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EDITORIAL ANALYSIS

India's Maize-Led Ethanol Story Needs a Course Correction

DOWN TO EARTH

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INTERVIEW ANGLE

"Should India's biofuel policy carry an explicit 'food-first' cap that automatically triggers a feedstock review when domestic maize imports cross a threshold?"

EDITORIAL SUMMARY:

Down to Earth argues that India's ethanol blending push has rapidly made maize the dominant feedstock, with around 9 lakh hectares of additional area in the 2025-26 kharif season displacing pulses and oilseeds and turning India into a net maize importer for the first time in decades. Policymakers must recalibrate the policy to embed safeguards for food security, nutrition, water, and soil within the energy transition framework — including yield-focused R&D, water-saving cultivars, and crop-diversification incentives.

THE POLICY TRAJECTORY — E20 IN 2025-26, E30 IN MAY 2026

India's biofuel framework was set out in the **National Biofuel Policy 2018** and accelerated by an amendment in **June 2022** that advanced the E20 target from 2030 to 2025-26. The E30 standard was notified in **May 2026**.

MILESTONE	YEAR
National Biofuel Policy	2018
Amendment advancing E20 target	June 2022
E20 achieved nationally	2025
E30 standard notified	May 2026

The policy categorises ethanol by feedstock generation:

- **1G ethanol** — from sugar molasses (B-heavy, C-heavy) and grains (broken rice, maize, Damaged Food Grains)
- **2G ethanol** — from lignocellulosic biomass (rice straw, bagasse, agricultural residues)
- **3G ethanol** — from algae and other advanced biomass

The 1G pathway scaled fast. The 2G and 3G pathways have not.

WHY MAIZE BECAME DOMINANT

Sugarcane molasses, the original 1G feedstock, has approached its diversion ceiling — roughly 60% of molasses is already converted to ethanol, with the balance needed for chemicals, beverages and animal feed. Grain-based ethanol from broken rice, Damaged Food Grains and FCI rice surpluses filled part of the gap, but the FCI rice route was later restricted on food-security grounds.

That left **maize** as the scalable kharif feedstock.

FEEDSTOCK PROPERTY	VALUE
Ethanol yield from maize	~480-490 L per tonne of grain
Crop season	Kharif (rainfed and irrigated zones)
2025-26 ethanol procurement price — B-heavy molasses	~₹60.73/L
2025-26 ethanol procurement price — C-heavy molasses	~₹56.58/L
2025-26 ethanol procurement price — FCI/maize-based	~₹71.86/L

The procurement price structure tilted economics decisively toward maize.

THE 2025-26 ACREAGE SHIFT

The 2025-26 kharif season saw approximately **9 lakh hectares of additional maize area** in India, displacing pulses and oilseeds.

What Was Displaced

CROP CATEGORY	CROPS AFFECTED
Pulses	Tur (arhar), moong, urad
Oilseeds	Soybean, mustard, groundnut

Where the Shift Was Biggest

- **Madhya Pradesh** — soybean and pulses to maize
- **Karnataka** — pulses to maize in northern districts
- **Telangana** — soybean to maize
- **Andhra Pradesh** — pulses to maize
- **Maharashtra** — soybean to maize in Vidarbha and Marathwada

India's maize production for FY26 is estimated in the **38-40 million tonne range** — and yet the country has slipped into the net-importer column.

INDIA BECOMES A NET MAIZE IMPORTER

For decades, India was a net exporter of maize. In **2024-25, India turned into a net importer** of maize for the first time in that period.

INDICATOR	VALUE
Earlier status	Net maize exporter for decades
2024-25 status	Net importer for the first time in decades
Import sources	United States, Ukraine, Myanmar

The imports have ripple effects beyond India — they disrupt global commodity markets and complicate trade relations, particularly with US corn exporters lobbying for permanent market access.

FOOD AND NUTRITION IMPLICATIONS

The maize-ethanol pivot has displaced two crop families that India is structurally short on.

Pulses

- India imports around **4.6 million tonnes of pulses** (FY24, a six-year high), rising to a record **6.5-7.3 million tonnes** in MY 2024-25 — the largest pulses importer in the world
- Pulses are the principal source of plant protein for Indian diets; displacement worsens nutrition outcomes
- The **National Pulses Mission** targets **35 million tonnes by 2030-31** — incompatible with continued area loss to maize

Edible Oils

- India imports around **60% of its edible oil** consumption — an annual import bill of around **$15 billion**
- The **National Mission on Edible Oils — Oilseeds (NMEO-Oilseeds, 2024-25 to 2030-31)** targets oilseed area expansion
- Soybean and mustard, principal kharif and rabi oilseeds, are exactly what maize is displacing

Poultry Feed and Food Inflation

Maize is the **principal input in poultry feed**. Rising maize prices feed directly into chicken and egg prices, which disproportionately affect lower-income consumers for whom poultry is a primary affordable animal-protein source.

ENVIRONMENTAL COSTS

Water

1G ethanol production uses approximately **1,500-2,000 litres of water per litre of ethanol**. The maize-irrigated regions of India are among the more water-stressed in the country.

Soil

Maize monoculture displaces **nitrogen-fixing pulse rotation**. The agronomic consequence is faster nitrogen depletion, micronutrient loss, and yield plateauing — exactly the dynamic that the long-term diversification logic of Indian agronomy is designed to prevent.

Tailpipe Emissions

Ethanol-blended fuels can elevate **acetaldehyde and formaldehyde emissions** at the tailpipe — a gap not yet adequately captured in current BS-VI norms. This is a separable concern, addressed in detail in the May 20 daily edition; the policy point is that auto-emission standards need to evolve in parallel with blending levels.

THE ECONOMIC CASE — REAL BUT PARTIAL

The ethanol blending programme has delivered genuine benefits.

BENEFIT	ESTIMATE
Cumulative forex saving 2014-2024 (Petroleum Ministry)	~₹99,000 crore (~US$11.8 billion)
Farmer income for maize farmers	Remunerative procurement prices
Use of surplus and broken grain	Productive monetisation
Petrol decarbonisation	Partial, ongoing
Particulate emissions in transport	Reduced

The case for blending was sound. The case for letting maize crowd out pulses and oilseeds without a parallel investment in yield, water and crop diversification is not.

POLICY CONTRADICTIONS

The maize-ethanol pivot contradicts other stated policy objectives.

PROGRAMME	STATED TARGET	CONFLICT
National Pulses Mission	35 mt by 2030-31	Pulse area is shrinking as maize expands
NMEO-Oilseeds (2024-25 to 2030-31)	Oilseed self-sufficiency expansion	Soybean and mustard displaced by maize
Water conservation programmes	Reduce irrigation intensity	1G ethanol is water-intensive
Edible Oil import substitution	Reduce $15 bn import bill	Reverse trend in 2025-26

Policy coherence requires that the ethanol programme operate within food-security and water-security envelopes, not as a parallel track that overrides them.

WAY FORWARD

Down to Earth's recommended course correction:

1. **Cap maize-ethanol diversion at around 30%** — proposed by Economic Survey 2025-26 — with automatic feedstock review triggered when domestic maize imports cross a defined threshold
2. **R&D for higher-yield maize cultivars** — move from the current national average of around 3 tonnes a hectare toward the achievable 7-8 tonnes a hectare through public-sector and ICAR-led breeding programmes

3. **Water-saving cultivation** — drip irrigation, precision fertiliser application, and shift to less-water-intensive maize varieties in stressed regions
4. **Re-incentivise pulses** — a 10%-of-MSP premium under an expanded **PM-AASHA** framework, alongside procurement guarantees
5. **Accelerate 2G ethanol commercialisation** — through the **HPCL Bathinda** and **IOCL Panipat** lignocellulosic plants, supported by viability gap funding where required
6. **Compressed biogas via SATAT** — Sustainable Alternative Towards Affordable Transportation, as an alternative to grain-based ethanol
7. **National Biofuel Coordination Committee** — should publish a periodic **food-energy-water review** linking ethanol blending levels with crop area, water use and import dependence on pulses and oilseeds
8. **Bring NMEO-Oilseeds and the Pulses Mission targets into feedstock-planning calculus** — so that ethanol policy is consistent with the food-security architecture

UPSC MAINS ANALYSIS

GS Paper 3 — Agriculture, Food Security, Environment and Energy

- National Biofuel Policy 2018 (amended June 2022); E20 in 2025; E30 notified May 2026
- 1G, 2G, 3G ethanol pathways; SATAT compressed-biogas programme
- Pulses Mission (35 mt by 2030-31); NMEO-Oilseeds (2024-25 to 2030-31)
- PM-AASHA; MSP architecture; FCI grain management
- Water security; soil health; nitrogen-fixing pulse rotation

GS Paper 3 — Indian Economy and Trade

- Forex savings (~₹99,000 crore cumulative 2014-2024; Petroleum Ministry)
- Maize import dependence; pulses and edible oil import bills
- Procurement price structure for ethanol — B-heavy, C-heavy, FCI/maize routes

Keywords: National Biofuel Policy 2018, E20, E30, 1G/2G/3G ethanol, maize feedstock, B-heavy molasses, C-heavy molasses, broken rice ethanol, Damaged Food Grains, National Pulses Mission, NMEO-Oilseeds, PM-AASHA, MSP, SATAT, HPCL Bathinda, IOCL Panipat, Economic Survey 2025-26.

The maize-ethanol story is a useful reminder that energy transition policy does not happen in isolation from food, water and nutrition policy. India's ethanol programme has delivered real benefits — about ₹99,000 crore in cumulative forex savings from 2014 to 2024, farmer income, partial decarbonisation — but it has also displaced pulses and oilseeds, raised poultry-feed prices, intensified water use, and pulled the country into the net-importer column for maize for the first time in decades. The right policy response is not to halt blending; it is to install guardrails. A diversion cap, a yield-focused R&D push, a re-incentivised pulses regime, and faster 2G commercialisation can convert the maize lesson into a structural correction. The slogan should be food-first within an energy transition, not energy at the cost of food.

Sources: Down to Earth , MoEFCC

KEY ARGUMENTS AT A GLANCE

India's ethanol blending push has rapidly made maize the dominant feedstock, with around 9 lakh hectares of additional area in the 2025-26 kharif season displacing pulses and oilseeds and turning India from a net maize exporter into a net importer for the first time in decades; policymakers must recalibrate the policy to embed safeguards for food security, nutrition, water and soil within the energy transition framework — including yield-focused R&D, water-saving cultivars, and crop-diversification incentives.

✓ SUPPORTING

- The National Biofuel Policy 2018 was amended in June 2022 to advance the E20 (20% ethanol blending) target from 2030 to 2025-26, and the E30 standard has been notified in May 2026; this acceleration outran the feedstock supply chain and forced rapid diversification beyond sugarcane molasses, which had already approached its diversion ceiling, into grain-based ethanol from broken rice, Damaged Food Grains, FCI rice surpluses and finally maize as the scalable kharif feedstock.
- The 2025-26 kharif season saw approximately 9 lakh hectares of additional maize area, drawn primarily from pulses (tur, moong, urad) and oilseeds (soybean, mustard, groundnut), with the biggest acreage shifts in Madhya Pradesh, Karnataka, Telangana, Andhra Pradesh and Maharashtra; India's maize production for FY26 is estimated in the 38-40 million tonne range but domestic ethanol demand has nevertheless pulled the

country into the net-importer column for the first time in decades, with corn flowing in from the United States, Ukraine and Myanmar.

- The food and nutrition cost is significant — India already imports around 4.6 million tonnes of pulses (FY24, a 6-year high) rising to a record 6.5-7.3 million tonnes in MY 2024-25 (the largest pulses importer in the world) and roughly 60% of its edible oil (an annual import bill of around $15 billion) — and pulses and oilseeds are exactly the crops that maize is displacing; meanwhile, poultry feed costs, in which maize is the principal input, have risen, pushing up chicken and egg prices that disproportionately affect lower-income consumers.
- The water and soil costs add a second layer — 1G ethanol production uses approximately 1,500-2,000 litres of water per litre of ethanol, with the maize-irrigated regions among the more water-stressed in India; maize monoculture displaces nitrogen-fixing pulse rotations, accelerating soil degradation; and the auto-emissions side carries its own concern, with acetaldehyde and formaldehyde emissions not adequately captured in current BS-VI norms.

⚠ COUNTER

Ethanol blending has delivered real benefits — cumulative forex savings estimated at around ₹99,000 crore from 2014 through 2024 (as reported by the Petroleum Ministry in September 2024), remunerative prices for maize farmers, a productive use for surplus and broken grain, partial decarbonisation of petrol, and lower particulate emissions in transport; a course correction is not the same as a rollback, and policy must avoid swinging from accelerator-only to brake-only.

→ WAY FORWARD

Cap maize-ethanol diversion at around 30% (as proposed by Economic Survey 2025-26); fund R&D for higher-yield maize cultivars to move from the current national average of around 3 tonnes a hectare toward the achievable 7-8 tonnes a hectare; promote water-saving drip irrigation and precision fertiliser application; re-incentivise pulses with a 10%-of-MSP premium under an expanded PM-AASHA framework; accelerate 2G ethanol commercialisation through the HPCL Bathinda and IOCL Panipat lignocellulosic plants and the SATAT compressed-biogas programme; bring the Pulses Mission (35 million tonnes by 2030-31) and the National Mission on Edible Oils - Oilseeds (NMEO-Oilseeds, 2024-25 to 2030-31) targets into the feedstock- planning calculus; and require the National Biofuel Coordination Committee to publish a periodic food-energy-water review.

✍️ MAINS ANSWER FRAMEWORK

QUESTION

"India's ethanol blending programme has accelerated decarbonisation of transport but created new fault lines in food security, nutrition and water." Discuss with reference to the maize-led feedstock pivot in 2025-26 and suggest a course correction. (250 words)

INTRODUCTION

Down to Earth argues that India's ethanol blending programme has accelerated the decarbonisation of petrol but, by pivoting rapidly to maize as the dominant feedstock in 2025-26, has created new fault lines in food security, nutrition, water use and soil health that demand an immediate course correction.

BODY

The National Biofuel Policy 2018 was amended in June 2022 to bring forward the E20 target from 2030 to 2025-26, and the E30 standard was notified in May 2026. This acceleration outran the feedstock supply chain.

Sugarcane molasses had approached its diversion ceiling at around 60% conversion to ethanol; grain-based ethanol from broken rice, Damaged Food Grains and FCI rice surpluses filled part of the gap; maize, with a yield of around 480-490 litres of ethanol per tonne of grain, emerged as the scalable kharif feedstock. The 2025-26 kharif season saw approximately 9 lakh hectares of additional maize area, drawn primarily from pulses and oilseeds, with the biggest acreage shifts in Madhya Pradesh, Karnataka, Telangana, Andhra Pradesh and Maharashtra.

FY26 maize production is estimated at around 38-40 million tonnes, yet domestic ethanol demand has pulled India into the net-importer column for the first time in decades, with corn flowing in from the United States, Ukraine and Myanmar. The consequences extend across food, water, soil and fiscal domains.

India already imports around 4.6 million tonnes of pulses (FY24, six-year high), rising to a record 6.5-7.3 million tonnes in MY 2024-25 — the largest pulses importer in the world — and around 60% of its edible oil at an annual import bill of around $15 billion; the crops being displaced by maize are precisely these. Poultry feed costs, with maize as principal input, have risen, pushing chicken and egg prices upward. 1G ethanol production consumes around 1,500-2,000 litres of water per litre of ethanol; maize monoculture displaces nitrogen-fixing pulse rotation, and acetaldehyde and formaldehyde emissions remain inadequately captured in BS-VI norms.

Against this, ethanol blending has delivered cumulative forex savings of around ₹99,000 crore from

2014 to 2024 (Petroleum Ministry, September 2024), remunerative maize prices, and partial petrol decarbonisation; the ethanol procurement price structure for 2025-26 — B-heavy molasses around ₹60.73/L, C-heavy molasses around ₹56.58/L and FCI/maize-based at around ₹71.86/L — has tilted economics strongly toward maize.

CONCLUSION

The course correction is straightforward in design: cap maize-ethanol diversion at around 30% as Economic Survey 2025-26 proposed, fund R&D to raise maize yields from the current national average of around 3 tonnes per hectare toward the achievable 7-8 tonnes, re-incentivise pulses with a 10%-of-MSP premium under an expanded PM-AASHA, accelerate 2G ethanol through HPCL Bathinda and IOCL Panipat and the SATAT compressed-biogas programme, and bring the Pulses Mission (35 mt by 2030-31) and NMEO-Oilseeds (2024-25 to 2030-31) targets into the feedstock-planning calculus. Energy transition cannot come at the cost of food, water and nutrition security.

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