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El Nino and Indian Agriculture: How Extension Services Can Help Farmers Prepare for Climate Risks

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El Nino is a natural climate phenomenon associated with warmer-than-average sea-surface temperatures in the central and eastern equatorial Pacific Ocean. It can influence atmospheric circulation and increase the likelihood of below-normal or uneven monsoon rainfall in India, although its effects vary by year, region and season. In 2026, the India Meteorological Department (IMD) forecast below-normal southwest monsoon rainfall, and the Government of India reported that El Nino conditions developed during the monsoon and were expected to strengthen later in the year (PIB, 2026a; WMO, 2026). For farmers, the main concern is not the climate label alone but the farm-level consequences: delayed sowing, dry spells, soil-moisture stress, pressure on irrigation, and possible crop and livestock losses. Agricultural extension services can translate forecasts into locally relevant decisions through district contingency plans, crop diversification, short-duration and drought-tolerant varieties, moisture conservation, balanced nutrient management and timely advisories.

Introduction

Indian agriculture is closely connected with the timing, distribution and amount of rainfall. Rainfed farmers in particular depend on the onset and continuity of the southwest monsoon for land preparation, sowing and crop establishment. When rainfall is delayed or uneven, farmers may have to re-sow, change crops, reduce cultivated area or manage longer dry spells. These decisions affect input costs, labour use, yields and household income. El Nino is one of the large-scale climate drivers that can influence monsoon behaviour. It is part of the El Nino–Southern Oscillation (ENSO) system, which involves changes in sea-surface temperatures and atmospheric circulation across the tropical Pacific. El Nino is often associated with a weaker Indian summer monsoon, but the relationship is not exact: not every El Nino year produces below-normal rainfall across India, and impacts differ across regions and months. The Ministry of Earth Sciences stated in July 2026 that El Nino conditions were weak in June and had intensified to moderate levels in July, with further strengthening possible during October–December 2026 (PIB, 2026a). The practical challenge is therefore to convert climate information into timely action. Forecasts become useful when farmers and extension workers know what to do if sowing is delayed, rainfall stops during a sensitive crop stage, or irrigation water becomes limited. Agricultural extension is central to this process because it connects meteorological information, agricultural research, government departments and farmers.

What is El Nino?

El Nino is the warm phase of ENSO, characterised by unusually warm sea-surface temperatures in parts of the equatorial Pacific Ocean. These oceanic changes can influence wind patterns, atmospheric circulation and rainfall in different parts of the world. El Nino is

not itself a drought forecast for every location; it changes the probability of certain climate conditions. Local rainfall observations and official forecasts must therefore guide farm decisions. The World Meteorological Organization reported in September 2026 that El Nino was firmly established and was expected to persist through the Northern Hemisphere winter of 2026–27, with the possibility of further intensification (WMO, 2026). The Government of India has also emphasised that the intensity and regional impacts depend on the evolution of coupled ocean–atmosphere conditions, and that IMD continues to issue forecasts and advisories (PIB, 2026a). Farmers should follow current IMD and state agricultural advisories rather than relying on general predictions or social-media messages.

Why does El Nino matter to Indian farmers?

1. Delayed or uneven rainfall

A delayed monsoon onset or long dry spell after sowing can affect seed germination and crop establishment. Uneven rainfall may also create a mismatch between crop water requirements and the water available in the field. The effect depends on the crop, soil type, sowing date, local rainfall and access to irrigation.

2. Soil-moisture stress and irrigation pressure

When rainfall is deficient, soil moisture can decline and farmers may depend more heavily on wells, tanks, farm ponds or other irrigation sources. In areas with limited groundwater or unreliable electricity, this can increase production costs and make water-saving practices especially important.

3. Crop growth and yield risks

Moisture stress during germination, flowering, pod formation or grain filling can affect crop growth and yield. Crops and varieties differ in their sensitivity, so local crop calendars and stage-specific advisories are important. Extension workers should avoid giving a single recommendation to all farmers without considering crop, soil, location and growth stage.

4. Livestock and household livelihood pressures

Poor rainfall can reduce fodder availability and affect drinking-water supplies for livestock. If crop income declines, farm households may also face difficulty meeting expenses for seed, fertiliser, labour and animal care. Preparedness should therefore include fodder planning, water management and links to relevant livestock and rural support services.

Table 1. Potential El Nino-related risks and extension responses

Risk area	Possible farm-level effect	Practical response
Rainfall	Delayed onset or dry spells can affect sowing and crop establishment.	Follow IMD/KVK advisories and district contingency plans.
Soil moisture	Declining moisture may increase crop stress and irrigation demand.	Use mulching, weed control, bund maintenance and suitable water-saving practices.
Crop growth	Stress at flowering or grain filling may reduce crop performance.	Use locally recommended varieties and stage-specific advisories.
Livestock	Fodder and drinking-water shortages may arise.	Plan fodder reserves and consult local livestock services.

What official forecasts and preparedness efforts indicate in 2026

In its second-stage long-range forecast, IMD projected southwest monsoon rainfall for 2026 at 90 per cent of the Long Period Average (LPA), with a model error of ±4 per cent, as reported by the Ministry of Earth Sciences in August 2026 (PIB, 2026b). This was a seasonal forecast and should not be interpreted as a uniform rainfall prediction for every district. The Government of India reported that ICAR–Central Research Institute for Dryland Agriculture (ICAR-CRIDA), in consultation with states, updated District Agriculture Contingency Plans for 342 districts across 14 states considered likely to receive below-normal rainfall. It also reported that ICAR issued standard operating procedures for KVKs to mitigate El Nino-related risks, with emphasis on crop diversification, short-duration and drought-tolerant

varieties, balanced fertiliser use, water conservation, micro-irrigation, mulching and intercropping (PIB, 2026c).

Table 2. Key 2026 preparedness information reported by official sources

Preparedness area	Reported information	Relevance for farmers and extension
Seasonal outlook	IMD's second-stage forecast reported 90% of LPA, with ±4% model error.	Use forecasts as probabilities; combine them with local weather and crop advisories.
Contingency planning	ICAR-CRIDA plans were updated different districts across different states.	District-specific plans can guide crop choices and responses to delayed or deficient rainfall.
Extension delivery	KVKs and state agencies support communication and implementation.	Farmers should seek recommendations suited to their district, crop stage and water access.

These measures illustrate an important extension principle: preparedness should begin before a crop failure occurs. The appropriate action depends on the current crop stage and local conditions, so farmers should use district-level contingency plans and updated advisories from their KVK, state agriculture department and agricultural university.

Practical strategies for farmers

1. Follow location-specific advisories before sowing

Farmers should check IMD forecasts and advisories issued through KVKs and state agricultural departments before making major sowing decisions. If rainfall onset is delayed, the locally recommended contingency plan may identify suitable alternative crops, varieties or sowing windows. Seed should not be changed solely on the basis of a general El Nino headline.

Table 3. Farmer actions before and during a dry spell

Decision point	Recommended action	Important caution
Before sowing	Check the latest IMD forecast and local KVK advisory.	Do not change crop plans based only on unverified messages.
Delayed rainfall	Ask extension staff whether to wait, use a contingency crop, or adjust sowing.	Recommendations depend on district, soil, seed availability and season.
After crop establishment	Conserve soil moisture and control weeds in time.	Use locally suitable practices; avoid unnecessary expenditure.
Limited irrigation	Prioritise water for critical crop stages and schedule irrigation carefully.	Consider available water, crop needs and local technical advice.
Livestock planning	Check fodder stocks, drinking water and animal-health needs.	Seek veterinary support when needed.

2. Consider short-duration and stress-tolerant crops or varieties

Where appropriate for the local agro-climatic zone and market, short-duration crops and drought-tolerant varieties can reduce exposure to prolonged moisture stress. Depending on the district plan, alternatives may include millets, pulses or oilseeds. The final choice must be based on local recommendations, seed availability, soil conditions, expected rainfall and the farmer's livelihood needs.

3. Conserve soil moisture

Practices such as mulching, timely interculture, weed control, conservation tillage where suitable, contour measures and field bund maintenance can help retain soil moisture and reduce runoff. Farm ponds and rainwater harvesting structures may provide additional support where feasible, but they require appropriate design, maintenance and local water-management planning.

4. Use water efficiently

Farmers with irrigation facilities should prioritise water for critical crop-growth stages and use irrigation scheduling suited to the crop and soil. Drip or sprinkler systems may improve water-use efficiency in suitable crops, but installation alone is not enough: correct operation, maintenance and reliable water access are necessary.

5. Manage nutrients and crop protection carefully

Balanced nutrient management based on soil tests and crop recommendations can help avoid unnecessary input costs. During dry spells, farmers should consult extension experts before applying fertilisers or crop-protection products, because weather conditions influence their effectiveness and safe application.

6. Plan for livestock and farm income risks

Farm households can discuss fodder reserves, drinking-water availability and animal-health support with local livestock services. They should also keep records of crop expenditure, rainfall, sowing dates and field operations. These records help assess losses, make future decisions and provide evidence when applying for eligible assistance or insurance claims.

Agricultural extension: turning climate forecasts into farm decisions

- Agricultural extension has a key role in making climate information understandable, timely and actionable. Weather bulletins alone may not answer a farmer's practical question: should sowing be postponed, should a crop be changed, which variety is suitable, or how should limited irrigation water be prioritised? Extension workers can interpret the forecast in relation to local soil, crop, farm resources and the stage of cultivation.
- Disseminate verified IMD weather forecasts and crop advisories through village meetings, SMS, mobile applications, local-language audio, farmer groups and other accessible channels.
- Explain district and block-level contingency plans, including the conditions under which alternative crops or re-sowing may be considered.
- Organise field demonstrations on moisture conservation, crop diversification, intercropping, balanced nutrient management and water-saving practices.
- Coordinate among KVKs, agricultural universities, agriculture and horticulture departments, irrigation agencies, livestock services, FPOs and local administrations.
- Identify vulnerable farmers and farming systems, including rainfed smallholders, and connect them with suitable technical guidance and available support services.
- Collect farmer feedback on rainfall, crop condition, seed availability and advisory usefulness, and share field observations with research and government agencies.
- A useful extension message should be timely, local, practical and transparent about uncertainty. It should not create unnecessary alarm or promise that any single practice will eliminate climate risk.

Table 4. Core functions of agricultural extension during El Nino risk

Extension function	Examples of action	Expected contribution
Climate communication	Share verified forecasts and advisories in local languages through meetings, SMS and farmer groups.	Improves access to timely, understandable information.
Contingency guidance	Explain district plans and conditions for alternative crops or re-sowing.	Supports better-informed farm decisions.
Demonstration	Show moisture conservation, diversification and water-saving methods.	Builds practical knowledge and confidence.
Coordination	Connect KVKs, universities, departments, FPOs, irrigation and livestock services.	Helps align advice and available support.
Feedback and monitoring	Record farmer concerns, adoption and field conditions.	Helps improve advisories and document outcomes.

Challenges in communicating El Nino risk

- Uncertainty in seasonal forecasts: El Nino affects probabilities, but local rainfall and crop impacts are not identical across districts.
- Limited last-mile communication: Some farmers may not receive advisories in time or in a language and format they can easily use.
- Input and market constraints: Recommended alternative crops may not be practical if suitable seed, labour, machinery, buyers or credit are unavailable.
- Water-access inequalities: Farmers with irrigation and storage may have more adaptation options than farmers who depend entirely on rainfall.
- Coordination gaps: Weather, agriculture, irrigation, livestock and disaster-management services need to share timely information.
- Weak impact documentation: Counting meetings or advisories is not enough; agencies should also examine whether farmers adopted recommendations and whether outcomes improved.

Table 5. Communication barriers and ways to address them

Challenge	Possible response
Seasonal forecasts are uncertain	Explain probabilities clearly and update advice as forecasts and field conditions change.
Farmers do not receive advisories in time	Use multiple channels, local languages and farmer groups; check whether messages reach vulnerable households.
Alternative inputs or markets are unavailable	Coordinate recommendations with seed suppliers, FPOs, credit services and local buyers.
Unequal access to irrigation	Prioritise rainfed and water-constrained farmers when planning demonstrations and support.
Weak outcome tracking	Monitor advisory reach, adoption, crop condition, input costs and farmer feedback—not only meeting counts.

Strategies for strengthening farmer preparedness

- Update and communicate district- and block-specific agricultural contingency plans before and during vulnerable crop stages.
- Strengthen two-way communication between IMD, agricultural universities, KVKs, extension staff and farmer organisations.
- Ensure recommended seed varieties and alternative crop options are locally suitable and practically available.
- Promote demonstrations of soil-moisture conservation, efficient irrigation and diversified farming systems.
- Provide special attention to rainfed farmers, tenant cultivators, women farmers and households with limited access to water and information.
- Evaluate extension activities using indicators such as advisory reach, adoption, re-sowing decisions, water-use practices, crop loss, input costs and farmer satisfaction.

A practical checklist for farmers

- Follow the latest IMD forecast and local KVK or agriculture-department advisory.
- Confirm crop and variety recommendations for your district, soil and available water.
- Avoid changing crops or investing in costly inputs based only on unverified social-media messages.
- Maintain soil moisture and use available irrigation water carefully.
- Discuss fodder, livestock water and crop-risk planning with relevant extension or veterinary personnel.
- Record sowing dates, rainfall, crop operations and expenses, and report field-level problems to extension staff.

Conclusion

El Nino is an important climate driver that can increase the risk of below-normal or uneven rainfall in India, but its agricultural effects vary by region, season and crop. For farmers, the priority is to make informed decisions using current forecasts, local crop conditions and official contingency plans. Short-duration and stress-tolerant varieties, crop diversification, soil-moisture conservation, efficient irrigation and careful input management can form part of a locally appropriate response. Agricultural extension is the bridge between climate science and farm-level action. The 2026 initiatives in different districts, demonstrate how KVKs, research institutions, government departments and farmers can work together on awareness and contingency planning. The next step is to strengthen last-mile advisory delivery and systematically document adoption and outcomes. Effective preparedness is not achieved by forecasting alone; it requires timely information, feasible options, institutional coordination and continuous feedback from farmers.

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