



POLICY BRIEF #79

# REPURPOSING INDIA'S FERTILISER POLICY TOWARDS NUTRIENT OPTIMISATION

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# **Repurposing India's Fertiliser Policy towards Nutrient Optimisation**

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## Abstract

India's fertiliser subsidy has kept fertiliser affordable and supported output, but it has left nutrient use out of balance. The Nutrient Based Subsidy (NBS), introduced in 2010 to correct this, covers phosphatic and potassic fertilisers, while urea remains outside it at a more or less fixed price. Between triennium ending (TE) 2009-10 and TE 2024-25, nitrogen use at national level moved from 7 per cent below its recommended dose to 6 per cent above it. The phosphorus deficit narrowed only from 29 to 22 per cent, and the potassium deficit deepened from 48 to 72 per cent. The all-India N:P:K ratio of 10.5:4.1:1 compares with a normative 2.8:1.5:1. Eleven of 20 major states, accounting for 39 per cent of gross cropped area, over-apply nitrogen, while all but three under-apply phosphorus and every state under-applies potassium. The central finding is that this is a relative-price problem, and what farmers know explains little of it. The consequences extend beyond nitrogen, so policy should be judged by the balance among nutrients, whatever the volume of any one fertiliser applied. Subsidy design also does not operate in isolation: Minimum Support Price (MSP) procurement and subsidised power lock Punjab and Haryana into a rice-wheat rotation, more input-intensive than the region's water endowment can sustain. The subsidy bill peaked at INR 2.51 trillion in 2022-23, and the disruption at the Strait of Hormuz could take it to INR 2.42–3.32 trillion in 2026-27. The brief recommends a direct cash transfer to farmers that is neutral across nutrients and crops, with the savings directed to fertigation and drip irrigation. It also recommends a farmer-level successor to PM-PRANAM, the incentive scheme for states that reduce fertiliser use, which assesses reductions product by product, and a shift in products and practice built on the 4Rs of nutrient stewardship (right source, right rate, right time and right place).

**Keywords:** *Fertiliser subsidy, Nutrient imbalance, Direct cash transfer, Nutrient-based subsidy*

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The findings, interpretations, and conclusions presented in this policy brief are solely those of the authors and do not necessarily reflect the views or positions of the supporting organisations.

### **List of Abbreviations**

|               |                                                           |
|---------------|-----------------------------------------------------------|
| <b>AAGR</b>   | Annual Average Growth Rate                                |
| <b>CCEA</b>   | Cabinet Committee on Economic Affairs                     |
| <b>CGWB</b>   | Central Ground Water Board                                |
| <b>CRISPR</b> | Clustered Regularly Interspaced Short Palindromic Repeats |
| <b>DAP</b>    | Di-Ammonium Phosphate                                     |
| <b>DCT</b>    | Direct Cash Transfer                                      |
| <b>FAI</b>    | Fertiliser Association of India                           |
| <b>FY</b>     | Financial Year                                            |
| <b>GCA</b>    | Gross Cropped Area                                        |
| <b>GHG</b>    | Greenhouse Gas                                            |
| <b>GVA</b>    | Gross Value Added                                         |
| <b>ICAR</b>   | Indian Council of Agricultural Research                   |
| <b>IEC</b>    | Information, Education and Communication                  |
| <b>INR</b>    | Indian Rupee                                              |
| <b>K</b>      | Potassium                                                 |
| <b>MMT</b>    | Million Metric Tonnes                                     |
| <b>MOP</b>    | Muriate of Potash                                         |
| <b>MoSPI</b>  | Ministry of Statistics and Programme Implementation       |
| <b>MRP</b>    | Maximum Retail Price                                      |
| <b>MSP</b>    | Minimum Support Price                                     |
| <b>N</b>      | Nitrogen                                                  |
| <b>NAAS</b>   | National Academy of Agricultural Sciences                 |
| <b>NBS</b>    | Nutrient Based Subsidy                                    |
| <b>NPK</b>    | Nitrogen, Phosphorus and Potassium                        |
| <b>NSA</b>    | Net Sown Area                                             |

|                  |                                                                                                              |
|------------------|--------------------------------------------------------------------------------------------------------------|
| <b>NUE</b>       | Nutrient Use Efficiency                                                                                      |
| <b>P</b>         | Phosphorus                                                                                                   |
| <b>PIB</b>       | Press Information Bureau                                                                                     |
| <b>PM-PRANAM</b> | Prime Minister Programme for Restoration, Awareness Generation, Nourishment and Amelioration of Mother Earth |
| <b>RPS</b>       | Retention Price Scheme                                                                                       |
| <b>SAU</b>       | State Agricultural University                                                                                |
| <b>SHC</b>       | Soil Health Card                                                                                             |
| <b>SOC</b>       | Soil Organic Carbon                                                                                          |
| <b>SSP</b>       | Single Super Phosphate                                                                                       |
| <b>STCR</b>      | Soil Test Crop Response                                                                                      |
| <b>TE</b>        | Triennium Ending                                                                                             |
| <b>TSP</b>       | Triple Super Phosphate                                                                                       |

# Repurposing India's Fertiliser Policy towards Nutrient Optimisation

Ramesh Chand, Purvi Thangaraj, Ritika Juneja and Ashok Gulati

## 1. Introduction

India is the world's second-largest producer and consumer of fertiliser after China. In 2025-26, the country used about 71.6 million metric tonnes (MMT) of fertiliser products, with urea accounting for roughly 55 per cent of total fertiliser consumption (39.6 MMT) followed by complex fertilisers (NP/NPKs) at 20 per cent (14.1 MMT); di-ammonium phosphate (DAP) at 13 per cent (9.4 MMT); single super phosphate (SSP) at 8 per cent (5.5 MMT); and muriate of potash (MOP) at 3 per cent (2.3 MMT) (FAI, 2026). The Union government provided a fertiliser subsidy of INR 1.86 trillion (revised estimate) in 2025-26 and has budgeted INR 1.71 trillion for 2026-27 (Ministry of Finance, 2026), around 3.2–3.8 per cent of total Union expenditure (INR 53.47 trillion), making it one of the costliest subsidy programmes the government runs after the food subsidy (INR 2.27 trillion, budgeted estimate). Of the INR 1.71 trillion budgeted for 2026-27, urea alone accounts for roughly INR 1.16 trillion (about 68 per cent), while the remaining INR 0.54 trillion is allocated to non-urea fertilisers (DAP, MOP, NPKs, SSP) under the Nutrient Based Subsidy (NBS) regime (Ministry of Finance, 2026). That scale of spending reflects fertiliser's foundational place in Indian agricultural policy. Since the onset of Green Revolution in the late 1960s, fertiliser has been one of three principal inputs, alongside high-yielding seed varieties and expanded irrigation, credited with transforming Indian food output. Foodgrain production rose a little over three-fold from about 108 MMT in 1970-71 to roughly 358 MMT in 2024-25, while fertiliser consumption grew nearly fourteen-fold over the same period from 2.3 MMT to 32.9 MMT, and consumption per hectare (kg/ha) of gross cropped area (GCA) rose from under 14 kg/ha to 146 kg/ha. Based on these aggregates, input subsidies appear to have done exactly what they were designed to do: encourage the use of chemical fertilisers as a route to higher agricultural productivity and output.

However, these aggregates conceal the composition of fertilisers, which is where the story turns. The agronomic benchmark for balanced nutrient use, a nitrogen-phosphorus-potassium (N:P:K) ratio of roughly 4:2:1, is hard to trace to a source, but is believed to date to field experiments from the 1950s on a narrow set of crops, mainly irrigated wheat and paddy in north-west India (NAAS, 2009). It has never been formally revised, even as India's cropping pattern, productivity levels, irrigation coverage and soil characteristics have changed substantially over the years (Chand and Pavithra, 2015). In practice, nitrogen consumption has consistently outpaced phosphorus and, in particular, potassium (Chand and Pandey, 2009), and this divergence has widened, not narrowed, since the NBS was introduced in 2010 specifically to correct it. The result is a policy that keeps succeeding by its own headline metric: tonnes applied, output produced, while quietly eroding the soil base it was meant to sustain.

This paper extends the normative-NPK framework developed by Chand and Pavithra in 2015 for Triennium Ending (TE) 2011-12 to TE 2024-25. Using Fertiliser Statistics consumption data along with state agricultural university (SAU) and Indian Council of Agricultural Research (ICAR) recommended doses, it builds a bottom-up, crop- and irrigation-specific estimate of what each state would need to apply under recommended agronomic practice, and compares this against what each state actually applied. Since exact, verified data on actual on-farm consumption by state is not available, this paper relies on a standard proxy used in the literature: fertiliser supplied by the Centre to each state in a given year, as recorded in the Fertiliser Statistics series. This is a reasonable approximation of use at the state level over a full year, though it may not perfectly capture diversions to other industries, storage carryover, or cross-border leakages.

The central finding is that this gap is, at its root, a relative-price problem rather than an agronomic-knowledge problem; a pattern that shows up even in schemes explicitly designed to correct it. India's normative NPK requirement has moved only modestly over two decades, while actual fertiliser use has moved a great deal, almost entirely in the wrong direction since the introduction of the NBS in 2010. Nationally, nitrogen use has moved from 7 per cent below its recommended dose to 6 per cent above it, and eleven of twenty major states now exceed it, against five in TE 2009-10, while potassium use has fallen in per-hectare terms even though the crop need for it has not changed. The 2010 subsidy reform meant to correct this pattern instead reinforced it, precisely because it left urea outside its scope, and reinforcement is sharpest in the high-nitrogen-consuming states that also draw the largest nitrogen subsidy per hectare.

The policy brief proceeds in eight sections. Following this introduction, Sections 2 and 3 set out the policy background and methodology; Section 4 presents the state-level findings; Sections 5 and 6 trace the environmental and fiscal consequences of imbalanced fertiliser use; Section 7 sets out what a more balanced fertiliser policy would need to do differently; and Section 8 concludes.

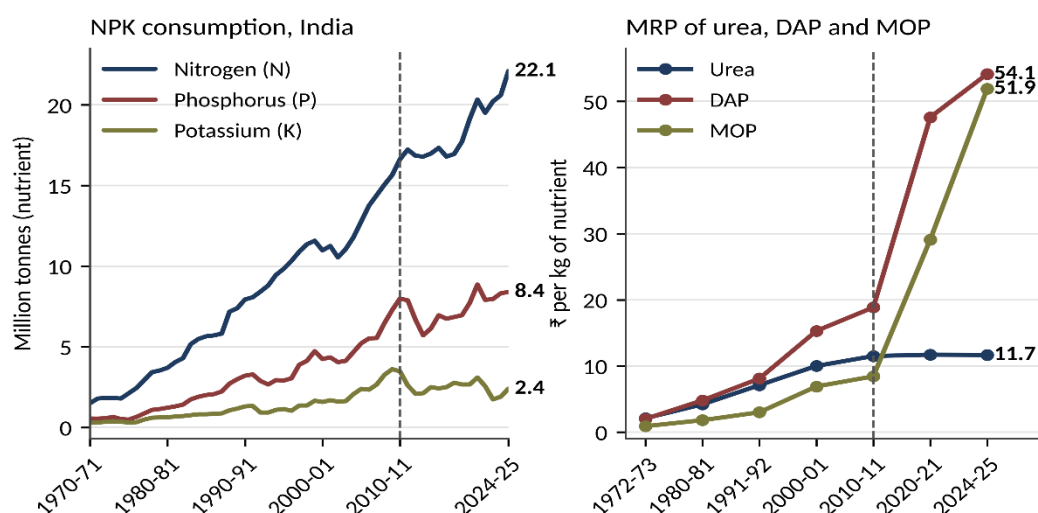
## **2. Fertiliser Policy and Consumption Since the Green Revolution**

Fertiliser policy in India has moved through several distinct pricing regimes since the onset of Green Revolution. High-yielding seed varieties combined with assured irrigation and chemical fertiliser took hold in the late 1960s and drove fertiliser use up rapidly from a very low base. The Retention Price Scheme (RPS), introduced on 1 November 1977, fixed a cost-plus retention price for each domestic urea plant, based on assessed production cost plus a 12 per cent post-tax return on net worth; imported urea was subsidised through a separate route, but both fed into the same government-controlled retail price, insulated from production cost and world prices alike. RPS initially covered nitrogenous (N) fertiliser and was soon extended to phosphatic fertilisers in February 1979. Phosphatic and potassic (P&K) fertilisers were decontrolled on 25 August 1992, on the recommendation of a Joint Parliamentary

Committee, while urea stayed under statutory price control. Decontrol in 1992 did not actually leave P&K to the market: an ad hoc concession scheme kept both subsidised, though on a looser footing than urea, and this ran until the NBS replaced it on 1 April 2010. NBS gave P and K a flat, government-announced subsidy per kilogram of nutrient, and from that point their maximum retail prices (MRP) were allowed to float with world costs. Urea got preferential treatment: it stayed outside the NBS entirely, its MRP fixed by the government, with the subsidy simply absorbing whatever gap exists between that fixed price and the actual cost of production or import. The result is an asymmetry that has done more to shape Indian fertiliser use than the 1992 decontrol itself: the price of two nutrients (P&K) now moves with the world market; the other, that is urea, which supplies roughly 80 per cent of total nitrogen applied in India, does not move at all unless the government decides it should.

The relative price divergence is also evident over time. Urea's price has moved modestly since the 1970s, from about INR 2/kg in 1972-73 to INR 11.65/kg by 2024-25, and has been unchanged since 2020-21. In contrast, between 2010-11 and 2024-25, the price of DAP increased nearly threefold, from INR 18.85/kg to INR 54.14/kg; MOP increased more than sixfold, from INR 8.43/kg to INR 51.92/kg, whereas the price of N in urea in this period increased merely by 1 per cent, from about INR 11.54 to INR 11.65/kg. This represents a sharp divergence in the price signals facing farmers, with the urea price barely changed in fifteen years against P and, particularly, K prices that have multiplied several times over (**Figure 1**).

**Figure 1: NPK consumption in India, and MRP of urea, DAP and MOP**



Source: Authors' compilation from Fertiliser Statistics (FAI, 2026).

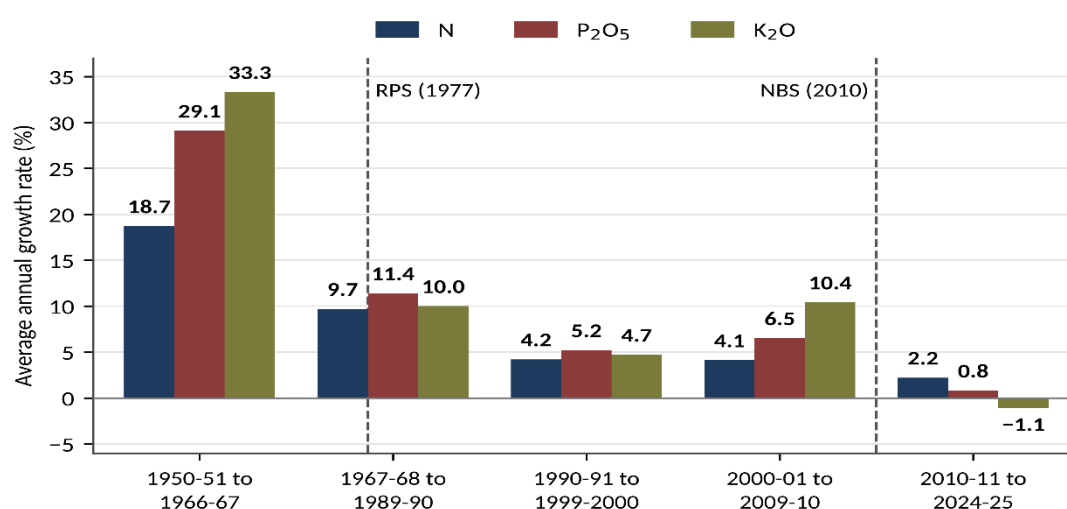
National fertiliser consumption volumes tell the same story from a different angle. In the four decades before NBS (1970-71 to 2009-10), N use increased at an annual average growth rate (AAGR) of 6.5 per cent, while P and K grew somewhat faster at 7.6 and 8.4 per cent respectively, catching up from a much smaller base. The situation changed sharply after 2010, following the introduction of the NBS. AAGR slowed for all three nutrients over 2010-11 to

2024-25. Nitrogen growth fell by roughly two-thirds, to 2.2 per cent; phosphorus growth slowed even more sharply, to 0.8 per cent; and potassium use turned into an outright, sustained decline of 1.1 per cent.

This shows up directly in composition. What happened to the NPK mix after NBS was, in effect, the opposite of what had come before. Fertiliser use in India skewed towards nitrogen before 2000-01 and moved towards a more balanced structure as the century turned, as phosphorus and potassium use caught up through the 2000s. The NBS reform rather reversed this healthy trend and disrupted the balanced use of NPK: nitrogen's share of total NPK consumption, having eased back through the 2000s as P and K gained ground, climbed back to roughly 67 per cent by 2024-25, almost exactly where it stood in 1970-71, meaning three-and-a-half decades of gradual rebalancing were undone in the fifteen years since NBS. Potassium bore the brunt of that reversal: its share, which never exceeded 14 per cent even at its historical peak in 2009-10, fell to 5.7 per cent in 2022-23 and had recovered only to 7.2 per cent by 2024-25. Phosphorus's share moved between the two: it rose from about 24 per cent in 1970-71 to a peak of roughly 29 per cent around 2010-11, before easing back to about 25 per cent by 2024-25.

**Figure 2** splits the growth in nutrient consumption into phases, so that the path of N, P and K can be read against the changes in fertiliser policy. Growth in all three nutrients was fastest in the earliest years of the Green Revolution (1950-51 to 1966-67), when consumption started from almost nothing, and it moderated through the 1970s, 1980s and 1990s as the base grew larger. The 2000s brought a rebound in phosphorus and, especially, potassium AAGR: 6 per cent and 10 per cent respectively over 2000-01 to 2009-10, both faster than nitrogen's 4 per cent that decade. In the fifteen years since the NBS, that pattern inverted: potassium, the nutrient that had grown fastest, became the only one in sustained decline.

**Figure 2: Average annual growth rate in NPK consumption**



Source: Authors' calculations based on FAI (2026)

These trends in aggregate consumption and relative prices set the stage for a more precise question than the national picture can answer: how far has actual fertiliser use, by state, moved from what each state's own cropping pattern and irrigation coverage require, and how much of that gap traces to the price distortions? Section 3 sets out the data and method used to answer this.

### 3. Methodology

Like Chand and Pavithra (2015), this paper starts from the state as the natural unit of analysis, since cropping patterns and other factors having bearing on fertiliser requirement vary across states. Therefore, nutrient balance and optimal use vary far more across regions within India than the national NPK ratio can show. Actual consumption of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O at the state and national level is taken from the Fertiliser Association of India's Fertiliser Statistics. The normative requirement against which this is compared (how much of each nutrient a state would need to apply under recommended agronomic practices) is constructed for this paper, drawing on the SAU, ICAR and state agriculture department recommended doses of fertiliser compiled in FAI's regional reports, and extending the state-wise method Chand and Pavithra (2015) set out.

For each state, the desired quantity of a given nutrient is estimated as the sum, across all crops grown in the state, of the crop's irrigated area multiplied by the irrigated recommended dose, plus its rainfed area multiplied by the rainfed recommended dose:

$$D(N, s) = \sum_i [A(i, s, irr) \times R(N, i, irr)] + \sum_i [A(i, s, rain) \times R(N, i, rain)]$$

D(N) -designates the desired quantity of N, s- state, A- area, i- crop, irr- irrigated and rainfed area. R(N) refers to the recommended dose of N. Correspondingly for P and K, where A(i, s, ·) is the area under crop "i" in state "s" under a given irrigation status, and R(·) is the recommended dose of the nutrient for that crop and irrigation status, drawn from the package of practices published by the relevant SAU, state agriculture department or ICAR institute.

Chand and Pavithra (2015) reported this for TE 2011-12. This paper extends that comparison to TE 2024-25, comparing with TE 2009-10, so that it can bracket the introduction of the NBS in 2010 and capture the fifteen years since. Because reported crops do not fully account for a state's GCA, a scaling step was undertaken: the crop-level normative total is scaled up by the ratio of GCA to the area covered by reported crops, on the assumption that unreported area carries a comparable average dose, and state totals are similarly scaled to an All-India estimate using the ratio of All-India GCA to the summed GCA of the states covered. Alongside the comparison in absolute quantities, actual and normative use are also compared per hectare of GCA, which is size-neutral across states of differing area. Actual and normative use are compared in three ways, following Chand and Pavithra (2015). Overuse or deficit is expressed as a percentage deviation, (Actual – Normative) / Normative, positive for over-

application and negative for under-application. The N:P:K ratio is normalised to potassium equal to one, for both actual and normative use, so that the widening or narrowing of the ratio is visible directly. Because year-to-year fertiliser use is affected by weather, prices and stock adjustment, each measure is reported as a triennium average rather than a single year.

A few limitations bear on how the results should be read. The normative benchmark is only as current as the underlying SAU and ICAR packages of practice; where a state has not revised its recommended doses recently, the norm may not fully reflect current seed varieties and irrigation. Both normative and actual figures are state averages, which means within-state variation disappears from view. A district where potassium mining is severe and a district that is close to balance would show up identically in a state-level number; we cannot tell them apart in our analysis. The GCA-scaling step assumes unreported cropped area carries a dose comparable to reported crops, an assumption more binding in states with lower reported-crop coverage of GCA. Finally, actual use is proxied by the fertiliser supplied to each state, which may differ from the quantity applied where subsidised fertiliser is diverted. None of these is likely to overturn the central finding, given how large and consistent the potassium deficit is and how more N is used than what is optimum across states with different crop coverage and histories of dose revision. Still, they warrant caution in comparing precise point estimates across states.

#### **4. State-level Findings: How Far Has India Drifted from Norm?**

At the all-India level, actual nutrient use in TE 2024-25 stood at 94.7 kg/ha of N, 37.1 kg/ha of P and 9 kg/ha of K, against a normative requirement of 89.2, 47.7 and 32 kg/ha of cropped area respectively: deviations of +6.2 per cent for N, -22.2 per cent for P and -71.8 per cent for K (**Table 1**). Comparable figures for TE 2009-10 were -6.8 per cent for N, -28.6 per cent for P and -48.4 per cent for K. Over the fifteen years spanning the NBS, India's nitrogen use moved from below the recommended dose to above it. The phosphorus deficit narrowed, but only modestly. Potassium went the other way: its deficit deepened sharply even though the normative requirement, which tracks the crop pattern rather than any policy decision, was basically unchanged at 32 kg/ha in both trienniums. Actual potassium application per hectare of GCA nearly halved over this period, from 16.5 to 9 kg/ha, so the decline cannot be attributed to any fall in agronomic requirement.

Eleven of the twenty major states apply more nitrogen than their recommended dose: Jharkhand (+72 per cent), Punjab (+65 per cent), Andhra Pradesh (+64 per cent), Bihar (+56 per cent), Odisha (+52 per cent), Telangana (+37 per cent), Assam (+35 per cent), Uttarakhand (+28 per cent), Haryana (+22 per cent), Chhattisgarh (+8 per cent), and Uttar Pradesh (+6 per cent). Kerala (-65 per cent) and Himachal Pradesh (-53 per cent) remain furthest below their nitrogen norm, along with Maharashtra (-23 per cent), West Bengal (-22 per cent), Gujarat (-8 per cent), by narrower margins. The number of states with overuse has grown markedly since the NBS: only five states, Andhra Pradesh, Bihar, Haryana, Punjab and Uttarakhand,

overused nitrogen in TE 2009-10; the same five remain on the list in TE 2024-25, joined by six more. In these eleven states, which account for 39 per cent of India's GCA, nitrogen use exceeds the normative recommendation. It is also pertinent to point out that excess use of N in states like Jharkhand, Assam, and Odisha, which use much lower N than the national average, is due to low levels of recommended doses of N for paddy, which is a dominant crop in these states.

**Table 1: State-wise normative vs. actual NPK use per hectare of GCA, and deviation of actual from normative use, TE 2009-10 and TE 2024-25**

| State            | TE 2009-10            |    |     |                    |    |    |                         |      |      | TE 2024-25            |    |     |                    |    |    |                         |      |      |
|------------------|-----------------------|----|-----|--------------------|----|----|-------------------------|------|------|-----------------------|----|-----|--------------------|----|----|-------------------------|------|------|
|                  | Normative use (kg/ha) |    |     | Actual use (kg/ha) |    |    | Deviation from norm (%) |      |      | Normative use (kg/ha) |    |     | Actual use (kg/ha) |    |    | Deviation from norm (%) |      |      |
|                  | N                     | P  | K   | N                  | P  | K  | N                       | P    | K    | N                     | P  | K   | N                  | P  | K  | N                       | P    | K    |
| Andhra Pradesh   | 84                    | 51 | 35  | 125                | 61 | 35 | +48%                    | +18% | -2%  | 102                   | 61 | 39  | 167                | 86 | 25 | +64%                    | +41% | -35% |
| Assam            | 30                    | 22 | 17  | 29                 | 13 | 15 | -5%                     | -42% | -12% | 35                    | 23 | 19  | 47                 | 13 | 8  | +35%                    | -44% | -61% |
| Bihar            | 91                    | 49 | 33  | 119                | 30 | 18 | +31%                    | -39% | -45% | 105                   | 59 | 41  | 165                | 51 | 13 | +56%                    | -13% | -69% |
| Chhattisgarh     | 88                    | 53 | 37  | 50                 | 24 | 10 | -43%                    | -54% | -74% | 87                    | 51 | 34  | 94                 | 45 | 8  | +8%                     | -13% | -78% |
| Gujarat          | 100                   | 37 | 36  | 92                 | 40 | 15 | -8%                     | +6%  | -57% | 101                   | 40 | 35  | 93                 | 29 | 6  | -8%                     | -27% | -84% |
| Haryana          | 125                   | 52 | 31  | 148                | 47 | 6  | +18%                    | -11% | -81% | 135                   | 54 | 46  | 164                | 43 | 4  | +22%                    | -20% | -91% |
| Himachal Pradesh | 86                    | 45 | 35  | 35                 | 11 | 11 | -60%                    | -76% | -69% | 88                    | 46 | 36  | 42                 | 12 | 8  | -53%                    | -74% | -77% |
| Jharkhand        | 60                    | 35 | 30  | 57                 | 31 | 9  | -4%                     | -13% | -71% | 59                    | 36 | 29  | 102                | 32 | 3  | +72%                    | -10% | -91% |
| Karnataka        | 79                    | 50 | 43  | 69                 | 41 | 32 | -13%                    | -17% | -27% | 87                    | 58 | 45  | 87                 | 45 | 16 | -0.2%                   | -21% | -64% |
| Kerala           | 84                    | 63 | 134 | 39                 | 19 | 32 | -53%                    | -70% | -76% | 84                    | 63 | 131 | 29                 | 13 | 21 | -65%                    | -80% | -84% |
| Madhya Pradesh   | 48                    | 53 | 20  | 41                 | 25 | 5  | -14%                    | -53% | -78% | 68                    | 51 | 23  | 65                 | 32 | 3  | -5%                     | -37% | -85% |
| Maharashtra      | 74                    | 50 | 27  | 60                 | 36 | 22 | -18%                    | -29% | -20% | 87                    | 60 | 34  | 67                 | 40 | 15 | -23%                    | -34% | -57% |
| Odisha           | 65                    | 37 | 36  | 37                 | 18 | 10 | -44%                    | -53% | -73% | 49                    | 28 | 28  | 74                 | 35 | 9  | +52%                    | +25% | -69% |
| Punjab           | 121                   | 48 | 30  | 169                | 49 | 7  | +40%                    | +2%  | -76% | 115                   | 49 | 15  | 189                | 44 | 5  | +65%                    | -9%  | -67% |
| Rajasthan        | 55                    | 31 | 5   | 32                 | 13 | 1  | -42%                    | -56% | -77% | 50                    | 27 | 5   | 48                 | 18 | 1  | -3%                     | -35% | -87% |
| Tamil Nadu       | 114                   | 46 | 52  | 104                | 43 | 58 | -8%                     | -6%  | +12% | 112                   | 48 | 51  | 108                | 45 | 21 | -3%                     | -6%  | -60% |
| Telangana        | —                     | —  | —   | —                  | —  | —  | —                       | —    | —    | 101                   | 43 | 28  | 138                | 53 | 10 | +37%                    | +23% | -66% |
| Uttar Pradesh    | 126                   | 56 | 42  | 112                | 36 | 10 | -11%                    | -36% | -76% | 126                   | 50 | 36  | 133                | 41 | 5  | +6%                     | -17% | -87% |
| Uttarakhand      | 85                    | 40 | 26  | 96                 | 24 | 9  | +13%                    | -41% | -65% | 98                    | 49 | 35  | 125                | 30 | 5  | +28%                    | -38% | -84% |
| West Bengal      | 83                    | 43 | 43  | 73                 | 44 | 40 | -13%                    | +1%  | -8%  | 106                   | 56 | 58  | 83                 | 46 | 30 | -22%                    | -18% | -49% |
| All India        | 83                    | 47 | 32  | 78                 | 33 | 17 | -7%                     | -29% | -48% | 89                    | 48 | 32  | 95                 | 37 | 9  | +6%                     | -22% | -72% |

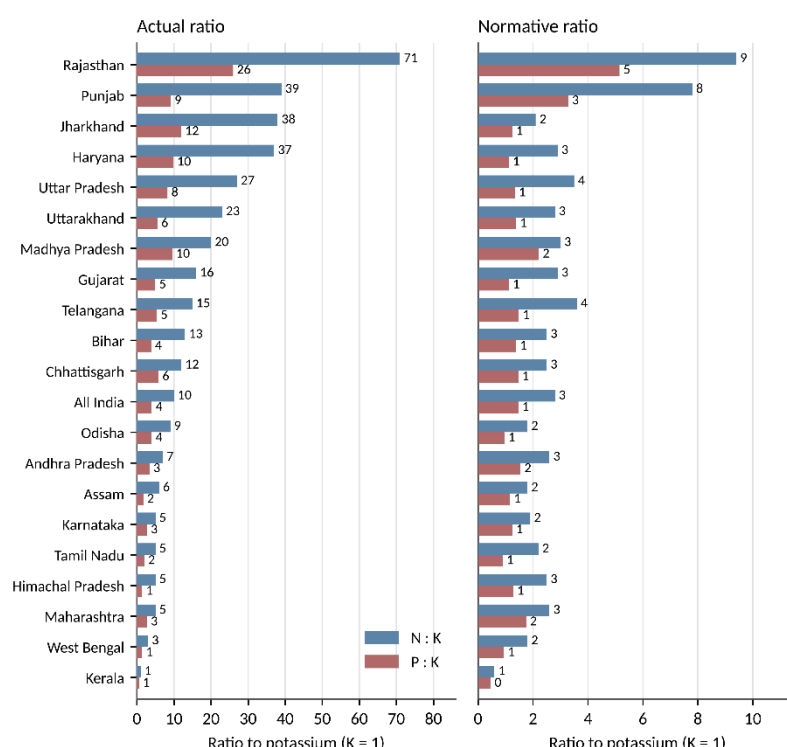
Source: Authors' calculations

Phosphorus use exceeds the norm in three states only: Andhra Pradesh (+41 per cent), Odisha (+25 per cent) and Telangana (+23 per cent). Every other state remains under-applied, from a near-negligible shortfall in Tamil Nadu (-6 per cent) to a severe one in Kerala (-80 per cent)

and Himachal Pradesh (–74 per cent). Potassium is the sharpest and most universal signal in our analysis. Every state, without exception, applies less potash than its cropping pattern demands. The mildest deficit, in Andhra Pradesh, is still –35 per cent; most states cluster between –60 and –90 per cent; Jharkhand and Haryana both apply barely a tenth of their normative requirement, –91 per cent in each case. The universality is itself recent. In TE 2009-10, Tamil Nadu was still applying 12 per cent more potash than its norm; by TE 2024-25 it has swung to a 60 per cent deficit, the same reversal playing out in miniature across most of the country.

The compositional shift is clearest in the N:P:K ratio. Normalised to potassium equal to one, India’s actual ratio moved from about 4.7:2.0:1 in TE 2009-10 to 10.5:4.1:1 by TE 2024-25, while the normative ratio implied by the current cropping pattern moved only slightly, from 2.6:1.5:1 to 2.8:1.5:1, a widening driven by how states apply fertiliser rather than by any shift in what their cropping pattern requires. The state-level picture shows this is not confined to the handful of states already named above (**Figure 3**). Rajasthan’s actual N:K ratio, already the highest in the country in TE 2009-10 at 27:1, reached 71:1 by TE 2024-25, more than seven times its own normative ratio of 9.4:1. Gujarat and Madhya Pradesh, neither of which stood out in the deviation figures earlier, saw their actual N:K ratios roughly triple over the same period, from around 6:1 and 9:1 to 16:1 and 20:1, respectively.

**Figure 3: State-wise actual and normative N:K and P:K ratios, TE 2024-25**



*Source: Authors’ calculations.*

Haryana is a good illustration. Its actual N:K ratio went from about 25:1 in TE 2009-10 to 37:1 by TE 2024-25, in the wrong direction, given that the state’s own normative ratio actually

compressed over the same period, from roughly 4.0:1 to 2.9:1. The state's cropping pattern now needs less nitrogen relative to potassium than it did fifteen years ago; actual use overlooked that and moved further the other way. Jharkhand went further still. Its N:K ratio widened from about 6.5:1 to 38.4:1, close to six-fold, almost entirely because potassium use collapsed, down to just 2.7 kg/ha against a 28.5 kg/ha requirement. Punjab, which already had one of the highest normative N:K ratios to begin with, a reflection of the state's cropping patterns, has widened its actual-to-norm gap further, roughly doubling its actual ratio over the fifteen years. Agriculture University in the state now recommends zero use of K in some crops unless soil tests specifically find it deficient.

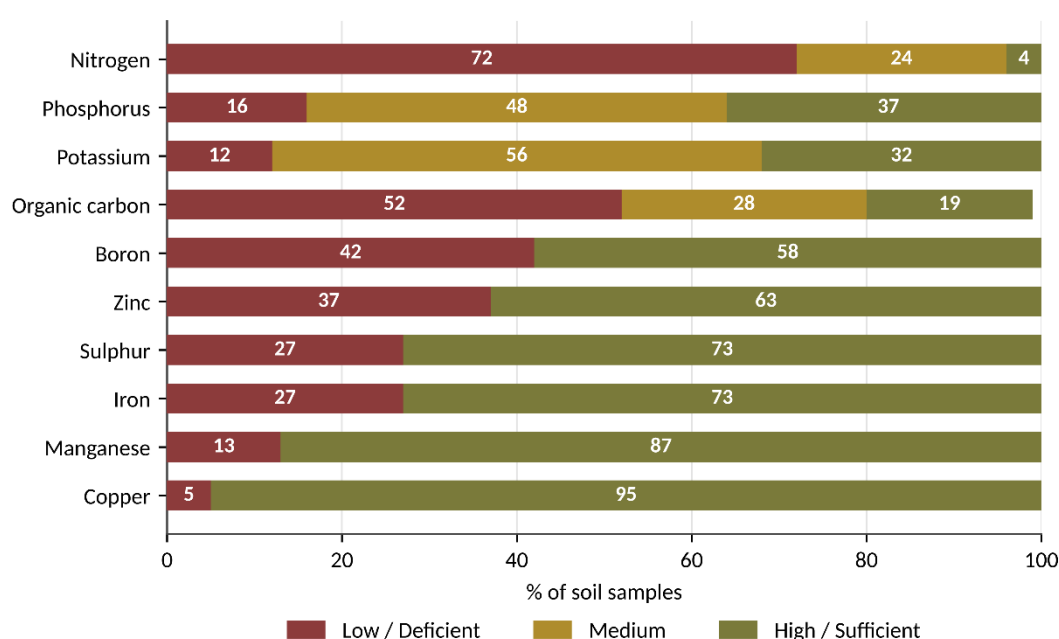
## **5. Environmental Consequences of the Imbalance**

The fertiliser imbalance is not merely a question of whether India is obtaining the maximum output from every kilogram of nutrient applied. Its consequences accumulate over time, affecting soil quality, nutrient use efficiency (NUE), greenhouse gas (GHG) emissions and water quality. The environmental cost of the current fertiliser regime is therefore broader than the immediate cost borne by the government subsidy bill and extends to farmers' long-term gains from better crop health and yields as well as soil and water health. Farmers' profitability and the health of soil and water therefore weigh in the case for reform as heavily as the subsidy bill does.

The Soil Health Card (SHC) data provide an important indication of the condition of India's soils (**Figure 4**). Of the 96,62,955 samples analysed in the 2025-26 cycle, 72 per cent tested low in nitrogen (<280 kg/ha), while 52 per cent recorded low (<0.5 per cent) soil organic carbon (SOC). Low available nitrogen in these samples is not at odds with the over-application: the SHC test measures the nitrogen the soil itself can supply, not the fertiliser applied to the crop, and soils low in organic carbon hold on to little of what is applied. The nitrogen that is not retained is lost through ammonia volatilisation, nitrous oxide emissions and nitrate leaching. Lal (2023) puts the optimal level in the root zone of tropical agricultural soils at 1.0–1.5 per cent, a level most Indian soils fall well below and one that is hard to hold in India's hot, humid climate, where decomposition and microbial oxidation remove carbon quickly.

Similarly, intensive cropping and inadequate application of K cause K mining, to the tune of 85 - 261 kg/ha/yr (Singh et al., 2019). Another long-term nutrient budget analysis (1970-2018) by Pathak et al. (2024) shows that Indian agricultural soils experienced an overall P deficit of 0.06 MMT and a large cumulative K depletion of about 5.27 MMT, reflecting continuous K mining by crops. The SHC cycle (2025-26) also reported on other nutrients in Indian agricultural soils: 16 per cent of samples tested low (<10 kg/ha) in phosphorus and 12 per cent (<120 kg/ha) in potassium. Micronutrient deficiencies were more pronounced for some nutrients: 42 per cent of samples were deficient in boron and 37 per cent in zinc, while 27 per cent were deficient in sulphur and iron, 13 per cent in manganese and 5 per cent in copper. The consequences of nutrient imbalance therefore extend beyond nitrogen, and fertiliser policy should be judged by the balance among nutrients, whatever the volume of any one fertiliser applied.

**Figure 4: Status of Indian Soils, 2025-26**



*Source: Authors' compilation from SHC scheme dashboard (based on 9.6 million samples tested)*

Nitrogen-use efficiency in India is estimated at 30–45 per cent, compared with 15–25 per cent for phosphorus and 50–60 per cent for potassium (PIB, 2026a). The low efficiency of nitrogen application has significant environmental and health costs. Nitrogen not absorbed by crops is lost through gaseous emissions, including nitrous oxide ( $\text{N}_2\text{O}$ ), a greenhouse gas with approximately 273 times the global warming potential of  $\text{CO}_2$  over 100 years, and through nitrate leaching into groundwater. At the state level, the heaviest nitrogen-applying states carry the highest per-hectare emissions intensity ( $\text{kg CO}_2 \text{ eq/ha}$ ): Punjab (476), Bihar (433), Andhra Pradesh (421) and Haryana (417) run almost twice the all-India average of 244  $\text{kg CO}_2 \text{ eq/ha}$  (Singh and Gulati, 2025). Field estimates put nitrogen recovery at 30–70 per cent, averaging around 50 per cent, with losses beyond the root zone reaching 10–30 per cent in upland wheat, maize and sorghum and 30–50 per cent in lowland rice (Katyal, 2019).

Phosphorus and potassium present a different challenge: phosphorus accumulates in the soil but becomes available to crops only gradually, while potassium is held by clay minerals, with some fixed in unavailable forms, particularly in illite- and vermiculite-rich soils. Repeated wetting and drying in paddy fields reinforces potassium fixation. Deficiencies in these nutrients undermine crop productivity and resilience: phosphorus deficiency delays flowering and reduces seed production, while potassium deficiency impairs water regulation and resistance to drought and disease, compromising grain quality (Sahu et al., 2026). Potassium depletion is particularly concerning, with application averaging just 9  $\text{kg/ha}$  against the recommended 32  $\text{kg/ha}$  (**Table 1**). Thus, while nitrogen-use imbalances can be addressed relatively quickly through application in accordance with recommended doses of fertilisers, rebuilding depleted phosphorus and potassium stocks requires sustained application over several seasons. Continued nutrient imbalance and depletion therefore threaten the long-term sustainability of agricultural productivity.

Nitrate contamination above the Bureau of Indian Standards' permissible limit of 45 mg/l has now been detected in parts of 502 districts across 26 states and union territories, with 20.7 per cent of all groundwater samples analysed nationally by the Central Ground Water Board exceeding the limit (CGWB, 2025). Rajasthan, Karnataka and Tamil Nadu remain worst affected, with more than 40 per cent of sampled sources in each state exceeding the permissible limit. Nitrate at these concentrations in drinking water is associated with methemoglobinemia, or blue baby syndrome, in infants, along with other health risks in adults, and it depresses the vitamin C content of the crop on which fertiliser is applied.

Nitrogen drives vegetative growth, so a crop that has received it looks greener and fuller, and farmers apply it generously in the expectation of a higher yield. Shortfalls of phosphorus and potassium show up later and less visibly, and farmers protect the nutrient whose absence they can see (Sahu et al., 2026). Sixteen years after the NBS, which was introduced specifically to correct fertiliser imbalance, urea's exemption remains the main structural reason the imbalance has worsened.

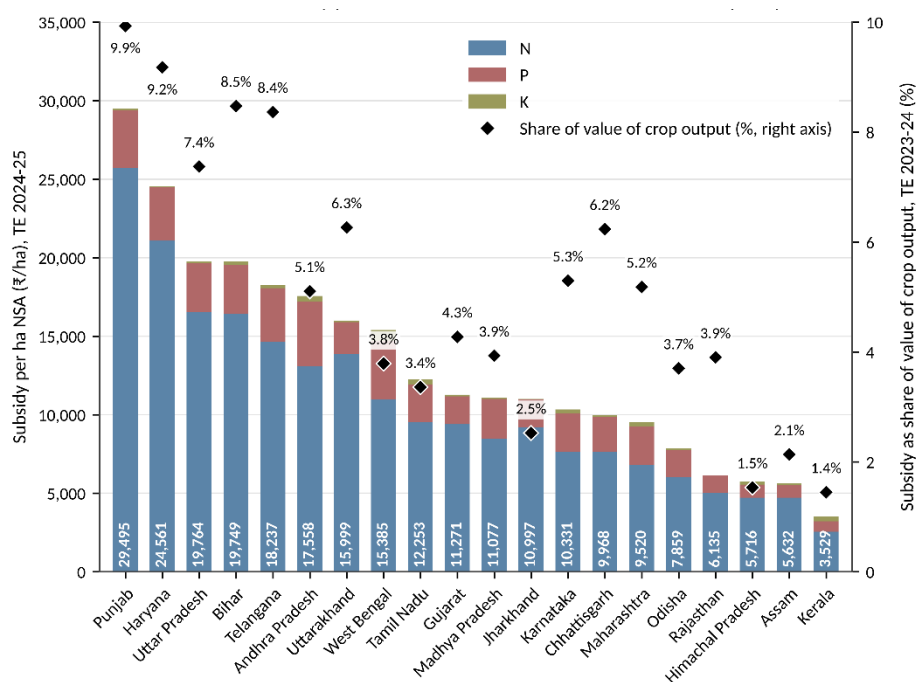
## **6. Fiscal Cost of the Fertiliser Policy**

The price protection provided to farmers also carries a substantial fiscal cost, while exposing the government to volatility in international markets. The fertiliser subsidy bill rose from about INR 0.14 trillion in 2000-01, about 4.7 per cent of crop-sector gross value added (GVA), to a peak of INR 2.51 trillion in 2022-23, accounting for 8.6 per cent of crop-sector GVA, the year global fertiliser and energy prices spiked after the war in Ukraine, before easing to a range of roughly INR 1.7 to 1.9 trillion over the following three years. The 2026-27 budget allocation of INR 1.71 trillion is already under strain. The Strait of Hormuz was disrupted in late February 2026; scenario estimates suggest the fertiliser subsidy could rise to INR 2.42–3.32 trillion during 2026-27, depending on the duration and severity of the disruption (Juneja et al., 2026).

The fiscal cost of fertiliser subsidy is also unevenly distributed across states (**Figure 5**). Punjab and Haryana draw by far the largest nitrogen subsidy per hectare of net sown area (NSA), roughly INR 25,701 and INR 21,071 respectively in TE 2024-25, five to ten times what Kerala (INR 2,540), Assam (INR 4,703) or Himachal Pradesh (INR 4,710) receive.

Expressed relative to the value of crop output, the contrast is equally wide, with fertiliser subsidy accounting for 9.9 per cent of crop output value in Punjab and 9.2 per cent in Haryana, compared with only 1.4–1.5 per cent in Kerala and Himachal Pradesh. A gap of this size means that Punjab and Haryana receive a much larger volume of central government support relative to the value of what they produce than most other states. Because this support is tied to the use of a specific input rather than provided directly as farm income support, it cannot readily be repurposed towards other objectives, such as water conservation or crop diversification, even where a reallocation of public support might make fiscal or environmental sense.

**Figure 5: State-wise fertiliser subsidy per hectare NSA and as share of value of crop output**



Source: Authors' calculations from Fertiliser Statistics, and MoSPI.

The concentration becomes even sharper when the analysis moves from states to crops.

Within Punjab and Haryana, a disproportionate share of the fertiliser subsidy is associated with paddy (a fertiliser-intensive crop). In 2022-23, the fertiliser subsidy on paddy came to about INR 17,912/ha in Punjab and INR 23,071/ha in Haryana, six to nine times the INR 2,649/ha and INR 2,614/ha on pulses in the same two states, respectively (Singh, Thangaraj and Gulati, 2026). Paddy in this belt is also underwritten by a Minimum Support Price (MSP) and by power and irrigation subsidies that make water-intensive cultivation privately cheap regardless of its cost to the aquifers. Fertiliser subsidy design, therefore, does not operate in isolation. It reinforces a wider set of incentives, MSP-driven procurement and subsidised power chief among them, that together lock Punjab and Haryana into a rice-wheat rotation more input-intensive than the region's water endowment can sustain.

Each of these subsidies lowers the price of one input: cheap urea lowers the cost of nitrogen, subsidised electricity the cost of groundwater extraction, and assured procurement the market risk of growing paddy. Together they keep the existing cropping system financially attractive to farmers even when its fiscal, environmental and resource costs are considerably higher. The imbalance in nutrient use cannot be corrected through fertiliser pricing alone.

## 7. Policy Recommendations for Optimising Fertiliser Use in India

India's fertiliser policy has kept fertiliser affordable, raised agricultural productivity and supported national food security. It has also distorted the choice and application of nutrients. The deep subsidy on urea, set against the weaker economics of phosphatic and potassic

fertilisers, has pushed nutrient use out of balance. Ensuring availability is no longer the main task. Policy now has to encourage farmers to use the right source, at the right rate, at the right time and in the right place (the 4Rs).

### 7.1 Policy: Transition towards Farmer-centric Direct Cash Transfers (DCT) and Crop and Nutrient Neutral Incentive Structure

The most important reform is removing the urea-specific skew in the subsidy system, and extending NBS-style price parity across N, P and K. Possible alternatives include:

- **Direct cash transfer.** The subsidy would move from the product to the farmer as a DCT, paid per hectare and adjusted periodically for crop productivity. Because the transfer does not depend on which product is bought, the farmer faces the market price of each nutrient and urea loses its price advantage. Implementing it at scale would need a farmer-level database well beyond what currently exists, combining satellite land-use data with the patwari revenue-record system to establish who is farming what, and how much (Gulati and Juneja, 2024).
- **Where full price decontrol is judged too abrupt, two options remain:** quantity-based restrictions tied to landholding size, cropping pattern and soil-test results, or bringing urea under the NBS with compensating adjustments to DAP and MOP prices. The second of these carries an obvious political cost, since it would raise urea prices sharply; one way to offset that cost is to lower DAP and MOP prices in step as urea rises, so relative prices move back into alignment without leaving farmers worse off.
- **Nutrient and crop neutrality.** Equal treatment of the nutrients is a separate design choice from the transfer and can be applied to either form of subsidy: the total allocated to all fertilisers is divided in proportion to the cost of each element, N, P and K. Equal support per kilogram of nutrient removes the price signal that now favours nitrogen. Support would also be neutral across crops, in that it would not scale with the fertiliser a crop customarily takes, which now steers the subsidy towards paddy in Punjab and Haryana. Farmers would be free to choose between urea, balanced NPK fertilisers, SSP, triple super phosphate (TSP), fortified products, micronutrient fertilisers, organic sources, biofertilisers and validated next-generation products based on their agronomic suitability and cost-effectiveness.
- **Repurposing the savings.** Any savings from curbing excess fertiliser use have a specific use already proposed in the literature: redirected toward fertigation and drip-irrigation infrastructure, they would address the upfront cost that Section 7.3 identifies as the main obstacle to farmers adopting more efficient, soluble fertilisers (Gulati and Juneja, 2024).
- **A state-level incentive.** Incentives for using less fertiliser have so far been tried only at the level of the state, and the Prime Minister Programme for Restoration, Awareness Generation, Nourishment and Amelioration of Mother Earth (PM-PRANAM) is the closest India has come to a savings-linked scheme of this kind. **Box 1** sets out its first three years and what the Department of Fertilisers said about its design.

### Box 1: PM-PRANAM performance

PM-PRANAM, approved by the Cabinet Committee on Economic Affairs (CCEA) on 28 June 2023 for the period 2023-24 to 2025-26, offers each state or union territory a grant equal to 50 per cent of the fertiliser subsidy it saves in a given year by consuming less chemical fertilisers (urea, DAP, MOP and NPK) than its average consumption over the preceding three years. Of the resulting grant, 95 per cent goes to the state, with 65 per cent of the grant for capital expenditure projects, preferably as contributions to Centrally Sponsored Schemes, and 30 per cent untied for other activities, including Information, Education and Communication (IEC) initiatives; the Centre retains 5 per cent (PIB, 2026b).

PM-PRANAM is a savings-linked, nutrient-neutral incentive, and it appeared to work in its first year. Fourteen states and union territories reported a reduction in chemical fertiliser consumption in FY 2023-24 against the average of the previous three years. After adjustment for natural calamities and consumption in neighbouring districts, nine were eligible, with a combined reduction of 14.59 lakh tonnes (Standing Committee on Chemicals and Fertilizers, 2026). Karnataka accounted for nearly a third of the total on its own, at 4.61 lakh tonnes, followed by Maharashtra (3.41 lakh tonnes) and West Bengal (3.31 lakh tonnes); together with Andhra Pradesh (2.13 lakh tonnes), they made up 92 per cent of the eligible reduction. The other five, led by Jammu and Kashmir (0.64 lakh tonnes) and Kerala (0.41 lakh tonnes), contributed 1.15 lakh tonnes between them.

The following two years told a sharply different story. Only three regions, Jammu and Kashmir, Manipur and the Andaman and Nicobar Islands, qualified for an incentive in FY 2024-25 (six reported a reduction), on a combined reduction of just 41,842 tonnes (Standing Committee on Chemicals and Fertilizers, 2026). FY 2025-26 was smaller still. Five states and union territories qualified this time: Dadra and Nagar Haveli, Delhi, Goa, Manipur and Mizoram, and between them they saved just 0.18 lakh tonnes (PIB, 2026b).

No incentive has been paid to any state or union territory under PM-PRANAM, even in the scheme's final year (PIB, 2026b). The Standing Committee on Chemicals and Fertilizers called the scheme a non-starter in financial disbursement, found its eligibility criteria too complex and restrictive, and asked for a simpler successor designed with state governments (Standing Committee on Chemicals and Fertilizers, 2026).

In our consultation with the Department of Fertilisers on 25 September 2026, officials described the reductions achieved by states as marginal and inconsistent from year to year, said that no decision has been taken to continue the scheme beyond 2026-27, and confirmed that any revised scheme would need the approval of the Expenditure Finance Committee and the Union Cabinet.

We recommend two changes to any successor. First, the benefit should go to the farmers who reduce their use. At present the grant goes to the state, to be reinvested in agriculture, so a farmer who applies less fertiliser gains nothing from doing so. A transfer to that farmer, paid out of the subsidy saved, puts the reward where the decision is made. Second, the reduction should be assessed product by product, and a blanket cut in total consumption should not qualify. The scheme now measures the saving on total fertiliser consumption, so a state earns the same grant for reducing potash consumption as for reducing urea consumption, although a fall in potash use widens the imbalance. Crediting reductions only in the products that the soil test and the recommended dose show to be over-applied, mainly urea, would tie the reward to the nutrient that needs to fall. The checks the scheme already applies for cropped area, a normal year and consumption in neighbouring districts cut 14 reporting states to nine in 2023-24 and six to three in 2024-25, and would still be needed on farmer-level records.

## 7.2 Product Innovation

Improving NUE requires not only developing more efficient fertiliser formulations, but also matching nutrient supply to crop requirements, soil conditions and local deficiencies. Customised soil-health solutions and fertilisers can help bridge this gap by shifting the focus from supplying nutrients uniformly to managing them according to agronomic need. The SHC scheme already provides soil-test-based recommendations on fertilisers, biofertilisers, organic inputs and soil amendments. The next step is to translate these recommendations more consistently into customised products, farm-level nutrient plans and timely agronomic advice. This approach is consistent with ICAR's emphasis on site-specific nutrient management, which combines soil testing, crop requirements and in-season assessment to improve NUE, reduce input costs and limit environmental losses.

- **Nano-urea**, commercialised from 2021, is intended to improve nutrient delivery through formulations with much smaller particles. Trials have reported NUE above 80 per cent, compared with 30–45 per cent for conventional urea, and average yield gains of around 8 per cent, ranging from 3 to 16 per cent across crops (Gulati and Juneja, 2024). These estimates should, however, be interpreted in light of differences in experimental conditions and measurement methods. Newer **nano-DAP** formulations make a similar efficiency case, but the agronomic performance of both products requires continued independent evaluation across India's diverse cropping systems before broad claims can be generalised.
- **Biofertilisers**, which are microbial inoculants such as nitrogen-fixing and phosphate-solubilising bacteria, and speciality water-soluble formulations offer additional options for improving nutrient availability and delivery. Their role differs by product: biofertilisers can supplement nutrient supply through biological processes, while water-soluble formulations can facilitate more precise application. Their promotion, alongside nano and customised fertilisers, has been recommended as part of a broader shift away from excessive reliance on bulk urea (Gulati and Juneja, 2024).
- **Controlled-release, customised and organic fertilisers**, including neem-coated urea and sulphur- or polymer-coated formulations, offer another route to improving NUE by synchronising nutrient release more closely with crop demand and potentially reducing leaching and volatilisation losses. Customised fertilisers offer a complementary approach. These crop- and soil-specific NPK formulations, sometimes fortified with micronutrients, can address identified deficiencies rather than supplying nutrients in standard proportions. Alternatively, organic fertilisers like compost, farmyard manure, green manure, etc. also help increase organic carbon in the soils. Their effectiveness depends on reliable soil testing, suitable product formulation and recommendations that reflect crop requirements and local conditions.
- **Seed innovation and gene editing for higher NUE.** Product innovation need not be confined to the fertiliser applied to the soil; it can also involve developing crops that use

applied nitrogen more efficiently. Conventional breeding, molecular breeding and gene-editing technologies such as clustered regularly interspaced short palindromic repeats (CRISPR) can help develop varieties with improved nitrogen uptake, assimilation and internal utilisation, potentially sustaining yields with lower fertiliser application. Research has identified genes regulating nitrogen transport and metabolism as promising targets, while an ICAR-led research project is exploring CRISPR-Cas approaches to improve both yield and nitrogen-use efficiency in rice.

The economic incentives for adoption also matter. Customised, fortified and controlled-release fertilisers may cost more per tonne than conventional products, while the deeply subsidised price of urea weakens the incentive to switch to formulations that offer a more balanced nutrient mix. As a result, the potential efficiency gains from product innovation will depend not only on agronomic performance but also on affordability, availability, extension support and the relative prices farmers face.

### 7.3 Practice

- The **4R Nutrient Stewardship framework** should underpin fertiliser policy. This requires regularly updated, digitised, crop- and plot-specific recommendations based on soil tests, crop requirements and locally validated Soil Test Crop Response (STCR) equations, rather than blanket state-level doses. Although the SHC scheme provides a foundation, its recommendations need to translate into actual fertiliser choices and application practices.
- Practices such as **fertigation**, split application and site-specific nutrient management can improve NUE without necessarily increasing fertiliser expenditure. However, their adoption is constrained by the upfront cost of drip irrigation and water-soluble fertilisers, particularly where subsidised electricity and water weaken incentives to conserve these resources. Fertiliser reform must therefore be accompanied by measures that make precision application economically viable.
- Chemical fertilisers must also be complemented by organic inputs, compost, farmyard manure, biochar, green manure and crop-residue incorporation to rebuild SOC. Crop rotation with pulses can further reduce nitrogen requirements for subsequent cereal crops by an estimated 20–30 per cent through biological nitrogen fixation, while improving soil fertility and farm profitability (Hashim et al., 2026). These gains require sustained adoption over several seasons.
- Finally, fertiliser reform must align with wider agricultural incentives, including MSP and procurement, irrigation, electricity pricing and crop profitability, which shape farmers' cropping choices and nutrient demand. India's dependence on imported potash and phosphate also exposes it to supply and price shocks that can widen the imbalance between N, P and K. The objective should be to give farmers greater flexibility to choose appropriate nutrient sources while creating incentives for balanced and efficient use.

## 8. Conclusion

The analysis supports a single explanation for the nutrient imbalance: farmers respond to relative prices. Since the NBS was introduced, nitrogen use has risen above its recommended level and potassium has fallen further below it, and the states that draw the largest nitrogen subsidy per hectare are the ones that over-apply it. Nitrogen is over-applied on two counts: nationally it exceeds its own recommended dose by 6 per cent, and relative to phosphorus and potassium the actual N:P:K ratio of 10.5:4.1:1 stands far above the normative 2.8:1.5:1. Advice alone cannot reverse a pattern of this kind. Soil testing and up-to-date recommendations matter, but they act on a choice that the price of urea has already made for the farmer. Two incentive designs follow from this. PM-PRANAM pays the state, measures the saving in total quantity, whichever nutrient is cut, and has disbursed nothing in three years. A cash transfer that does not vary with the nutrient or the crop reaches the farmer who decides how much to apply, and corrects the price at that point.

Fertiliser pricing is one of several subsidies that hold the pattern in place. In Punjab and Haryana, cheap urea, procurement at the MSP and subsidised power and irrigation reinforce one another, and the cropping system they sustain creates the demand for nitrogen. Balancing nutrients in isolation will therefore not be enough. The transfer needs to be paired with reform of power pricing and procurement, and the savings from curbing excess urea use should go to the fertigation and drip systems that make efficient application practicable. The measure of success is the balance among nutrients that results, and the volume of any one fertiliser says little about it. The cost of waiting is rising, and the policy correction is long overdue.

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