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RESEARCH REPORT
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AGRO-COMMODITY INTELLIGENCE • SPECIAL REPORT

Is India's Food Security Under Threat?

Ft. El Niño — Rising Risks. Dry Fields. Uncertain Future.

MONSOON DEPENDENCY
75% of India's annual rainfall originates from the Southwest Monsoon, directly determining Kharif crop performance and national food security.

EL NIÑO 2026 RISK
IMD projects below-normal monsoon at 92% of LPA (−8% deviation). Skymet confirms July–September as the window of peak stress.

CROPS AT RISK
Oilseeds, Cotton & Sugarcane face highest downside. Rice is relatively protected through existing irrigation infrastructure.

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SECTION 01 —

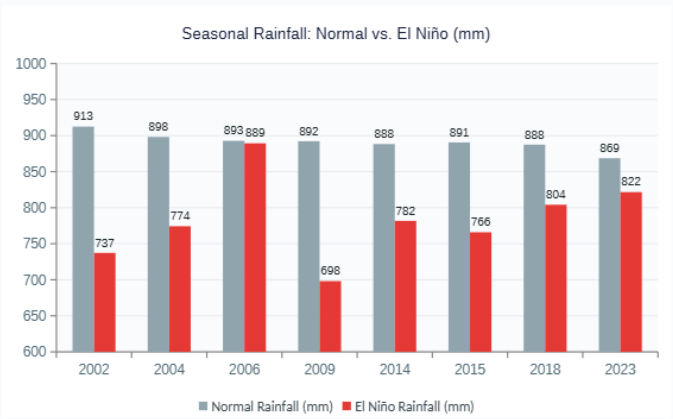
What El Niño Does to India?

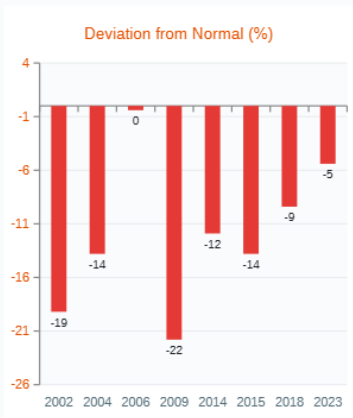
Understanding the monsoon–agriculture nexus under ENSO stress conditions

75%	−8%	60%	4
of annual rainfall from SW Monsoon	LPA deviation forecast 2026 (IMD)	of seasonal rain falls Jul–Aug	major El Niño events in 25 years

Impact on Normal Rainfall During El Niño Years

Annual rainfall (mm) vs. normal baseline and deviation % by El Niño year

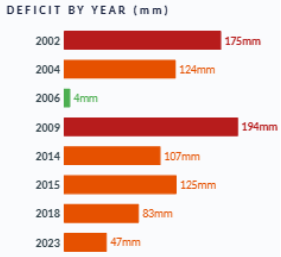




-21.8%
Worst year 2009
698mm vs 892mm

-12.0%
Average deviation across all El Niño yrs

-0.4%
Best year 2006
889mm vs 893mm



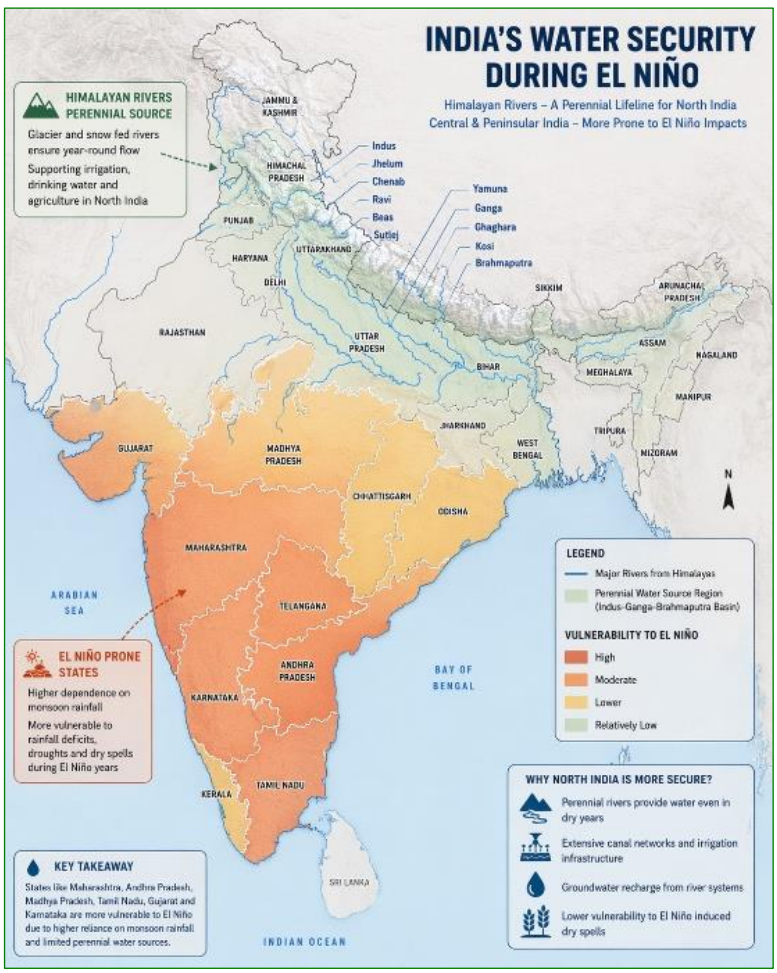
Monsoon is the backbone of India's agricultural economy, contributing nearly **75% of annual rainfall** and directly influencing the performance of the Kharif crops. The southwest monsoon, spanning **June to September**, determines sowing decisions, crop health, and ultimately yields for key crops such as ***rice, cotton, soybean, groundnut, and sugarcane.***

Over the years there has been a significant impact of **El Niño** - the warming of sea surface temp. in Central and Eastern Pacific Ocean - on the Indian Monsoon. Over the past 25 years, El Niño episodes such as **2002, 2009, and the back-to-back events of 2014-2015** have led to major deficits, particularly across **central and peninsular India**.

The risk is not limited to rainfall shortfalls, a critical challenge is the intra-seasonal variability and uneven rainfall distribution, especially during the key Jul-Aug window, disrupting sowing, germination, and yields, amplifying agricultural vulnerability even in years where seasonal deficits may appear moderate.

A clear spatial asymmetry emerges. ***Northern India, remains relatively insulated due to the presence of perennial Himalayan river systems***, which provide a stable irrigation backbone. But, central & southern parts, largely rainfed are more exposed to disruptions.

Year	Monsoon Impact
2002	July collapse — strongest single-month deficit on record
2009	Multi-month failure — prolonged Jun–Sep sequential weakness
2014–15	Back-to-back events — two consecutive seasons of stress
2023	Intra-seasonal distortion — erratic Jun–Aug distribution



> ***"Monsoon risk during El Niño is not simply about how much it rains — it is fundamentally about when it rains. Failures in July and August alone can devastate an entire Kharif season."***

KEY CROP BELTS MOST EXPOSED

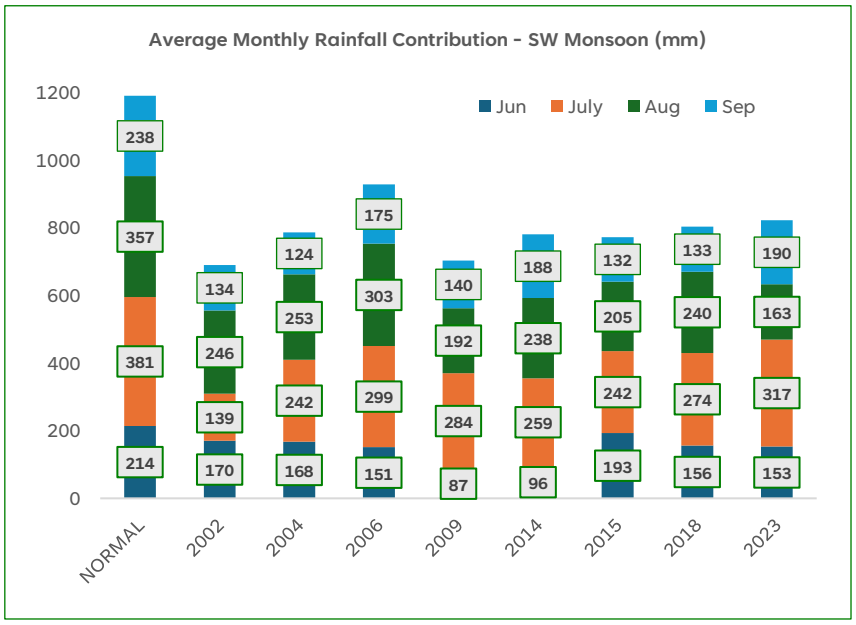
- **Gujarat**
  Cotton and Groundnut — late-season stress (Aug–Sep)
- **Madhya Pradesh**
  Soybean, Cotton, Maize — sharp Jul–Aug weakness in East MP
- **Maharashtra**
  Soybean, Cotton, Sugarcane — Marathwada structurally most exposed
- **Karnataka / Tamil Nadu**
  Pulses, Sugarcane — consistent mild deficit in Karnataka
- **Rajasthan**
  Pulses and Millets — erratic distribution pattern

SECTION 02 —

Historical Rainfall Deviation

How El Niño distorts the timing — not just the volume — of India's monsoon

Average Monthly Rainfall — SW Monsoon (mm)



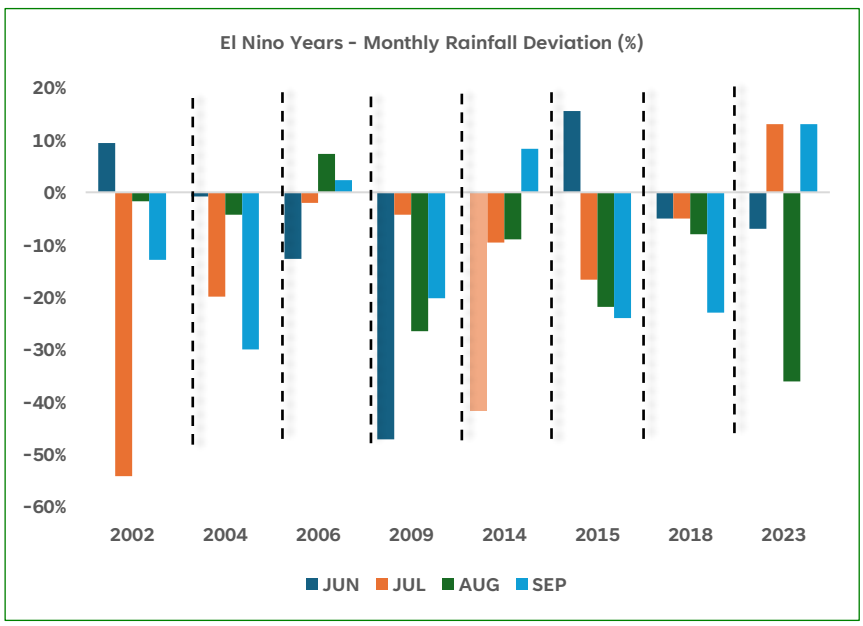
"El Niño distorts the Timing of Monsoon Rainfall"

Over the years, India's monsoon follows a stable structure, with **July and August contributing nearly two-thirds of seasonal rainfall**. However, during El Niño, this distribution becomes highly inconsistent, with rainfall shifting away from peak months.

In several instances (2002, 2009, 2015), the strongest **El Niño** impact years, July's share drops sharply, while rainfall becomes **more fragmented across June and September**. This indicates that even when total rainfall is not severely deficient, it affects agriculture

"Monsoon risk during El Niño is not just about how much it rains — it is fundamentally about when it rains. Deficits concentrated in peak months are disproportionately damaging."

Monsoon risk during El Niño is not just about "How much it rains", but "WHEN IT RAINS".



El Niño does not uniformly reduce rainfall in India, it disrupts the distribution of rainfall across the monsoon cycle, with **failures in high-contribution months** creating **outsized impacts** on agriculture.

Extreme events such as 2002 and 2009 show significant rainfall deficits in July, directly impacting crop establishment.

Other years (2015, 2023) highlight uneven patterns, where deficits shift between July and August or extend into September, reinforcing that **El Niño impact is not uniform across years**

Monthly Deviation During El Niño Years (%)

Red = severe (≤–15%), Amber = moderate, Green = above normal. July and August show the most consistent weakness across all El Niño years.

Year	Jun	Jul ⚠	Aug ⚠	Sep	Season Assessment
2002	+11%	-39%	-35%	-1%	*Severe — July collapse; strongest single-month deficit on record*
2004	-13%	-20%	-30%	+49%	*Moderate — early season weakness; Sep recovery buffers total*
2006	-51%	-50%	-59%	-18%	*Severe — sustained deficit across all months; worst distribution*
2009	+5%	-38%	-55%	-22%	*Severe — multi-month Aug–Sep failure; one of worst crop years*
2014	-43%	-36%	-10%	-22%	*Strong — broad seasonal deficit; no recovery phase visible*
2015	-33%	-28%	-27%	+12%	*Strong — Jul–Aug weakness with partial Sep offset*
2018	-54%	-17%	-29%	+42%	*Moderate — uneven; Sep surplus masks core Jul–Aug deficit*
2023	-20%	-32%	+33%	+52%	*Mixed — July weak; strong Aug–Sep recovery*

SECTION 03 —

The Regional Effect — Who's the Sufferer?

Average SW Monsoon deviation (Jun–Sep) by region, averaged across all El Niño-affected years

Zone	Region	Jun	Jul ⚠	Aug ⚠	Sep	Key Observation
CENTRAL	West MP	-6%	-3%	-11%	-4%	*Mild but consistent; stress concentrated in August*
	East MP	-14%	-23%	-16%	-27%	*Sharp Jul–Aug weakness; most vulnerable central belt*
	Madhya Maharashtra	2%	-4%	8%	-2%	*Near-normal overall; no sustained stress pattern*
	Marathwada	-20%	-27%	-14%	-15%	*Broad-based deficit all months; structurally most exposed*
	Vidharbha	-5%	-12%	-12%	-10%	*Moderate consistent deficit; no recovery phase visible*
WEST	Gujarat Region	-7%	1%	-14%	-18%	*Late-season stress (Aug–Sep); moderate volatility*
	Saurashtra & Kutch	25%	26%	-15%	-24%	*Highly volatile; excess early rainfall, sharp Aug correction*
SOUTH	Tamil Nadu	8%	-30%	-16%	4%	*Weak Jul–Aug offset by Sep recovery; less exposed*
	Coastal Karnataka	-21%	-8%	-10%	0%	*Consistent mild deficit; evenly distributed*
	North Karnataka	-10%	-15%	-9%	-15%	*Steady moderate deficits; prolonged intra-seasonal stress*
	South Karnataka	1%	-8%	-8%	-1%	*Near-normal; limited El Niño impact*

⚠ **Peak monsoon months (Jul–Aug) account for ~60% of seasonal rainfall. Deficits in these months carry disproportionate agricultural weight across all rainfed belts.**

NOTE: Figures represent actual average deviations for SW Monsoon (Jun–Sep) across El Niño-affected years by region, based on IMD historical data.

Over the years, **El Niño events have shown a clear pattern** in how they affect India's monsoon, not uniformly, but in **specific regions** and **at specific times**.

India's agriculture depends heavily on **rainfall**, especially during the monsoon months of June to September. However, not all regions depend on rainfall in the same way

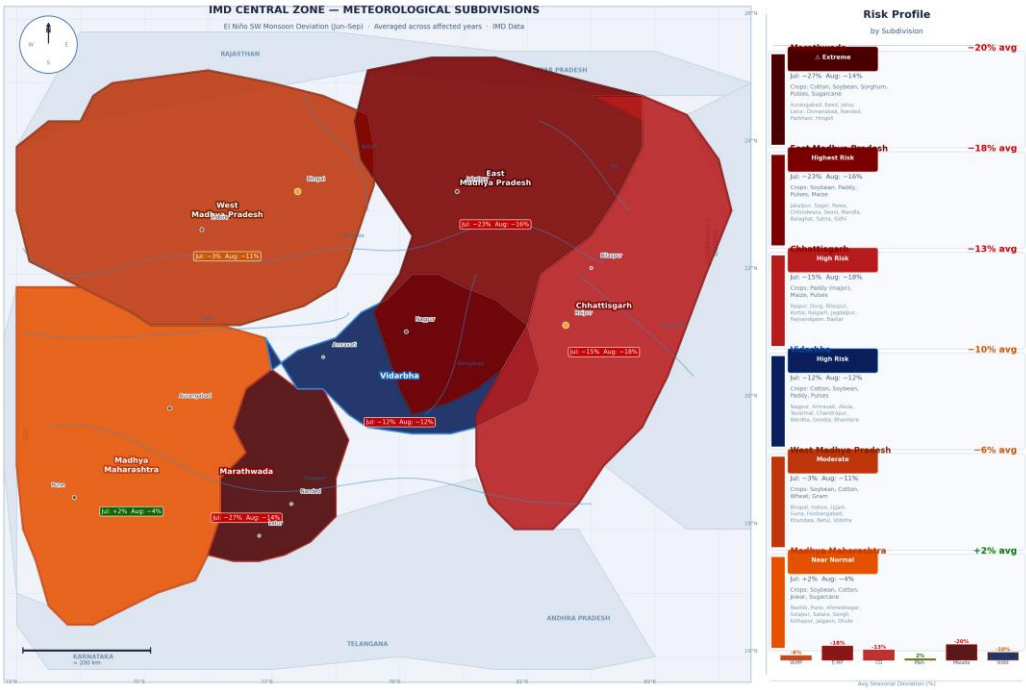
CENTRAL INDIA : THE MOST CRITICAL ZONE

Regions like Madhya Pradesh and Maharashtra represent the heart of India's rainfed agricultural belt. The maps below illustrate the differential El Niño exposure across sub-regions, based on historical monsoon deviation data

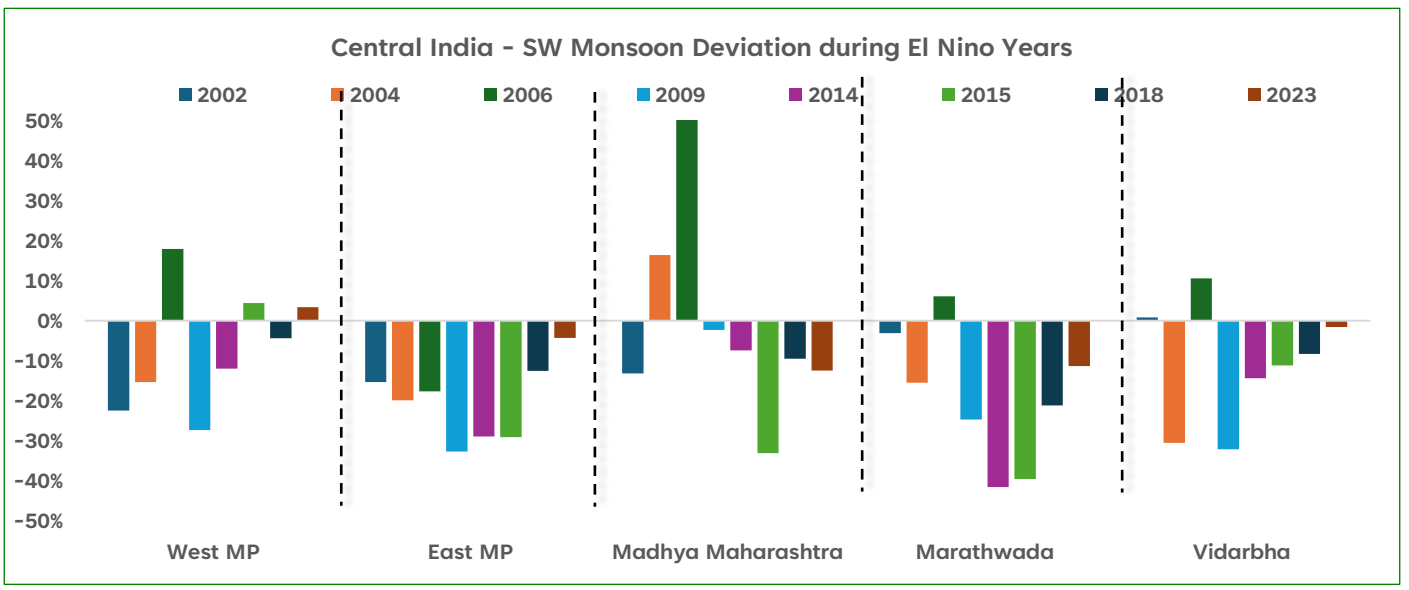
These are extremely important because they produce:

- **Soybean (India's largest oilseed crop)**
- **Cotton (India's textile backbone)**
- **Pulses (Helps India reach self-sufficiency in it)**
- **Sugarcane (Economic backbone + ethanol feedstock)**

So, when rainfall is disrupted, production falls; prices rise & imports increase (esp for edible oils)



During El Niño, July and August rainfall weakens consistently, the most important months for the crops. So even a moderate rainfall deficit delays sowing, affects germination and reduces final yield



> ***"During El Niño, July and August rainfall weakens consistently across Central India — precisely the months when sowing decisions, germination, and early crop growth are most critical. Even a moderate deficit at this stage delays establishment and reduces final yield."***

Crop Impact Analysis & 2026 Forecast

Analog Year Scenarios — Mirroring 2004 & 2018 El Niño Rainfall Patterns

Based on current projections by **Skymet & IMD**, 2026 monsoon rainfall mirrors moderate El Niño analogs of **2004 and 2018** — characterised by near-normal onset, gradual weakening during July–September, and absence of an extreme single-month collapse.

- **Skymet 2026:** Moderate rainfall deficit; stress concentrated in the latter half of monsoon season.
- **IMD 2026:** Below-normal monsoon at **92% of LPA (−8% deviation)** due to emerging El Niño conditions.

> ***"Even moderate rainfall deficits can translate into meaningful production risks when concentrated in peak monsoon months of July and August — the most agriculturally critical window of the season."***

2026 PRODUCTION OUTLOOK

- **Oilseeds:** Highest sensitivity — rainfed dependency makes soybean & groundnut most exposed
- **Rice:** Relatively stable — irrigation buffers moderate deficits in major producing states
- **Cotton & Maize:** Mixed outcomes — highly dependent on timing of disruption within the season
- **Sugarcane:** Downside of 2–29% in 2026 scenarios — Maharashtra most at risk

Historical Crop Vulnerability Matrix — El Niño Impact Years

Central India monthly rainfall deviations alongside crop exposure and production impact patterns across all major El Niño years.

Year	Jun	Jul	Aug	Sep	Rainfall Pattern	Crop Impact
2002	9.4%	**-54.2%**	-1.7%	-12.9%	*Rainfall highly variable; strong start, sharp Aug–Sep weakening.*	*Moisture stress during growth stage; yield uncertainty and volatility.*
2004	-0.8%	**-19.9%**	-4.3%	**-30.0%**	*Gradual weakening through season; no extreme single-month collapse.*	*Moderate stress; recoverable with timely input intervention.*
2006	-12.7%	-2.0%	7.3%	2.3%	*Early deficit followed by mid-season recovery in Aug–Sep.*	*Mixed outcomes; early sown crops most affected.*
2009	**-47.2%**	-4.3%	**-26.5%**	**-20.2%**	*Broad-based multi-month failure across Jun, Aug and Sep.*	*Severe production losses; one of the worst El Niño crop years.*
2014	**-41.7%**	-9.6%	-9.0%	8.3%	*Spread impact across months; some regions see late Sep recovery.*	*Less severe but prolonged stress; affects crop consistency.*
2015	**15.5%**	**-16.7%**	**-21.9%**	**-24.0%**	*Strong Jul–Sep sequential deficit after surplus June.*	*Crop establishment disrupted; sugarcane most impacted.*
2018	-5.0%	-5.0%	-8.0%	**-23.0%**	*Moderate but steady weakening through season.*	*Prolonged stress; output stability reduced across most crops.*
2023	-7.0%	13.0%	**-36.1%**	13.0%	*Volatile: strong Jul followed by sharp Aug collapse and Sep recovery.*	*Mixed outcomes; late-season crops partially insulated.*
2026 (Proj.)	1.0%	-5.0%	-8.0%	-11.0%	*Moderate deficit expected in latter half; Skymet/IMD*	*Analog to 2004 & 2018; gradual weakening, no*

2026 Kharif Crop Production Forecast (MMT)

Using 2025 actual production as base year. Two analog scenarios constructed: Scenario A mirrors 2004 El Niño rainfall patterns; Scenario B mirrors 2018 patterns. Changes expressed as % deviation from 2025 base.

Crop	2025 Prod (MMT)	Scenario A — 2004 Analog (MMT)	Change	Scenario B — 2018 Analog (MMT)	Change	Risk Flag
Maize	45	36	-20%	44	-3%	High
Rice	152	147	-3%	160	+5%	Low
Soybean	13	12	-8%	15	+15%	High
Groundnut	11	11	0%	11	0%	Medium
Cotton	10	10	-2%	8	-15%	Medium
Sugarcane	405	356	-12%	292	-28%	High
Sunflower	397	397	0%	369	-7%	Medium

** Figures represent directional production scenarios based on observed YoY changes in analog years. Estimates are indicative and should not be used as definitive forecasts. Actual outcomes will depend on sown area, input usage, seed quality, government policy and irrigation coverage.*

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