khurda, Koraput, Mayurbhanja, Sudargarh
Puducherry	Karaikal	
Rajasthan	Banswara	Bundi, Dungarpur, Hanumangah, Kota, SawaiMadhopur

Tamil Nadu		Nagapattinam, Perambalur
Uttar Pradesh	Azamgarh, Ballia, Balrampur, Chandauli, Chitrakoot, Deoria, Ghazipur, Mirzapur, Siddharthnagar, Sonbhadra, Varanasi	Aligarh, Allahabad,Budaun, Banda, Basti, Gonda, Gorakhpur, Kaushambi, Kheri, Mau,Pratapgarh, SantKabir Nagar, Shravasti, Sitapur
Uttarkhand	Uttarkashi	Garhwal, Tehri
Total no. of districts	**77**	**103**

(b)Sorghum

State	**Districts having all the years (2002, 2004 & 2009) having> 10 per cent decrease in yield**	**Districts having either two years having >10 per cent decrease in yield**
Andhra Pradesh	East Godavari	Kurnool
Gujarat	Ahmedabad,PanchMahal,Patan	Gandhinagar
Haryana	Rewari	Jhajjar, Panchkula,Sonepat
Chhattisgarh	Bastar, Sarguja	Kawardha(Kabirdham)
Jharkhand		Godda
Karnataka		Ballary, Bijapur,Koppal
Madhya Pradesh	Barwani,Betul,Datia, Dindhori,Khargaon, Mandsaur, Nimach,Panna, Raigarh,Raisen, Ratlam, Satna,Shahdol, Sheopur Kala, Shivpuri,Tikamgarh, Vidisha	Chhatarpur, Dewas, Dhar, Gwalior, Harda, Jhabua, Katni, Morena,Narsimpur,Sagar, Seoni, Umaria
Maharashtra	Chandrapur, Dhule	Nandurbar
Odissa	Baleshwar,Bolangir	
Rajasthan	Ajmer, Bharatpur, Bundi, Jaipur,Rajasmand, Sirohi,Tonk	Alwar, Banswara, Barmer, Bikaner, Dungarpur, Jaisalmer, Jalore, Karoli,
Tamil Nadu	Salem	Dindigul
Uttar Pradesh		Gonda, Mirzapur
Total no. of districts	**36**	**34**

(c) Pearlmillet

State	**Districts having all the years (2002, 2004 & 2009) having >10 per cent decrease in yield**	**Districts having either two years having >10 per cent decrease in yield**
Andhra Pradesh	Adilabad,Anantpur, Chittoor, Karimnagar, Kurnool, Nizamabad	
Gujarat	Porbandar	Kachchh, Rajkot, Surendranagar
Haryana	Jind, Sirsa	Mohindergarh
Karnataka	Bagalkot, Koppal, Raichur	
Madhya Pradesh	Bhopal, Datia, Raigarh, Sheopur Kala,	Barwani, Gwalior, Morena, Shivpuri, Khargaon
Rajasthan	Ajmer,Banswara, Baran, Barmer,	Bharatpur

	Bhilwara,Bikaner, Bundi, Churu, Dausa,Dungarpur, Ganganagar,Hanumangarh, Jaisalmer, JaloreJhunjhunu,Jodhpur, Rajsamand, Sirohi	
Tamil Nadu	Tiruvannmalai	Dharmapuri
Uttar Pradesh	Pratapgarh	
Total no. of districts	**36**	**11**

(d) Maize

State	**Districts having all the years (2002, 2004 & 2009) having >10 per cent decrease in yield**	**Districts having either two years having >10 per cent decrease in yield**
Andhra Pradesh	Karimnagar, Khammam, Kurnool, Nizamabad	Adilabad, Warangal
Bihar	Aurangabad, Banka, Begusarai, Khagaria, Jamui,	PurbiChamparan, Sheikhpura, Nawadah
Gujarat	Bhavnagar, Bharuch, Dang, Dohad,Mahesana, Rajkot,Sabarakantha	Ahamdabad,Amreli, Jamnagar, Surat, Vadodara, Narmada,
Himachal Pradesh	Shimla, Sirmaur	Kinnaur,Mandi, Solan
Jammu & Kashmir	Anantnag,Budgam, Doda	Kathua, Pulwama
Jharkhand	Chatra, Garhwa, Gumla, Lohardaga, Ranchi,	
Madhya Pradesh	Chhatarpur,Damoh, Datia, Guna, Gwalior, Jhabua, Katni, Mandala, Mandsaur, Panna, Sagar,Satna, Nimach, Ratlam, Seoni, Sheopurkala, Shivpuri, Tikamgarh, Ujjain	Badwani, Indore, Rajgarh, Shajapur
Maharashtra	Ratnagiri, Sindhudurg	
Orissa	Baleshwar, Nuapada	Gajapati, Malkangiri
Rajasthan	Ajmer, Banswara, Bundi, Dausa, Jaipur,Jalor, Kota, Pali, Rajasmand, Sawaimadhopur, Sirohi, Tonk, Udaipur	Alwar, Dungarpur, Jhalawar, Chittorgarh
Uttar Pradesh	Allahabad, Fatehpur, Pratapgarh	Budaun, Bulandshahar, Meerut, SantRavidas Nagar, Soanbhadra
Uttaranchal		Garhwal, Tehrigarhwal
Total no. of districts	**65**	**33**

Annexure – II

State-wise contingency planning for Major crops under El Nino Condition

Uttar Pradesh

Area under major crops

Crop	Area (lakh ha)
Paddy	73.50
Sugarcane	27.20
Bajra	9.31
Maize	6.81

Districts vulnerable to El Nino

High	Medium	Low
Nil	Mahoba	Chitrakoot, Jhansi, Badaun, Deoria, Kheri, Saharanpur, Farrukhabad, Sonbhadra

Contingency measures for major crops during El Nino

Paddy

- Grow drought-tolerant short-duration varieties (NDR-97, Susk Samrat, Sahbhagi, UPS-212, PS-4, PS-5, PB-1 and PRH-10 etc)
- Adopt direct seeded rice (DSR), drum seeding or SRI method wherever feasible.
- Undertake timely transplanting with 3–4 seedlings per hill and maintain closer spacing (20 × 15 cm) under delayed conditions.
- Carry out thinning, gap filling and weeding in the existing crop to maintain optimum plant population.
- Provide irrigation at hairline crack stage and restrict irrigation to critical growth stages only using available tube well water.
- Follow alternate wetting and drying (AWD) irrigation schedule to conserve water.
- Apply recommended fertilizers along with additional urea and zinc sulphate as required.
- Spray 2 per cent urea and KCl solution as foliar application during moisture stress conditions.
- Apply 1per cent MOP foliar spray to reduce drought stress.
- Use locally available weeds or crop residues as mulch for moisture conservation.
- Replace rice with maize, aerobic rice, green gram or Pearlmillet if rainfall delay or moisture stress becomes severe.
- Provide irrigation at critical crop growth stages based on water availability.

Sugarcane

- Apply MOP as recommended to improve drought tolerance and crop vigor
- Remove lower/dry leaves (detrashing) to reduce non-productive water loss and improve field sanitation.
- Apply mulch using sugarcane trash or locally available crop residues to conserve soil moisture and suppress weeds.
- Adopt alternate furrow irrigation to improve water-use efficiency and reduce irrigation water requirements.
- Provide light irrigation at critical growth stages based on water availability.
- Maintain moisture conservation practices throughout the crop period to minimize the impact of drought stress

Bajra

- Use drought-tolerant varieties/hybrids(WCC-75, Raj-171, Pusa-23, Pusa-322, ICMH-451etc)
- Carry out thinning, weeding and gap filling to maintain optimum plant population.
- Postpone top dressing of fertilizers until adequate soil moisture is available.
- Provide life-saving irrigation whenever water is available during critical growth stages.
- Apply foliar spray of urea or KCl to alleviate moisture stress and sustain crop growth.
- Harvest pods/ears at maturity to minimize losses under drought conditions.
- Harvest the crop at physiological maturity stage for grain production.

Maize

- Select early and short-duration varieties/hybrids such as Azad Uttam, Azad Kamal, Tarun, Naveen, Prakash, PEHM-2, PEHM-5, Kanchan, Sweta and Surya.
- Adopt ridge and furrow planting for better moisture conservation and drainage.
- Carry out thinning and gap filling to maintain optimum plant population.
- Apply the recommended basal fertilizer dose (2/3 RDF) at sowing.
- Postpone top dressing of fertilizers until adequate soil moisture is available.
- Apply the remaining 1/3 RDF of potassium (K) at tassel initiation stage.
- Undertake timely weed control to reduce competition for moisture and nutrients.
- Provide life-saving irrigation and irrigate at critical growth stages whenever water is available.
- Foliar spray of urea or KCl during moisture stress conditions.
- Harvest cobs/ears at maturity to minimize yield losses.
- Harvest the crop at physiological maturity for grain production.
- If severe drought persists, harvest the crop for fodder to obtain economic returns.

Madhya Pradesh

Area under major crops

Crop	Area (Lakh ha)
Soybean	58.72
Paddy	38.85
Maize	23.03
Cotton	5.37

Districts vulnerable to El Nino

High	Medium	Low
Dindori, Shahdol, Anuppur	Alirajpur, Singrauli, Betul	Umaria, Jhabua, Chhindwara, Panna, Seoni, Shivpuri, Mandsaur, Rajgarh, West Nimar, Rewa, Chhatarpur, Shajapur, Ratlam, Vidisha, Burhanpur, Dhar, Katni, Damoh, Barwani, Sehore, East Nimar, Sagar, Raisen, Sidhi, Bhopal, Narsimhapur, Tikamgarh, Agar Malwa, Guna, Dewas, Ujjain, Niwari, Sheopur, Ashoknagar

Contingency measures for major crops during EL Nino

Soybean

- Select short duration varieties (JS-95 60, IS 9305, JS 335 and NRC-7)
- Re-sowing of Soybean (15-20 days after sowing): JS 9305, JS 95-60
- Change the Crop with: Sweet corn/ Sunflower (Modern) /Pigeon pea
- Sowing of crops in furrow irrigation ridge bed system (FIRBs)
- Spray 2% urea and maintain optimum plant population by thinning in alternate row
- Increase seed rate by 10 per cent of optimum and maintain inter row spacing of 30cm
- Seed dressing with Thirum + carbendazim in 2:1 ratio 3g/kg seed - Rhyzobium culture + PSB 5g./kg. seed each. 1.0 g. Ammonium Molibdate/kg. of seed for soybean and
- Inter cropping with chickpea cropping sequence -Cultivate the field on receiving pre monsoon showers - Intercropping of pigeonpea with soybean (2:4)
- Gap filling with seed, spray 2 per cent solution of DAP water during the dry spell Spraying of PMA@ 3 ppm solution during dry spell
- 1 per cent N Spraying, use dora and lifesaving irrigation in FIRBs, if available, mulching of Polythene sheet, drip irrigation system facilities developed
- 20 per cent defoliation in soybean and use as mulching -Spray of 2 per cent solution of MOP/DAP/ water during the dry spell -Spraying of PMA @3 ppm solution during the dry

Paddy

- Delayed Sowing:If monsoon onset is delayed, shift from traditional broadcasting to direct-seeded rice or adopt the SRI method to reduce water dependency.
- Crop Substitution**:** Black gram**,** green gram**,** sesame orsoybean
- Growing of drought resistant var. (Pusa Sugandha-3, Pusa Sugandha-5, IR-36, JR-201)
- Use short duration varieties: DRR Dhan 42 DRR Dhan 44MTU 1010
- Spray 2 per cent urea or MoP during the dry spell

Maize

- Short Duration Varieties and Hybrids (PMH-2**,** JH 3459**,** Prakash**,** Pusa Early Hybrid Maize-6, Ganga-2, Ganga Safedi-2, HPQM 1, JVM 421 etc)
- Seed priming of maize (0.1 per cent Thiourea) for 6hrs
- One hoeing may be done for conserving soil moisture
- Seed dressing with Thirum + carbendazim in 2:1 ratio 3g/kg seed
- Seed Treatment with Rhizobium culture + PSB 5g./kg. seed each. 1.0 g. Ammonium Molibdate/kg.
- Sowing Method: Ridge and furrow
- Maintain a row-to-row spacing of 60 cm and plant-to-plant spacing of 20 to 25 cm.
- Intercropping of Maize with Black gram (10:2)
- Earthing up at 30 to 35 days after sowing and Spray of kaolin at 5 per cent and Spray of 1000 ppm thiourea
- Delay the spray of urea till optimum soil moisture availability 20per cent defoliation of lower leaves and use as mulching
- Application of 1per cent N Spraying (2 Weeks after Sowing)
- Terminal Drought: Harvest at physiological maturity or sale green cobs (dough stage) and green fodder for cattle.

Cotton

- Change the Cropping pattern: Black gram JU-86, JU-3, T-9, or Green gram: JM-721 K-851
- Increasing seed rate up to 25 per cent and select short duration varieties for sowing
- Use Ridge/ BBF sowing Method
- Seed treatment with thirum+bavistin in equal ratio @3 gm/kg seed
- Sowing of crops in furrow irrigation ridge bed system (FIRBs)
- Growing of Bt cotton Varieties: KHy 1,4,11,
- Making field free of weeds full utilization of water and nutrients by the crops
- Inter Cropping: Cotton + Soybean
- 1per cent N Spraying, use dora and lifesaving irrigation in FIRBs, if available, mulching of Polythene sheet, drip irrigation system facilities developed
- Foliar application of 2per cent DAP solution at Flowering stage
- Spray 2per cent urea during the drought spell Maintain optimum plant population by gap filling Timely weed control

- Use Biofertilizer:Arbuscular Mycorrhizal Fungi (AMF)and drought-tolerantPlant Growth-Promoting Rhizobacteria (PGPR)like *Bacillus* strains.

Maharashtra

Area under major crops

Crop	Area (Lakh ha)
Soybean	50.72
Cotton	41.23
Sorghum	16.91
Paddy	16.82
Maize	16.25
Sugarcane	11.67

Districts vulnerable to El Nino

High	Medium	Low
Akola, Amravati, Aurangabad, Bombay city, Bombay suburban, Buldana, Chandrapur, Dhule, Gondia, Jalna, Kolhapur, Nandurbar, Nashik, Osmanabad, Palghar, Ratnagiri, Raygad, Satara, Sindhudurg, Thane, Wardha, Yavatmal	Nil	Nil

Contingency measures for major crops during EL Nino

Soybean

- Drought tolerant varieties promotion: MAUS-612, MAUS-162
- Broad Bed and Furrow (BBF) system to be use
- Intercropping: Soybean (JS-335, MAUS-71) + Pigeon pea (BSMR 736, 853, BDN708, 711) in 4:2 or 6:3 row proportion
- Crop Substitution: Pearlmillet (ICTP-8203, GHB 558, AIMP92901, Shradha, Saburi) + Pigeon pea (BSMR 853, 708, BDN-708, 711) in 4:2 or 3:3 row proportion
- Give protective irrigation and foliar spray with 2 percent urea and DAP
- Gap filling within the rows with same or short duration cultivar to maintain at least 75per cent of optimum plant population, If the plant population is less than 50per cent go for re sowing of the crop.
- Interculture for weeding and to create soil mulch opening of alternate furrows with Balaram plough
- Intercropping: Soybean (JS-335, MAUS-71) + Pigeon pea (BSMR 736, 853, BDN708, 711) in 4:2 or 6:3 row proportion
- Crop Substitution: Pearlmillet (ICTP-8203, GHB 558, AIMP92901, Shradha, Saburi) + Pigeon pea (BSMR 853, 708, BDN-708, 711) in 4:2 or 3:3 row proportion
- Give protective irrigation and foliar spray with 2 percent urea and DAP

Cotton

- Prefer short duration varieties / hybrids or Cotton + pigeonpea (BSMR 736, 853, BDN 708,711) in 6:1 row proportion
- Broad Bed and Furrow (BBF) system to be use
- Gap filling 7-10 days after sowing by pot watering within the rows with same cultivar or pigeonpea to maintain at least 75per cent plant population.
- Avoid top dressing of fertilizers till sufficient soil moisture is available
- Mulching with crop residue @ 3-5 t / ha and Foliar spray of 2 per cent KNO3, urea, DAP, MgSo4, Zinc, Boron
- Opening of alternate furrows with Balaram plough
- Adoption of Relay cropping of chickpea, safflower, rabi sorghum
- Adopt 20-25 per cent more seed rate than recommended and reduce fertilizer dose by 25 per cent
- Crop Substitution: Pearlmillet (Shradha, Saburi, AIMP-92901), Sunflower (Morden, SS-56, LSFH-35, BSH-1) or Pearlmillet + Pigeonpea in 3:3 or 4:2 row proportion or keep fallow and plan for rabi season
- Crop Substitution: Hybrid Maize (Decalp, Kargil, Maharaja)
- Delayed Germination: Gap filling within the rows with same cultivar or pigeonpea to maintain at least 75 per cent plant population.
- Two sprays of 2 per cent MgSO4, Zn, Boron at weekly interval when the crop is encountered reddening symptoms Spray 2 per cent urea solution or 1 per cent water soluble fertilizers like 19-19-19, 20-20- 20, 21-21-21 to supplement nutrition.

Jowar

- Prefer Varieties like CSH 14,16,17
- Thinning, Hoeing at 25 DAS and weeding
- Seed Treatment of Imidachloprid 70 WS 7g/Kg Seed Sulphur 4g/Kg Seed
- Crop Substitution: Sunflower (Bhanu, Phule Raviraj) or Soybean Varieties JS-335, JS-93 -0
- Kaolin spray @ 8 per cent
- Resowing if population is less than 30 per cent

Paddy

- Prefer early varieties: Ratnagiri -73, Karjat184, Karjat -3 and Mid late Variety's: Palghar1, Palghar- 2, Karjat- 5
- Fallow cropping system Upland Paddy: Phule Radha, Indrayani, Bhogavati
- Sowing of sprouted seeds
- Direct seeding with seed drill - Weed free condition up to 40 days - N split application (50 kg N at sowing & 50 kg N at 25 DAS
- Increase number of seedlings per hill (5 to 6)
- Increase 25 per cent nitrogen application.
- Adopt closer spacing (15 x15 cm)

- Crop Substitution: Grow oil seed crops like groundnut (Konkan Gaurav, SB XI, Phule pragati)

Maize:

- Growing of fodder maize (African Tall) and Wider spacing (60 x 30 cm)
- Gap filling within the rows with same or short duration cultivar to maintain at least 75 per cent plant population
- Mulching with crop residue @ 3-5 t / ha
- Anti-transparent: If feasible spray anti-transparent 6 per cent kaolin
- Avoid applying fertilizers till sufficient soil moisture is available Making of conservation furrows for moisture conservation Interculture with harrows Two sprays of 2 per cent MgSO4, Zn, Boron at weekly interval when the crop is encountered reddening symptoms Spray 2 per cent urea solution or 1 per cent water soluble fertilizers like 19- 19-19, 20-20-20, 21-21-21 to supplement nutrition
- In case of severe stress harvest as green fodder

Sugarcane

- Raising of nurseries with single budded setts to save the time and water for pre-seasonal planting
- Drip system for enhancing the water productivity
- Mulching with sugarcane trash between rows and frequent intercultural to conserve moisture

Andhra Pradesh

Area under major crops

Crop	Area (Lakh ha)
Paddy	20.77
Cotton	4.04
Groundnut	3.28
Tobacco	1.39

Districts vulnerable to El Nino

High	Medium	Low
Kurnool	Anantapuramu, Sri Satya Sai	Nil

Contingency measures for major crops during EL Nino

Paddy

- Change the cropping system: Redgram (sole crop), Redgram + blackgram, Blackgram, Green gram.
- Prefer short duration varieties: Bharani, Somasila, MTU-1010, NLR34242, NLR-34449, JGL1798. SRI cultivation.
- Adopt direct seeding of paddy with short duration varieties by following proper weed management practice
- Adopt closer spacing by planting 4-6 plants/hill and transplanting of aged seedling
- Apply entire P and K and two third N as basal and remaining one third N as basal
- Instead of top dressing with N fertilizers, foliar application can be taken up for efficient use of N.
- Foliar application of 2 per cent urea

Cotton

- Change the cropping system: Redgram (sole crop), Redgram + blackgram, Blackgram, Green gram.
- Gap filling is to be taken up by pot watering 7-10 after sowing if the crop stand
- Foliar application with 2 per cent urea and inter-cultivates periodically to conserve soil moisture
- Spray urea 2 per cent urea or KNO3 Topping to prevent formation of new vegetative and reproductive flush
- Prefer NHH-44, H-8, Ajith11, BT cotton

Groundnut

- Intercropping: Groundnut, + Redgram intercropping (7:1) or (11:1)
- Cropping system: Ground nut (Narayani, K6, Greeshma) + Redgram (LRG41) (7:1 or 11:1)

- Groundnut short duration varieties (Narayani, K6, Greeshma, Abhaya) + Redgram (LRG-41) (7:1 or 11:1)
- Foliar application of 2 per cent urea or Multi-K or 19:19:19 @1 per cent at every 15 days' interval until rainfall receive

Tobacco

- Adopt closer spacing of 90x45cm
- Recommend short duration varieties such as G-11, ITC varieties
- Spray 2 per cent urea (Mid-Season drought)

Bihar

Area under major crops

Crop	Area (lakh ha)
Paddy	32.42
Maize	8.96
Pigeon pea	0.12

Districts vulnerable to El Nino

High	Medium	Low
Nil	Jamui, Bhagalpur, Katihar, Patna	Kishanganj, Nawada, Sheikhpura, Samastipur, Sheohar, Nalanda, Sitamarhi, Begusarai

Contingency measures for major crops during EL Nino

Paddy

- Use short-duration and drought-tolerant varieties such as Prabhat, Richharia, Dhanlaxmi, Turanta, Birsa Dhan-105, Birsa Dhan-106, Rajendra Bhagavathi, Rajshree, Rajendra Suwasni, Rajendra Sweta, Mahamaya, Birsamati and Swarna Sub-1.
- Adopt direct seeding of rice or transplant 30–35 days old seedlings with 3 seedlings per hill at closer spacing.
- Ensure application of recommended fertilizers, particularly phosphorus and potash and postpone top dressing of nitrogen until adequate moisture is available.
- Undertake gap filling and timely mechanical/chemical weed management to maintain optimum plant population.
- Provide life-saving irrigation and apply foliar spray of 1 per cent urea during moisture stress conditions.
- Raise mat-type nursery and Dapog nursery to save the time
- Apply nitrogen in 3-4 splits instead of basal-heavy application

Maize

- Cultivate drought-tolerant and suitable varieties such as Shaktiman-1, Shaktiman-2, Shaktiman-3, Shaktiman-4, Shaktiman-5, Suwan, Ganga-11, Deoki and Pusa Early Hybrid Makka-3.
- Timely sowing with drought-tolerant hybrids-DHM-117, HQPM-1, HQPM-5, Shaktiman-1 and Shaktiman-4
- Ridge-furrow and BBF planting
- Protective irrigation at tasselling and silking
- Apply the full basal dose of NPK fertilizers and ensure potash application as recommended.

- Incorporate organic manure or vermicompost at the initial stage to improve soil moisture retention and soil health.
- Undertake inter-culturing operations and adopt moisture conservation measures to reduce moisture loss.
- Apply mulching using locally available crop residues to conserve soil moisture and suppress weeds.

Pigeon pea

- Maintain adequate seed reserves of drought-resilient and wilt-tolerant varieties
- Shift to short duration varieties (Pusa 992, UPAS 120 and Rajendra Arhar-1)
- Use drought-tolerant varieties-IPA 203, Bahar and UPAS 120
- Increase seed rate by 15–20 per cent and seed treatment with Rhizobium + PSB + Trichoderma
- Seed priming with 2 per cent KCl solution for 6–8 hours
- Maintain optimum plant population
- Ridge-furrow sowing and moisture conservation
- Growing pigeonpea on crop field bunds
- Restrict cultivation to medium and lowland situations with residual moisture.
- Adopt intercropping systems: Pigeonpea + Maize (1:1); Pigeonpea + Sesame (2:1); Pigeonpea + Urd (1:2)
- Foliar nutrition during drought at veg. stage-2 per cent Urea, flowering stage: 2 per cent DAP and severe moisture stress 1 per cent Potassium nitrate (KNO_3) & 2 per cent KCl spray

Punjab

Area under major crops

Crop	Area (Lakh ha)
Paddy	32.43
Cotton	1.60
Sugarcane	0.89
Maize	0.86
Moong	0.33
Bajra	0.01

Districts vulnerable to El Nino

Highly	Medium	Low
Nil	Nil	Kapurthala, Pathankot, Rupnagar

Contingency measures for major crops during El Nino

Paddy

- Adopt short-duration varieties such as PR-115, PR-126, PR-128, PR-131 and PR-132.
- Paddy should be replaced with short duration basmati rice, maize, soybean and other pulse crops
- Direct Seeded Rice (DSR), laser land levelling, bed planting, and seed priming should be promoted to save water (Direct seeding of rice saves about 20 per cent of irrigation water and laser levelling of field also saves 20-25 per cent of irrigation water)
- Nitrogen fertilizer may be applied after drainage to aid crop recovery.

Cotton

- Drought-tolerant and resistant varietiesshould be promoted.
- Ridge planting and alternate furrow irrigation should be encouraged to conserve water.
- Gap filling should be done through transplantation of 21days healthy cotton seedlings.
- Integrated pest management practices should be followed.
- A foliar spray of 2 per centKNO_3 may be applied to reduce stress.
- Mealy bug and bollworm infestations should be controlled during the recovery period.

Sugarcane

- Paired-row trench planting should be promoted to improve water-use efficiency.
- In severe drought situations, farmers may shift to less water-intensive crop combinations such as wheat and oilseeds.
- Use drip irrigation wherever it is possible
- Trash mulching, micro-irrigation and timely earthing-up should be encouraged.
- Red rot, smut, pyrilla, and borer infestations should be monitored regularly.
- Provide irrigation only at critical growth stages.
- Earthing-up and propping operations should be carried out to prevent lodging and crop damage.

Maize

- Short-duration varieties such as PMH-2 and JH-3459 should be promoted.
- Pearlmillet varieties may be considered as substitute crops in severely affected areas.
- Staggered sowing, mulching, contour farming, seed treatment, and bed planting should be adopted.
- Stem borer, aphids, and turcicum blight should be monitored and managed promptly.
- Waterlogging should be avoided as maize is highly susceptible to stalk rot.

Moong/ Mash

- Pulses are suitable alternatives in areas facing groundwater scarcity and canal water shortages.
- Encourage intercropping with maize and cotton.
- Varieties such as ML-818 and PAU-911 should be promoted.
- Seed treatment, staggered sowing, and intercropping with maize can improve resilience.
- Reduced irrigation requirements make pulses suitable for drought-prone areas.
- Diseased plants should be removed and destroyed to prevent further spread.
- Appropriate fungicides may be applied to prevent root and stem rotting.

Bajra

- Bajra is a suitable crop option under severe rainfall deficit conditions.
- Drought-tolerant varieties such as FCB-164 and FBC-16 should be promoted.
- Adopt minimum tillage and moisture conservation practices.
- Downy mildew should be managed through seed treatment and timely fungicidal application.
- Re-sowing may be undertaken if crop establishment is severely affected.

Jharkhand

Area under major crops

Crop	Area (Lakh ha)
Paddy	14.69
Maize	2.89
Red gram	2.17
Black gram	1.26

Districts vulnerable to El Nino

Highly	Medium	Low
Jamtara, Bokaro Bokaro	Hazaribag, Kodarma, Dhanbad, Latehar, Devghar, Palamu, Ramgarh	Lohardaga, Giridih, Garhwa

Contingency measures for major crops during El Nino

Paddy

- Recommend direct-seeded upland rice along with pigeon pea, maize and groundnut as alternatives
- Replace long-duration varieties with short-duration cultivars
- Prefer Direct Seeded Rice (DSR) over conventional transplanting system
- Promote intercropping Pigeon pea + Upland rice and Maize + Ladies finger
- Use DSR short duration varieties like Sahbhagi, Lalat, IR-64, Naveen and Birsa Dhan-108
- Seed priming for hasten germination and better crop stands
- Seed treatment with Bavistin @ 2g/kg seed before sowing
- Shift uplands from rice to Finger millet (Ragi), Blackgram, Greengram, Sesame, Niger
- Promote Niger, Horsegram, *Toria*, or sweet potato as an alternate crop
- Carry out inter cultivation, gap filling and thinning to maintain optimum plant population
- Apply life-saving irrigation at tillering and panicle initiation.
- Follow alternate wetting and drying
- Mulching and field bund strengthening
- Establishment of Sprinkler irrigation system
- Residue management through waste decomposer
- Development of fallow land into cultivated land in Kharif season though millets and arhar

Maize

- Promote to cultivate varieties such as Birsa Makka-1, Birsa Vikas Makka-1 and 2
- Shift to intercropping: Maize + Pigeonpea (2:1), Maize + Cowpea (1:1), Maize + Blackgram (1:2
- Use only short-duration maize variety Birsa Vikas Makka-2
- Varieties Kanchan and Birsa Makai-1 are recommended for contingency sowing

- Use short-duration hybrids (85–95 days: DKC-9081)
- Increase seed rate by 10–15 per cent under late sowing
- Follow conservation furrows after every 4–6 rows
- Foliar spray of 1 per cent KNO_3 at tasselling and silking
- Practice staggered sowing to match available rainfall window
- Inter cultivation, gap filling and thinning at vegetative stage
- Provide life-saving irrigation at tasselling and silking stages

Red gram

- Recommend short duration varieties, such as Bahar, Birsa Arhar-1, UPAS-120, BR-65 and Narendra Arhar-1
- Prefer early- and medium-duration varieties (140-180 days) over long-duration cultivars
- Ensure optimum plant population through timely gap filling
- Shift to intercropping combination- pigeonpea + groundnut, pigeonpea + maize, pigeonpea, blackgram, pigeonpea + okra, pigeonpea + blackgram or pigeonpea + maize (1:2) as intercrop
- Follow closer spacing of 75 × 30 cm to compensate for late sowing planting
- Carry out earthing up and interculture operations
- Apply seed treatment with Bavistin @ 2g/kg followed by Rhizobium inoculant for all pulse crops
- Use wider spacing of 90 × 25 cm in pigeonpea under mild delay (2 weeks) to allow crop to spread
- Apply life-saving irrigation during flowering and pod filling
- Remove excess weeds to reduce competition for limited soil moisture
- Foliar spray of 2 per cent KCl or 1 per cent KNO_3 during prolonged dry-spells.
- Provide one life-saving irrigation, if water is available
- Foliar application of 2 per cent DAP or 1 per cent KNO_3 to reduce flower drop and improve pod setting

Blackgram

- Recommended blackgram varieties are Birsa Urd-1, Pant U-19, T-9
- Use Blackgram + Greengram intercropping system.
- Follow closer spacing for blackgram (75 × 30 cm) under delayed sowing
- Gap filling and re-sowing in case of severe mortality
- Apply mulching to conserve soil moisture

Assam

Area under major crops

Crop	Area (Lakh ha)
Paddy	22.03
Maize	1.00
Black gram	0.68

Districts vulnerable to El Nino

Highly	Medium	Low
Dhima Haso, Sibsagar, Jorhat, Karimganj, Kamrup Metropolitan, Darrang, Kamrup,Sonitpur	Nalbari, Goalpara	Karbi, Anglong, Dhuburi

Contingency measures for major crops during El Nino:

Paddy

- Shift to short-duration and drought-tolerant and direct seeded rice varieties Luit, Kapili, Disang, Kolong, and Jyoti.
- Follow wider spacing and line transplanting to reduce moisture stress.
- Promote System of Rice Intensification (SRI) techniques.
- Maintain field bunds to conserve soil moisture.
- Reduce nitrogen application during prolonged dry spells.
- Provide life-saving irrigation at tillering and flowering stages.
- Carry out timely weed management to reduce competition for moisture

Maize

- Cultivate short-duration hybrids and composite varieties.
- Adopt maize + cowpea or maize + blackgram intercropping systems.
- Carry out gap filling and thinning to maintain optimum plant population.
- Practice inter cultivation for moisture conservation.
- Apply mulch using crop residues.
- Provide protective irrigation during tasselling and grain-filling stages.

Blackgram

- Use short-duration drought-tolerant varieties.
- Utilize these crops as contingency options in failed rice fields.
- Follow line sowing and seed treatment with Rhizobium culture.
- Adopt moisture conservation practices.
- Harvest promptly at maturity to avoid shattering losses.

Tripura

Area under major crops

Crop	Area (Lakh ha)
Paddy	2.25
Maize	0.14
Black gram	0.06
Sesamum	0.05
Red gram	0.04

Districts vulnerable to El Nino

Highly	Medium	Low
Unakoti	North Tripura	

Contingency measures for major crops

Paddy

- Use short-duration and drought-tolerant rice varieties such as Gomati, Tripura Dhan-1, Tripura Dhan-2, and Sahbhagi Dhan.
- Adopt direct-seeded rice where transplanting is delayed.
- Maintain optimum plant population through gap filling.
- Promote System of Rice Intensification (SRI) techniques for water saving.
- Apply nitrogen fertilizers in split doses.
- Provide life-saving irrigation during tillering and flowering stages.

Maize

- Cultivate short-duration hybrid and composite maize varieties Vivek QPM-9, Vivek Hybrid-27, HQPM-1, and HQPM-5.
- Adopt maize + cowpea or maize + blackgram intercropping systems.
- Carry out thinning and gap filling operations.
- Practice inter cultivation and mulching to conserve moisture.
- Provide protective irrigation at tasseling and grain-filling stages.
- Harvest early for fodder if drought conditions become severe.

Black gram

- Grow short-duration drought-tolerant varieties such as T-9 and PU-31.
- Follow seed treatment with Rhizobium culture before sowing.
- Adopt line sowing and timely weed management.
- Practice moisture conservation through mulching.
- Harvest at physiological maturity to avoid shattering losses.

Sesamum

- Grow drought-tolerant varieties such as Tilottama, Prachi, Amrit, TC-25, and TKG-22.
- Utilize sesame as an alternative crop under delayed monsoon situations.
- Follow line sowing and thinning.
- Practice timely weed management.
- Harvest at physiological maturity to minimize seed loss.

Red gram

- Recommend short-duration drought-tolerant varieties are UPAS 120, Pusa Ageti, Pant A-291, and Paras.
- Follow groundnut + pigeonpea intercropping systems.
- Perform timely earthing-up operations.
- Adopt mulching and moisture conservation practices.
- Harvest at physiological maturity if drought intensifies.

Karnataka

Area under major crops

Crop	Area (Lakh ha)
Maize	19.14
Red gram	17.45
Paddy	11.81
Ragi	8.79
Green gram	5.67
Sugarcane	5.4
Groundnut	3.97

Districts vulnerable to El Nino

High	Medium	Low
Kodagu, Dharwad, Ramanagra	Gadag, Bangalore Rural, Chik Ballapur, Hassan, Bangalore Urban, Kolar, Chikmagalur, Chitradurga, Haveri, Udupi	Koppal, Tumkur, Uttar Kannad, Davanagere, Belgaum, Shimoga, Bellary, Dakshin Kannad

Contingency measures for major crops during El Nino

Maize

- Cultivate drought-tolerant and short-duration maize hybrids such as NAH-2049, NAH-1137, NAC-6002 (90 days) and NAC-6004 along with suitable moisture conservation measures
- Thinning and frequent intercultivation for moisture conservation.
- Gap filling and re-sowing within 15 days of sowing if plant population is less than 30 per cent.
- Opening conservation furrows at 1.5 m intervals.
- Dust mulching, conservation furrows, weeding, and thinning of excess plant population; removed plants can be used as mulch.
- Provide protective irrigation whenever water is available.
- Foliar spray of 2 per cent MOP (Muriate of Potash) or 1 per cent kaolin during moisture stress.
- Apply nitrogen in split doses to improve nutrient-use efficiency under drought conditions.
- Mulch with crop residues or other organic materials to prolong soil moisture availability.
- Thin out about 25 per cent of the crop under severe moisture stress and utilize the removed plants as fodder or mulch to reduce competition for limited soil moisture.

Redgram

- Adopt short-duration and drought-tolerant redgram varieties such as TS-3R, BRG-5, GRG-811 and Asha (ICPL 87119)
- 1 per cent potassium spray before the crop expresses wilting symptoms.
- Opening of conservation furrows at 1–2 m intervals.
- Compartment bunding for in-situ moisture conservation.
- Foliar nutrient spray of 1 per cent potassium or 1 per cent 19:19:19 water-soluble fertilizer.
- Harvest the crop at physiological maturity and take up an early rabi crop. In case of severe drought, harvest the crop for fodder purposes.
- Reduce plant population by thinning up to 25–66 per cent, depending on the severity of moisture stress, up to 30–35 DAS.
- Thinning out of excess plants to reduce competition for available moisture.

Paddy

- Use drought-tolerant/medium-duration varieties such as BR-2655, Jaya, KRH-1, and KRH-2.
- Adopt Aerobic Rice or System of Rice Intensification (SRI) methods under limited water availability.
- Maintain soil wetness without continuous ponding
- Scooping of topsoil were recommended for moisture conservation.
- Use rock phosphate (RP @ 250 kg/ha) as a phosphorus source along with phosphate-solubilizing bacteria (PSB).
- Reduce basal fertilizer application and apply fertilizers in split doses.
- Undertake timely intercultivation and effective weed management.
- Provide lifesaving irrigation, particularly during critical crop growth stages such as panicle initiation, flowering, and grain filling.

Ragi

- Prefer short-duration and drought-tolerant finger millet (ragi) varieties such as GPU-28, GPU-48, ML-365 and KMR-301
- Re-sow with medium- or short-duration varieties, or the recommended contingent crop, if the plant population is less than 70 per cent.
- Carry out intercultivation and shallow intercultivation to control weeds and conserve soil moisture.
- Adopt soil mulching and effective weed management practices.
- Open conservation furrows for moisture conservation.
- Incorporate in-situ green manuring and apply soil mulch wherever possible.
- Early-season moisture stress may induce uniform flowering; therefore, timely weed management and moisture conservation measures should be adopted.
- Recommend leaf clippingto reduce transpiration losses under drought conditions.

Greengram

- Treat seeds with 2 per cent $CaCl_2$ to enhance drought resilience.
- Shift to fast-maturing, drought-tolerant varieties such as Selection-4, PS-16, and BGS-series varieties**.**
- Undertake thinning and gap filling to maintain optimum plant population.

- Re-sow if the plant population falls below the recommended level.
- Spray 1–2 per cent urea or1 per cent potassium chloride (KCl) during prolonged dry spells to reduce leaf scorching and support plant survival.
- Under delayed sowing or semi-dry soil conditions, increase the seed rate by 15–20 per cent to ensure an adequate plant stand despite poor germination.

Sugarcane

- Strip the dry lower leaves of the standing cane crop at the 5th month and leave them as mulch in the inter-row spaces. This reduces soil temperature and minimizes moisture loss
- During a moisture stress period, spray 2.5 per cent Urea mixed with 2.5 per cent Muriate of Potash (MOP/KCl) at 15-day intervals to help the crop withstand drought.
- Perform hoeing in inter-row spacing to create a dust mulch, which breaks soil capillaries and restricts surface moisture evaporation.
- Carry out proper earthing-up operations to protect roots from exposure and improve water retention.
- Deploy recommended resilient sugarcane Drought-Tolerant Varieties like CO-86032COC-671, or CO-94012.
- Apply a 10 cm layer of cane trash over the ridges within a week of planting to reduce evaporation and retain moisture.

Groundnut

- Adopt drought-tolerant varieties such as JL-24 and GPBD-4.
- Practice intercultivation (dust mulching), conservation furrows, weeding, and thinning of plant population use removed plants as mulch.
- Spray 2 per cent MOP (Muriate of Potash) or 1 per cent Kaolin during moisture stress.
- Postpone top dressing of fertilizers during drought conditions.
- Undertake earthing-up and gypsum application after receipt of rains.
- Provide life-saving irrigation at critical crop growth stages.

Telangana

Area under major crops

Crop	Area (Lakh ha)
Paddy	48.09
Maize	5.79
Jowar	1.67
Soybean	1.54
Groundnut	1.05
Green gram	0.34

Contingency measures for major crops during El Nino

Paddy

- Prefer short-duration and drought-tolerant paddy varieties such as MTU 1010, JGL 1798 (Telangana Sona), KNM 118 and RNR 15048
- Maintain optimum plant population through gap filling within 10–15 days after transplanting.
- Follow alternate wetting and drying to conserve irrigation water.
- Use short-duration and drought-tolerant varieties in delayed planting situations.
- Apply mulch or conserve field moisture through intercultivation and bund maintenance.
- Foliar spray of 2 per cent urea or 1 per cent KCl during moisture stress conditions.

Maize

- Adopt tolerant hybrids such as NAH-2049, NAH-1137, NAC-6002 (90 days) and NAC-6004
- Carry out gap filling with healthy seedling with short-duration hybrids.
- Foliar application of 2 per cent urea solution, 2–3 times at 10–15 days interval.
- Apply 30 kg N/ha immediately on receiving rains during the vegetative stage.
- Carry out intercultivation and earthing up for moisture conservation.
- Provide protective irrigation at critical stages (knee-high, tasselling and grain filling) whenever possible.

Jowar

- Grow short-duration and drought-tolerant varieties such as CSV 15, CSV 20, CSV 23, CSV 27 and CSH 16
- Re-sowing with Redgram/Castor if the population is low.
- Undertake intercultivation (dust mulching) to conserve soil moisture.
- Thin excess plants to maintain optimum plant population.
- Apply 2 per cent KCl or 2 per cent urea foliar spray during prolonged dry spells.
- Harvest fodder from severely affected crop and utilize for livestock.

Soybean

- Drought-tolerant soybean varieties such as JS 20-34, JS 20-98, NRC 128 and RVS 2001-4
- 2 per cent urea foliar spray.

- Frequent intercultivation with push hoe to control weeds and conserve soil moisture.
- Reduce row spacing to 90 cm.
- Open conservation furrows at 15–20 m intervals.
- Use mulching and timely weed control to reduce moisture loss.

Groundnut

- Recommend short-duration and drought-tolerant groundnut varieties such as K-6, Kadiri Amaravathi (K-1902), Kadiri Harithandhra and Dharani
- Gap filling within 10–15 days of sowing to maintain optimum plant population.
- Frequent intercultivation and weeding for moisture conservation.
- Open conservation furrows at 15–20 m intervals.
- Foliar spray of 2 per cent KCl/MOP or kaolin (5 per cent) during moisture stress.
- Provide protective irrigation during flowering and peg formation stages, if water is available.

Odisha

Area under major crops

Crop	Area (Lakh ha)
Paddy	38.34
Green gram	2.35
Black gram	1.01
Maize	0.86

Districts vulnerable to El Nino

High	Medium	Low
Malakanagiri, Nabarangapur, Deogarh, Sundargarh, Kendujhar, Mayurbhanj	Khordha, Rayagarha	Nil

Contingency measures for major crops during El Nino

Paddy

- Use drought-tolerant varieties like CR Dhan 201, CR Dhan 203, CR Dhan 801, OUAT Kalinga Rice 9, Sahbhagi Dhan, DRR Dhan 42, and DRR Dhan 44.
- Gap filling with available seedlings and maintain optimum plant population.
- Raise bund height and plug field bund breaches to conserve rainwater.
- Keep fields weed-free and undertake intercultivation to reduce moisture loss.
- Provide life-saving irrigation from farm ponds or harvested rainwater wherever available.
- Apply foliar spray of 2 per cent urea during moisture stress.

Green gram

- Use varieties like Virat, Sikha, IPM 2-14 and Shreejan.
- Re-sow with short-duration varieties if plant population is below optimum.
- Reduce row spacing to improve canopy cover and moisture use efficiency.
- Carry out timely weeding and intercultivation for moisture conservation.
- Foliar spray of 2 per cent urea at flowering stage under drought stress.
- Control whitefly and sucking pests to minimize yield loss.
- Harvest rainwater and provide protective irrigation during flowering and pod formation.

Black gram

- Use varieties like PU 9, Sashi and IPU 2-43.
- Re-sow with drought-tolerant short-duration varieties when crop establishment is poor.
- Maintain optimum plant population through gap filling.
- Frequent intercultivation (dust mulching) to conserve soil moisture.
- Foliar spray of 2 per cent urea or 2 per cent DAP during moisture stress.
- Monitor and manage whitefly and Yellow Mosaic Virus (YMV).
- Provide protective irrigation at flowering and pod development stages, if possible.

Maize

- Use OUAT Kalinga Raj, DKC 9144, NK 6110, Bio 9544.
- Re-sow with short-duration hybrids if crop stand is poor.
- Gap filling to maintain optimum plant population.
- Apply 30 kg N/ha immediately after receipt of rainfall during vegetative stage.
- Foliar spray of 2 per cent urea solution 2–3 times at 10–15 day intervals.
- Earthing up and intercultivation for moisture conservation.
- Provide protective irrigation during tasselling and grain filling stages.

Rajasthan

Area under major crops

Crop	Area (Lakh ha)
Bajra	43.82
Cluster Bean	29.83
Green gram	23.67
Soybean	10.79
Groundnut	10.55

Districts vulnerable to El Nino

High	Medium	Low
Churu, Jaisalmer	Jodhpur, Barmer, Nagaur, Pali, Bikaner, Jaipur, Sikar	Dungarpur, Jalor, Dausa, Banswara, Udaipur, Jhunjhunun, Sirohi, Tonk, Sawai Madhopur, Alwar, Dhaulpur, Pratapgarh, Karauli, Bundi, Jhalawar, Bharatpur, Baran

Contingency measures for major crops during El Nino

Bajra

- Gap filling up to 15 DAS and thinning to maintain optimum plant population.
- Frequent intercultivation (dust mulching) for moisture conservation.
- Open conservation furrows at 15–20 m intervals.
- Foliar spray of 2 per cent urea during prolonged dry spells.
- Provide life-saving irrigation from farm ponds, if available.

Guar seed (Clusterbean)

- Re-sow when crop stand is below 50 per cent.
- Maintain optimum plant population through thinning and gap filling.
- Frequent intercultivation for soil moisture conservation.
- Foliar spray of 2 per cent urea at flowering stage.
- Conservation furrows/ridge-furrow system for rainwater harvesting.
- Harvest as fodder if drought becomes severe.

Green gram

- Re-sow with short-duration varieties where establishment is poor.
- Maintain optimum plant population through gap filling.
- Frequent intercultivation and weed control.
- Foliar spray of 2 per cent urea during flowering under moisture stress.
- Control whitefly and Yellow Mosaic Virus (YMV).
- Protective irrigation during flowering and pod formation, if available.

Soybean

- Gap filling to maintain optimum plant population.
- Frequent intercultivation with push hoe for moisture conservation.
- Open conservation furrows at 15–20 m intervals.
- Foliar spray of 2 per cent urea during drought stress.
- Timely weed control to reduce competition for moisture.
- Provide protective irrigation during flowering wherever possible.

Groundnut

- Gap filling within 10–15 days after sowing.
- Frequent intercultivation and weeding for moisture conservation.
- Open conservation furrows at 15–20 m intervals.
- Foliar spray of 2 per cent KCl/MOP or kaolin during moisture stress.
- Protective irrigation during flowering and pegging stages.
- Mulching with crop residues to reduce soil moisture loss.

Gujarat

Area under major crops

Crop	Area (Lakh ha)
Cotton	23.72
Groundnut	19.65
Bajra	4.98
Soyabean	3.01

Districts vulnerable to El Nino

High	Medium	Low
The Dangs	Panchmahals, Narmada, Chota Udaipur, Bhavnagar, Kachchh, Dohod	Tapi, Porbandar, Gir Somanath, Amreli, Banas Kantha, Dev Bhoomi Dwaraka, Mahisagar, Junagadh, Morvi, Rajkot, Sabar Kantha, Aravali, Gandhinagar, Botad, Valsad, Jamnagar

Contingency measures for major crops during El Nino:

Cotton

- Shift cotton to castor (GCH-4, 5 or 7) + cluster bean (Gujarat Guar 1 or 2) intercropping system.
- Switch to cluster bean Hg-75 or Gujarat Guar 1/2, with 25 per cent higher seed rate and 40 per cent reduced fertilizer. Apply 20 kg S/ha through gypsum for fodder sorghum.
- Weed and protect against sucking pests (jassids, aphids — spray imidacloprid 17.8 SL at 4 ml/10 lit water).
- Apply life-saving irrigation if possible.
- Use crushed cotton stalk as a mulching material.
- Harvest mature bolls immediately to secure yield.
- Life-saving irrigation at boll formation stage; prioritize over other crops.

Groundnut

- Recommend shorter-duration bunch-type varieties such as J-11, GG-2, GL-24, GG-4, 5 & 6, GAUG-1. Semi-spreading type GG-20 is also suitable. No change in crop if delay is only 2 weeks.
- Use seed hardening (soak seeds 3–4 hours in water, then shade-dry before sowing).
- Increase seed rate by 25 per cent with 60 cm spacing.

- Reduce fertilizer dose by 40 per cent
- Apply mulching with wheat straw, crushed cotton stalk, or plastic mulch (25 micron, ~200 kg/ha). Practice interculturing to conserve moisture.
- Life-saving irrigation at critical pod-filling stage if any source is available.
- Spray 1 per cent nitrogen through urea foliar application after drought relief.

Bajra

- Bajra is relatively drought-tolerant; delay up to 4 weeks is manageable with varieties like GHB-526, GHB-538, or GHB-744.
- Use seed hardening and increase seed rate by 15–20 per cent.
- Thinning to maintain plant-to-plant distance, reducing water competition.
- Interculturing to break soil crust and conserve moisture.
- Spray urea 1 per cent (foliar) after rainfall resumes.
- Shift to short-duration pulses (cowpea, moth bean) or fodder crops (dual-purpose sorghum Gujarat Jowar-39).

Soybean

- Recommend short duration varieties such as JS 335, JS 95-60, JS 20-29, NRC 37, NRC 86 and GS 2.
- Seed treatment with Rhizobium and PSB cultures.
- Adopt ridge-furrow planting system.
- Ensure adequate phosphorus and sulphur nutrition.
- Foliar spray of 2 per cent urea or 2 per cent DAP during moisture stress.
- Intercrop with pigeon pea (4:2 ratio).
- Undertake timely weed management during first 30–40 days.
- Shift to pigeon pea, sesame or green gram where soybean establishment fails.

Haryana

Area under major crops

Crop	Area (Lakh ha)
Paddy	16.09
Wheat	23.88
Bajra	5.74
Maize	0.04
Jowar	0.19

Districts vulnerable to El Nino

High	Medium	Low
Nil	**Nil**	Panchkula, Ambala, Yamuna-Nagar, Gurgaon, Kurukshetra

Contingency measures for major crops during El Nino

Paddy

- Drought-Resistant varietiessuch as PR 126, PR 121, PR 114, HKR 47, HKR 48, CSR 30, CSR 36
- Adopt Direct Seeded Rice (DSR) to save irrigation water and labour.
- Use Alternate Wetting and Drying (AWD) instead of continuous flooding to improve water-use efficiency.
- Undertake laser land levelling for uniform water distribution and reduced water losses.
- Strengthen field bunds and channels to conserve rainwater within fields.
- Apply crop residue mulch to reduce soil moisture evaporation.
- Prioritize irrigation at critical stages such as tillering, panicle initiation and flowering.
- Apply foliar spray of 1 per cent KNO_3 or 2 per cent KCl during moisture stress to reduce drought-induced yield losses.
- Split nitrogen into 3–4 applications instead of basal-heavy application.
- Monitor stem borer and leaf folder incidence, which may increase under intermittent dry spells.
- Alternative crops under severe water shortage in place of paddy such as Bajra, Maize, Mungbean and Cluster bean

Bajra

- Drought-Resistant Varieties/Hybrids: HHB 67 Improved, HHB 146, HHB 197, HHB 223, HHB 234, HHB 299, GHB 558
- Use bajra as a contingency crop where rice, maize or cotton establishment fails.
- Adopt bajra + mungbean intercropping for enhanced income and risk reduction.
- Promote bajra + cowpea intercropping in rainfed conditions.
- Create dust mulch through intercultivation to reduce evaporation losses.

- Maintain optimum plant population through thinning and gap filling.
- Construct conservation furrows for in-situ rainwater harvesting.
- Provide supplemental irrigation at flowering stage whenever water is available.
- Apply foliar spray of 2 per cent urea at flowering or 1 per cent KNO_3during moisture stress to reduce drought-induced yield losses.

Maize

- Drought-Resistant Varieties/Hybrids: HQPM 1, HQPM 5, HM 4, HM 10, HM 11, DHM 117.
- Adopt ridge and furrow planting for improved rainwater conservation and drainage.
- Create conservation furrows at regular intervals to enhance water infiltration.
- Promote maize + cowpea intercropping to reduce production risk under drought.
- Maintain optimum plant population through timely gap filling.
- Keep fields weed-free during early crop growth stages to reduce moisture competition.
- Provide life-saving irrigation during tasseling and silking stages.
- Apply foliar spray of 2 per cent urea or 1 per cent KNO_3 during moisture stress periods.

Sorghum

- Drought-Resistant Varieties/Hybrids: CSV 15, CSV 17, CSV 20, CSV 27, CSH 16, CSH 25; Fodder varieties: HC 136, HC 171, HC 308, SSG 59-3
- Cultivate fodder sorghum varieties such as HC 308 and SSG 59-3 to ensure fodder availability.
- Adopt ridge-furrow planting for better moisture conservation.
- Promote sorghum + cowpea intercropping in rainfed areas.
- Encourage sorghum + pigeonpea intercropping for enhanced resilience and soil fertility.
- Apply nitrogen fertilizers in split doses to improve nutrient-use efficiency under moisture stress.
- Provide life-saving irrigation at flowering stage and maintain weed-free fields to minimize moisture competition.
- Promote fodder sorghum in moisture deficit areas or Harvest early as fodder if prolonged drought threatens grain production.

West Bengal

Area under major crops

Crop	Area (Lakh ha)
Paddy	55.92
Maize	4.05
Ragi	0.06

Districts vulnerable to El Nino

Highly	Medium	Low
Alipurduar,Jalpaiguri, Kalimpong, Kochbihar, Maldah, Puruliya	Nil	Nil

Contingency measures for major crops during El Nino

Paddy

- Drought-Resistant/Suitable Varieties: Sahbhagi Dhan, DRR Dhan 42, DRR Dhan 44, Naveen, Swarna Shreya, MTU 1010, CR Dhan 201, CR Dhan 203
- Adopt Direct Seeded Rice (DSR) to reduce dependence on standing water and ensure timely crop establishment.
- Establish community nurseries for quick re-transplanting in case of delayed rainfall.
- Practice Alternate Wetting and Drying (AWD) to improve water-use efficiency.
- Strengthen field bunds and channels for rainwater conservation.
- Apply straw or crop residue mulch to reduce soil moisture loss.
- Prioritize irrigation at tillering, panicle initiation and flowering stages.
- Adopt SRI method of enhance water-use efficiency
- Use farm ponds and harvested rainwater for life-saving irrigation during dry spells.

Maize

- Drought-Resistant Varieties/Hybrids: HQPM 1, HQPM 5, Vivek QPM 9, Shaktiman 1, Shaktiman 2, DHM 117
- Adopt ridge and furrow planting for better moisture conservation and drainage.
- Create conservation furrows to improve rainwater infiltration.
- Promote maize + cowpea intercropping to reduce drought risk and improve income.
- Maintain optimum plant population through timely gap filling.
- Keep fields weed-free during early growth stages to reduce moisture competition.
- Provide protective irrigation at tasseling and silking stages whenever possible.
- Apply foliar spray of 2 per cent urea or 1 per cent KNO_3 during moisture stress.

Finger Millet

- Drought-Resistant Varieties: GPU 28, GPU 45, GPU 67, VL Mandua 324, VL Mandua 352, Bhairabi, Subhra
- Promote drought-tolerant varieties such as GPU 28 and GPU 67 in upland areas.

- Adopt line sowing for efficient moisture and nutrient utilization.
- Encourage ragi + pigeonpea intercropping for enhanced resilience and income stability.
- Promote ragi + blackgram intercropping to reduce production risk.
- Apply farmyard manure and organic matter to improve soil moisture retention.
- Practice contour bunding and conservation furrows in sloping lands.
- Maintain optimum plant population through thinning and gap filling.
- Apply organic mulches and provide protective irrigation from farm ponds during prolonged dry spells.

Tamil Nadu

Area under major crops

Crop	Area (Lakh ha)
Paddy	21.58
Maize	4.85
Black Gram	3.58
Sorghum	3.39
Groundnut	3.16
Sugarcane	1.31
Cotton	1.02
Ragi	0.64

Districts vulnerable to El Nino

High	Medium	Low
The Nilgiris	Perambalur, Dharmapuri, Ramanathapuram, Ariyalur, Virudhunagar (Kamara*, Krishnagiri, Vellore, Namakkal, Tiruchchirappalli	Madurai, Karur, Salem, Theni, Cuddalore, Sivaganga, Villupuram, Coimbatore, Tiruvannamalai, Pudukkottai, Tiruvallur, Kanchipuram

Contingency measures for major crops during El Nino

Paddy

- Use Short duration varieties such as ADT 36, 37, 43, ADT (R) 48
- SRI method of planting to reduce the duration of seedling age
- Direct sowing of wet seeding by drum seeder
- In case of aged rice seedling, to encourage the tiller production, enhance the basal N application by 50 per cent from the recommended and thereafter follow the normal schedule recommended for other stages.
- Semi dry rice cultivation (line sowing and broad casting of sprouted seeds in well ploughed soil based on the receipt rainfall and converted as wetland condition after water released from canal water.
- Spray Cycocel 1000 ppm (1 ml of commercial product in one lit. of water) under water deficit situations to mitigate ill-effects.
- Foliar spray of Kaolin 3 per cent or 1 per cent KCl to overcome moisture stress at different critical crop stages of dry seeded rain-fed and irrigated un-puddled lowland rice.
- Adopting System of Rice Intensification (SRI method) with 2.5 cm depth of irrigation at critical stages like Tillering, Panicle initiation, flowering and maturity
- To induce tolerance under short and prolonged drought situation, apart from seed treatment, foliar spray with 1 per cent KCl + CCC at 500 ppm during vegetative stage is effective in mitigating the drought in dry seeded irrigated un-puddled lowland rice.

- Conjunctive use of surface and ground water may be resorted to for Judicious use of water.

Maize

- Use maize short duration hybrids like COMH 5, Kargil, CoRH1, CoHM 4
- Cultivation of maize in broad bed furrows and make conservation furrow at 8m interval
- Application of micro nutrient @ 12.5 kg /ha
- Mulching with saw dust to conserve moisture
- Thinning must be carried out to maintain low plant population
- Supplementary irrigation should be given at tasseling and silking stage, if water is available
- Foliar spray 1 per cent KCl (or) 1 per cent K2SO4
- Foliar spray of TNAU Crop boosters viz., Maize Maxim (3 kg/acre/spray)for improving drought tolerance.

Blackgram

- Sowing short duration black gram varieties like ADT 3 and ADT 5.
- Seed hardening-(soak seeds in water for 18 hrs. followed by shade dry for 24 hrs)
- Blackgram seeds are fortified with 0.5 per cent Zn So4 for 3 hours (350 ml of 0.5 per cent Zn So4 solution is required to soak one kg of seed) followed by sequential coating with polykote / polymer @ 3g / kg + 5 ml of water + Dimethoate @ 4ml/kg + Trichoderma viride @ 4 g/kg + Rhizobium @ 20g/kg + Azophos @ 120g/ kg.
- Foliar application of 2 per cent DAP and 1 per cent TNAU Pulse wonder spray @ 2.25 kg/ac
- Thinning to retain one seedling at 30 cm
- Foliar application of 0.5 per cent KCl spray at vegetative stage

Sorghum

- Inter cultivation, conservation furrow, broad bed furrow and residue mulching to in-situ conservation of soil moisture.
- Adoption of drip irrigation
- Seed hardening (Soak the seeds in 2 per cent Potassium dihydrogen phosphate for 10 hours and shade dry)
- A foliar spray of 3 per cent Kaolin to avoid moisture loss.

Ground nut

- Use of short duration cultivars like VRI 2, TMV 7.
- Application of composted coir pith @ 10 t ha-1 to conserve soil moisture.
- Seed hardening with Soak the seeds in 2 per cent potassium dihydrogen phosphate for six hours and shade dry the seeds for 5 hours.
- Adopt wider spacing of 45 x 10 cm
- Conservation of soil moisture through straw/black polythene mulching.
- Resort to bed-furrow system and adopt alternate row irrigation.
- Spraying of Boron and potassium to increase drought tolerance.
- Foliar spray of TNAU Crop boosters viz., Groundnut Rich (2 kg/acre/spray) for improving drought tolerance.

- Supplemental irrigation during pod filling stage
- Reduce the plant population to the extent of 25 to 40 per cent and maintain low plant population
- Spraying of 0.5 per cent KCl to mitigate water stress.
- Spray kaoline @ 6 per cent will reduce the transpirational loss of water.
- Foliar spray of 2 per cent DAP plus 1 per cent KCl during flowering and pod formation stages
- Supplemental irrigation at critical stages of crop growth viz. sowing, flowering, peg formation and maturity.

Sugar cane

- Soak the setts in lime solution (80 kg Kiln lime in 400 lit) for one hour.
- Plant in deep furrows of 30 cm depth.
- Spray potash and urea each at 2.5 per cent during moisture stress period at 15 days' interval.
- Spray Kaolin (60 g in 1 ltr. of water) to alleviate the water stress.
- Under water scarcity condition, alternate furrow and skip furrow method of irrigation is advised.
- Apply 125 kg of MOP additionally at 120 days of planting.
- Removal of dry trash at 5th month and leave it as mulch, in the field.
- Adopt sub surface drip irrigation and fertigation in the field

Cotton

- Seed hardening is done using 2 per cent potassium chloride for 5 hours
- Use varieties like KC 2, SVPR 2
- Sowing with tractor drawn seed drill
- Acid delinting of seeds and dry sowing in Broad bed furrow system
- Seed treatment with wood ash
- Spray potassium chloride 1 per cent, twice on 50 and 70 DAS for delayed sowing (first fortnight of March) of summer irrigated cotton
- Mepiquat chloride at 250 ppm on 45 and 60 DAS for cotton to arrest excess vegetative growth.
- Foliar spray of 0.5 per cent ZnSO4 and 1 per cent MgSO4 on 45 and 60 DAS
- Nipping terminal portion of main stem beyond 15th (at 70 – 80 DAS) and at 20th (at 90 DAS) in case of hybrid and varieties, respectively for arresting transpiratory loss of water.

Ragi

- Change of ragi varieties from long duration (LD) to medium duration (MD). LD- Paiyur 1, GPU-28, L-5, MR-1, HR-911 MD- Paiyur 1
- Change long duration varieties to short duration Indaf 9, Co-7
- Raising community nursery and transplanting.
- Seed hardening (Soak the seeds in 2 per cent Potassium dihydrogen phosphate for 10 hours and shade dry)
- Soil mulching with blade harrow
- Spray ethrel 200 ppm at 45 and 65 DAS to induce early maturity

Chhattisgarh

Area under major crops

Crop	Area (lakh ha)
Paddy	39.05
Maize	1.11

Districts vulnerable to El Nino

Highly	Medium	Low
Sukma, Narainpur, Balarampur, Bijapur, Korba, Koriya, Bastar, Kondagaon, Surajpur, Surguja	Raj Nandgaon, Kawardha (Kabeerdham)	Nil

Contingency measures for major crops during EL Nino

Paddy

- Recommend drought-tolerant and suitable rice varieties such as Tulsi, Aditya, Kalinga-3, Samleswari, Vandana and Vanprabha.
- Establish the crop through line sowing, direct seeding of sprouted seeds under 'lehi' conditions, or transplanting of 15–20-day-old seedlings.
- Adopt SRI method of rice cultivation and improved biasi practices to maintain optimum plant population and crop growth.
- In delayed situations, shift to medium-duration rice varieties for better adaptation to the shortened growing season.
- Apply the recommended dose of fertilizers and incorporate 15–20 kg $ZnSO_4$/ha before sowing or transplanting.
- Ensure proper water management through efficient irrigation practices, including alternate furrow irrigation wherever feasible.

Maize

- Select early and short-duration varieties/hybrids such as Pro6444, DHM117117,PMH-3PRO4640,BIO-9681, PRO-4212, DHM117, PMH-3 PIO30-R2
- Adopt ridge and furrow planting for better moisture conservation and drainage.
- Carry out thinning and gap filling to maintain optimum plant population.
- Apply the recommended basal fertilizer dose (2/3 RDF) at the time of sowing.
- Apply the remaining 1/3 RDF of potassium (K) at tassel initiation stage.
- Undertake timely weed control to reduce competition for moisture and nutrients.
- Provide life-saving irrigation and irrigate at critical growth stages whenever water is available.
- Apply foliar spray of urea or KCl during moisture stress conditions.

Kerala

Area under major crops

Crop	Area (Lakh ha)
Paddy	1.77
Tapioca	0.5

Districts vulnerable to El Nino

Highly	Medium	Low
Trivandrum, Cannanore, Pattanamtitta, Kottayam, Wayanad, Malappuram, Idukki	Kasaragod, Alleppey	Nil

Contingency measures for major crops during El Nino

Paddy

- Drought-Resistant/Suitable Varieties: Uma (MO 16), Jyothi, Kanchana, Vyttila 6, Aiswarya, Prathyasa, Annapoorna
- Adopt Direct Seeded Rice (DSR) in upland and water-scarce areas.
- Strengthen field bunds to conserve rainwater and reduce runoff.
- Practice Alternate Wetting and Drying (AWD) for efficient water use.
- Maintain optimum plant population through gap filling.
- Apply straw mulching to conserve soil moisture.
- Prioritize irrigation during tillering, panicle initiation and flowering stages.
- Utilize harvested rainwater from farm ponds for supplemental irrigation.

Tapioca (Cassava)

- Drought-Tolerant Varieties: Sree Vijaya, Sree Jaya, Sree Prakash, Sree Rekha, H-226
- Plant on ridges to facilitate moisture conservation and root development.
- Apply organic mulch immediately after planting.
- Incorporate farmyard manure and compost to improve water-holding capacity.
- Maintain optimum spacing to reduce competition for moisture.
- Practice intercultivation to break soil crust and conserve moisture.
- Harvest rainwater and provide protective irrigation during prolonged dry periods.
- Adopt cassava-based intercropping systems with legumes.

Manipur

Contingency measures for major crops during El Nino

- Promotion of short-duration and climate-resilient paddy varieties such as RC-Maniphou-15, RC-Maniphou-12, CAU R-3 and Pari Phou.
- Adoption of Direct Seeded Rice (DSR) and System of Rice Intensification (SRI) in areas affected by delayed monsoon and water scarcity.
- Promotion of climate-smart maize varieties such as Vivek QPM-9, Vivek Hybrid-27, HQPM-1 and HQPM-5.
- Encouragement of maize-based intercropping systems with cowpea, blackgram, greengram, soybean and rice bean to minimize climatic risks.
- Promotion of short-duration pulse varieties such as SBC 47, PU-31 and IPU-10-26, along with Rhizobium seed treatment for improved productivity.
- Promotion of improved soybean varieties such as DSb-19, DSb-32, CAU-MS-1 and MACS 1407 with suitable adjustment of sowing time to avoid rainfall during harvesting.
- Promotion of rainwater harvesting through farm ponds, jalkunds and community water storage structures for supplemental life-saving irrigation.
- Adoption of contour farming, vegetative barriers and conservation bunds in hill areas to minimize soil erosion and runoff losses.
- Promotion of mulching, conservation furrows and in-situ moisture conservation practices for efficient use of available rainfall.
- Strengthening irrigation water-use efficiency through micro-irrigation and life-saving irrigation during critical crop growth stages.
- Promotion of integrated nutrient management through compost, farmyard manure and organic residue recycling to improve soil health and water-holding capacity.
- Promotion of maize-pulse-livestock based farming systems in hill districts.

Meghalaya

Contingency measures for major crops during El Nino

- Promotion of climate-resilient and short-duration paddy varieties such as CAU-R1, Shahsarang-1, Shahsarang-2, Vivek Dhan-82, Sahbhagi Dhan and DRR Dhan-44.
- Adoption of Direct Seeded Rice (DSR), community nurseries and staggered transplanting to cope with delayed monsoon conditions.
- Promotion of climate-resilient maize varieties such as Vivek QPM-9, Vivek Hybrid-27, HQPM-1 and HQPM-5 along with maize–cowpea and maize–soybean intercropping systems.
- Promotion of drought-tolerant pulses and oilseeds including black gram (PU-31, T-9), pigeonpea (Pusa Arhar 151, Pusa Ageti), sesamum (Prachi, Amrit and TKG-22) and soybean (RCH-1, KDS-753).
- Expansion of climate-resilient millets such as finger millet (VL Mandua-352, GPU-67), foxtail millet and barnyard millet in moisture-stressed uplands.

- Strengthening watershed-based resource management through Jalkunds, spring-shed management and community rainwater harvesting structures for supplemental irrigation.
- Adoption of minimum tillage, ridge-and-furrow planting, mulching cover cropping, contour bunding, terracing, vegetative barriers and trenching for soil and water conservation in sloping lands.
- Adjustment of sowing window based on seasonal forecasts to avoid flowering during peak heat stress periods.
- Application of biostimulants, PGPRs and balanced nutrient management, including adequate potash, to improve crop resilience under drought conditions.
- Promotion of recycling and efficient utilization of crop residues, livestock wastes and household organic wastes through composting, vermicomposting and on-farm nutrient recycling.

Nagaland

Contingency measures for major crops during El Nino

- Promotion of climate-resilient and short-duration paddy varieties such as Sahbhagi Dhan, Vivek Dhan-82, CAU-R1, RC Maniphou-13 and CR Dhan-802 and drought resistant paddy varieties CR Dhan 807 and DRR Dhan 44.
- Adoption of Direct Seeded Rice (DSR), community nurseries and staggered transplanting to cope with delayed monsoon situations.
- Promotion of climate-smart maize varieties such as Vivek QPM-9, Vivek Hybrid-27 and HQPM-1 along with maize–cowpea intercropping systems.
- Promotion of sesamum varieties such as Prachi, Amrit and TKG-22 as contingency crops under delayed sowing conditions.
- Expansion of climate-resilient millets such as GPU-67, VL Mandua-324 and VL Madira-172 in moisture-stressed uplands.
- Promotion of mulching, conservation tillage, ridge-and-furrow planting and organic nutrient management for moisture conservation.
- Adjust the sowing/planting window based on the forecasted El Niño-induced heat stress so that the flowering stage does not coincide with periods of high temperature stress.
- Apply foliar spray of plant growth regulators such as NAA (Naphthalene Acetic Acid) at the flowering stage to reduce flower drop and improve fruit/seed set.
- Apply Potash (MOP) as top dressing before and after flowering to enhance crop tolerance to heat and moisture stress.
- Maintain a shallow water level of 2–4 cm in rice fields during critical growth stages to minimize moisture stress and ensure optimum crop growth.
- Promotion of farm ponds, Jalkunds and community rainwater harvesting structures for supplemental irrigation during dry spells.
- Adoption of contour bunding, terracing, vegetative barriers and other soil conservation measures in sloping lands

Mizoram

- Promotion of short-duration and climate-resilient rice varieties such as Maniphou-10, Maniphou-12, DRR Dhan-67, DRR Dhan-69, CAU-R1, CAU-R2, CAU-R6, Bhalum-3 and Bhalum-5.
- Adoption of Direct Seeded Rice (DSR) and System of Rice Intensification (SRI) under delayed monsoon and water-scarce situations.
- Promotion of improved maize varieties such as Pusa Vivek QPM-9, RCM-75, RCM-76, HQPM-1 and HQPM-5, along with maize-soybean intercropping.
- Promotion of improved soybean varieties (DSB-19, DSB-21, Umiam Soybean-1) and ginger based intercropping systems.
- Rainwater harvesting through farm ponds, community water storage structures and rooftop harvesting systems and promotion of micro-irrigation and life-saving irrigation.
- In-situ moisture conservation through contour farming, log-wood bunding, vegetative barriers and mulching.
- Strengthening drainage systems, organic residue recycling and integrated nutrient management for improved soil health.
- Promotion of crop-livestock-poultry integrated farming systems for income diversification and risk reduction.
- Recycling of crop residues through composting and vermicomposting.

Hilly Areas of NW India

Contingency measures for major crops during El Nino

Maize

- Promote early-maturing and drought-tolerant hybrids/varieties.
- Encourage maize-based intercropping systems with blackgram, cowpea, soybean, or rajmash.
- Adopt ridge-furrow sowing, mulching, and conservation tillage for moisture conservation.
- Undertake gap filling or re-sowing where plant population falls below optimum levels.
- Provide life-saving irrigation at tasseling and silking stages whenever feasible.
- Apply foliar spray of 2 per cent KNO_3 during prolonged moisture stress.

Paddy

- Promote short-duration and drought-tolerant varieties in rainfed and mid-hill regions.
- Shift vulnerable paddy areas to maize, pulses, soybean, or finger millet under delayed monsoon conditions.
- Increase seed rate by 20-25 per cent and undertake gap filling under poor crop establishment.
- Apply foliar spray of 2 per cent urea or 1 per cent KNO_3 during extended dry spells.
- Utilize harvested rainwater for supplemental irrigation at critical growth stages.

Pulses (Rajmash, Blackgram, Cowpea)

- Expand pulse cultivation in moisture-stressed and marginal areas.
- Promote short-duration and drought-tolerant varieties.
- Encourage intercropping with maize and millets to reduce climatic risks.
- Adopt seed treatment with Rhizobium and biofertilizers.
- Practice mulching and moisture conservation measures.
- Ensure timely weed management to minimize moisture competition.

Soybean

- Promote soybean as an alternative crop under delayed monsoon situations.
- Adopt ridge sowing and residue mulching for moisture conservation.
- Encourage seed treatment with Rhizobium and PSB cultures.

Finger Millet

- Promote finger millet as a climate-resilient crop in drought-prone hill regions.
- Encourage cultivation on rainfed terraces and marginal lands.
- Adopt contour farming, vegetative barriers, mulching, and minimum tillage.
- Promote intercropping with pulses for enhanced resilience and income.
- Undertake re-sowing where crop establishment is severely affected

Annexure- III

State-Wise Vulnerability Districts for El Nino

STATE	DISTRICT	Irrigation (%)	Priority*
Andhra Pradesh	Anantapuramu	40	2
	Kurnool	19	1
	Sri Satya Sai	47	2
Arunachal Pradesh	Longding	11	1
	Tawang	9	1
	Tirap	19	1
	West Kameng	4	1
Assam	Darrang	11	1
	Dhima Haso	2	1
	Dhuburi	55	3
	Goalpara	43	2
	Jorhat	3	1
	Kamrup	11	1
	Kamrup Metropolitan	4	1
	Karbi Anglong	50	3
	Karimganj	4	1
	Nalbari	38	2
	Sibsagar	3	1
	Sonitpur	13	1
Bihar	Begusarai	97	3
	Bhagalpur	43	2
	Jamui	40	2
	Katihar	49	2
	Kishanganj	54	3
	Nalanda	69	3
	Nawada	55	3
	Patna	49	2
	Samastipur	64	3
	Sheikhpura	56	3
	Sheohar	68	3
	Sitamarhi	82	3
Chhattisgarh	Balarampur	2	1
	Bastar	7	1
	Bijapur	3	1
	Kawardha (Kabeerdham)	48	2
	Kondagaon	7	1
	Korba	4	1
	Koriya	6	1
	Narainpur	1	1

	Raj Nandgaon	25	2
	Sukma	0	1
	Surajpur	10	1
	Surguja	11	1
Goa	North Goa	36	2
	South Goa	26	2
GUJARAT	Amreli	64	3
	Aravali	82	3
	Banas Kantha	64	3
	Bhavnagar	35	2
	Botad	88	3
	Chota Udaipur	31	2
	Dev Bhoomi Dwaraka	66	3
	Dohod	42	2
	Gandhinagar	88	3
	Gir Somanath	61	3
	Jamnagar	89	3
	Junagadh	76	3
	Kachchh	38	2
	Mahisagar	67	3
	Morvi	77	3
	Narmada	27	2
	Panchmahals	26	2
	Porbandar	59	3
	Rajkot	79	3
	Sabar Kantha	82	3
	Tapi	52	3
	The Dangs	17	1
	Valsad	88	3
Haryana	Ambala	98	3
	Gurgaon	100	3
	Kurukshetra	100	3
	Panchkula	81	3
	Yamuna-Nagar	99	3
Himachal Pradesh	Bilaspur	5	1
	Hamirpur	5	1
	Kangra	34	2
	Kinnaur	64	3
	Kullu	5	1
	Mandi	17	1
	Shimla	3	1
	Sirmaur	36	2
	Solan	29	2
	Una	44	2

Jammu & Kashmir	Kupwara	48	2
	Rajauri	10	1
	Ramban	6	1
	Riasi	6	1
	Udhampur	13	1
Jharkhand	Bokaro	14	1
	Devghar	38	2
	Dhanbad	35	2
	Garhwa	87	3
	Giridih	67	3
	Hazaribag	26	2
	Jamtara	14	1
	Kodarma	30	2
	Latehar	38	2
	Lohardaga	67	3
	Palamu	39	2
	Ramgarh	48	2
Karnataka	Bangalore Rural	26	2
	Bangalore Urban	31	2
	Belgaum	67	3
	Bellary	76	3
	Chik Ballapur	28	2
	Chikmagalur	35	2
	Chitradurga	37	2
	Dakshin Kannad	91	3
	Davanagere	56	3
	Dharwad	12	1
	Gadag	25	2
	Hassan	31	2
	Haveri	38	2
	Kodagu	1	1
	Kolar	32	2
	Koppal	51	3
	Ramanagra	19	1
	Shimoga	74	3
	Tumkur	52	3
	Udupi	47	2
	Uttar Kannad	53	3
Kerala	Alleppey	42	2
	Cannanore	7	1
	Idukki	24	1
	Kasaragod	38	2
	Kottayam	12	1
	Malappuram	19	1

	Pattanamtitta	8	1
	Trivandrum	6	1
	Wayanad	14	1
Madhya Pradesh	Agar Malwa	96	3
	Alirajpur	39	2
	Anuppur	8	1
	Ashoknagar	100	3
	Barwani	93	3
	Betul	46	2
	Bhopal	96	3
	Burhanpur	89	3
	Chhatarpur	84	3
	Chhindwara	68	3
	Damoh	92	3
	Dewas	98	3
	Dhar	89	3
	Dindori	8	1
	East Nimar	94	3
	Guna	96	3
	Jhabua	65	3
	Katni	91	3
	Mandla	25	1
	Mandsaur	79	3
	Narsimhapur	96	3
	Niwari	100	3
	Panna	71	3
	Raisen	95	3
	Rajgarh	79	3
	Ratlam	88	3
	Rewa	83	3
	Sagar	94	3
	Sehore	94	3
	Seoni	75	3
	Shahdol	8	1
	Shajapur	88	3
	Sheopur	100	3
	Shivpuri	75	3
	Sidhi	95	3
	Singrauli	42	2
	Tikamgarh	96	3
	Ujjain	99	3
	Umaria	60	3
	Vidisha	89	3
	West Nimar	83	3

Maharashtra	Akola	-	1
	Amravati	-	1
	Aurangabad	-	1
	Bombay City	-	1
	Bombay Suburban	-	1
	Buldana	-	1
	Chandrapur	-	1
	Dhule	-	1
	Gondia	-	1
	Jalna	-	1
	Kolhapur	-	1
	Nandurbar	-	1
	Nashik	-	1
	Osmanabad	-	1
	Palghar	-	1
	Ratnagiri	-	1
	Raygad	-	1
	Satara	-	1
	Sindhudurg	-	1
	Thane	-	1
	Wardha	-	1
	Yavatmal	-	1
Manipur	Imphal East	-	1
	Senapati	-	1
	Tamenglong	-	1
	Tengnoupal	-	1
	Ukhrul	-	1
Meghalaya	East Garo Hills	30	2
	East Jaintia Hills	56	3
	East Khasi Hills	32	2
	North Garo Hills	37	2
	Ribhoi	59	3
	South Garo Hills	36	2
	South West Garo Hills	31	2
	South West Khasi Hi*	32	2
	West Garo Hills	24	1
	West Jaintia Hills	71	3
	West Khasi Hills	67	3
Mizoram	Saiha	5	1
Nagaland	Dimapur	64	3
	Kiphire	16	1
	Kohima	36	2
	Longleng	18	1
	Mokokchung	24	1
	Mon	14	1
	Peren	39	2
	Phek	49	2

	Tuensang	17	1
	Wokha	28	2
	Zunheboto	20	1
Orissa	Deogarh	7	1
	Kendujhar	10	1
	Khordha	28	2
	Malakanagiri	3	1
	Mayurbhanj	20	1
	Nabarangapur	6	1
	Rayagarha	31	2
	Sundargarh	8	1
Puducherry	Mahe	5	1
	Puducherry	92	3
	Yanam	100	3
Punjab	Kapurthala	100	3
	Pathankot	100	3
	Rupnagar	100	3
Rajasthan	Alwar	91	3
	Banswara	70	3
	Baran	97	3
	Barmer	28	2
	Bharatpur	96	3
	Bikaner	40	2
	Bundi	95	3
	Churu	24	1
	Dausa	65	3
	Dhaulpur	91	3
	Dungarpur	61	3
	Jaipur	43	2
	Jaisalmer	24	1
	Jalor	62	3
	Jhalawar	96	3
	Jhunjhunun	71	3
	Jodhpur	26	2
	Karauli	93	3
	Nagaur	32	2
	Pali	34	2
	Pratapgarh	92	3
	Sawai Madhopur	86	3
	Sikar	45	2
	Sirohi	72	3
	Tonk	84	3
	Udaipur	71	3
Sikkim	East	-	1

Tamil Nadu	Anna	-	2
	Ariyalur	41	2
	Coimbatore	74	3
	Cuddalore	66	3
	Dharmapuri	34	2
	Kanchipuram	100	3
	Karur	56	3
	Krishnagiri	43	2
	Madurai	55	3
	Namakkal	49	2
	Perambalur	25	2
	Pudukkottai	88	3
	Ramanathapuram	36	2
	Salem	57	3
	Sivaganga	70	3
	The Nilgiris	7	1
	Theni	61	3
	Tiruchchirappalli	49	2
	Tiruvallur	98	3
	Tiruvannamalai	82	3
	Vellore	43	2
	Villupuram	72	3
	Virudhunagar(Kamara*	42	2
Tripura	North Tripura	32	2
	Unakoti	25	1
Uttar Pradesh	Badaun	88	3
	Chitrakoot	56	3
	Deoria	90	3
	Farrukhabad	95	3
	Jhansi	63	3
	Kheri	90	3
	Mahoba	28	2
	Saharanpur	94	3
	Sonbhadra	100	3
Uttranchal	Almora	9	1
	Bageshwar	23	1
	Chamoli	4	1
	Champawat	12	1
	Dehra Dun	51	3
	Garhwal	13	1
	Haridwar	97	3
	Naini Tal	65	3
	Pithoragarh	7	1
	Rudraprayag	12	1

	Tehri Garhwal	16	1
	Udhamsingh Nagar	100	3
	Uttarkashi	18	1
West Bengal	Alipurduar	-	1
	Jalpaiguri	-	1
	Kalimpong	-	1
	Kochbihar	-	1
	Maldah	-	1
	Puruliya	-	1