FEEDING THE SOIL, NOT JUST THE CROP: WHY INDIAN FARMERS NEED TO RETHINK THEIR AFFINITY TOWARDS UREA

SHINOGI K C*, SANJAY SRIVASTAVA, IMMANUEL CHONGBOI HAOKIP, ADITI AGGRAWAL, SUDESHNA BHATTACHARJYA, DINESH KUMAR YADAV, ASHA SAHU, YASHWANT GEHLOT

ICAR-Indian Institute of Soil Science, Bhopal, Madhya Pradesh, India

*Corresponding Author, E-mail: shinojikallely@gmail.com

Chemical fertilizers have been central to the agricultural growth in India since the Green Revolution. Increase in foodgrain production from around 50 million tonnes in 1950-51 to a record 357.73 million tonnes in 2024-25 (Government of India, 2017; Ministry of Agriculture & Farmers Welfare, 2025), achieved largely without a matching increase in the country's net sown area. This growth has come with a steady rise in fertilizer consumption but also with a growing imbalance in how nutrients are applied, and a decline in soil health that has several contributing causes, of which fertilizer use is only one.

DECADES OF IMBALANCED FERTILIZER USE

India's fertilizer consumption has grown steadily since the Green Revolution, but the mix of nutrients applied has stayed skewed towards nitrogen for decades. Nitrogen currently accounts for roughly two-thirds of total fertilizer nutrient consumption in the country, with phosphorus and potassium making up most of the rest (Mujeri et al., 2012), well short of the balanced ratio recommended by agricultural scientists. India's per-hectare fertilizer use has also been higher than the global average since the mid-2000s (World Bank, 2016).

WHAT EXPLAINS THE IMBALANCE?

Though it is tempting to treat the overuse of urea as the single explanation for declining soil health in India, the picture is more complex. Soil nutrient depletion and imbalanced fertilizer use are among several factors contributing to land degradation, alongside wrong tillage practices, poor rainwater management, reduced crop rotation and fallow periods, and declining addition of organic inputs to soils. Multi-nutrient deficiencies and deterioration of soil physical and biological properties have been reported across many regions because of this combination of factors.

In fact, fertilizer pricing policy is another significant driver of the nitrogen skew. Urea is the only fertilizer in India that remains under direct statutory price control, keeping it comparatively inexpensive. Phosphatic and potassic fertilizers, by contrast, have been covered under the Nutrient Based Subsidy (NBS) policy since 2010, under which prices are more closely linked to market rates. This price difference has encouraged higher relative use of urea. But treating pricing policy as the sole cause would be an oversimplification since cropping patterns, irrigation practices, extension outreach, and availability of organic inputs all shape how farmers apply nutrients.

WHAT FERTILIZERS DOES INDIA PRODUCE?

India's reliance on urea is also connected to what the country can manufacture domestically. Around 87 per cent of urea consumption is met through domestic production, supported by capacity that has grown from about 225 lakh tonnes in 2014-15 to over 310 lakh tonnes more recently (PIB, 2025). Roughly 90 per cent of NPK complex fertilizers are also produced within the country. Phosphatic and potassic fertilizers tell a different story: only about 40 per cent of DAP demand is met domestically, and Muriate of Potash (MOP) is almost entirely imported, since India has no significant domestic potash reserves (PIB, 2025). This structural gap i.e., abundant capacity for nitrogen, heavy import dependence for phosphorus and potassium reinforces the price advantage of urea and adds a layer of difficulty to correcting the nutrient imbalance.

It is worth noting that domestic production does not mean self-sufficiency in raw materials. Even India's urea plants depend on imported natural gas for close to 85 per cent of the feedstock they use, since domestic gas output meets only about half of the country's overall gas demand (ICRIER, 2026). Domestic phosphatic fertilizer production is similarly import-dependent: around 90 to 95 per cent of the rock phosphate and about half the phosphoric acid used by Indian plants are sourced from abroad, along with much of the ammonia and sulphur required as intermediates (ICRIER, 2026). In effect, the Indian fertilizer economy is exposed to global supply and price shocks at the raw material stage even for products officially counted as domestically manufactured, which is a further reason organic nutrient sources, produced largely on the farm, carry a distinct resilience advantage.

HOW FERTILIZER SUBSIDY POLICY SHAPED NUTRIENT USE

India's fertilizer sector has been under government regulation since fertilizers were declared an essential commodity in 1955. Prices were initially uniform and centrally fixed, and the Retention Price Scheme introduced in the late 1970s reimbursed manufacturers for the difference between assessed production cost and the notified retail price, a scheme extended to nitrogenous fertilizers in 1977 and to phosphatic and complex fertilizers in 1979. In 1992, phosphatic and potassic fertilizers were decontrolled and a concession scheme introduced instead, while urea remained under the older framework. The New Pricing Scheme introduced for urea in 2003 allowed manufacturers limited freedom to sell outside the government allocation system, but full decontrol did not follow. The Nutrient Based Subsidy policy, effective from April 2010, moved

phosphatic and potassic fertilizers towards market-linked pricing, but urea has remained outside this framework, which is a key reason the nutrient imbalance has persisted despite multiple rounds of policy reform.

TRENDS IN ORGANIC INPUT USE

Alongside the rise in chemical fertilizer use, the relative importance of organic nutrient sources has declined significantly over the decades. The proportion of cattle manure available for agricultural use in India fell from close to 70 per cent in the early 1970s to about 30 per cent by the 1990s, as competing demands, particularly the use of dung as household fuel increased. Also, average farmyard manure application is estimated at about 2 tonnes per hectare, against a recommended level of around 10 tonnes per hectare (FAO, 2005).

This decline has not been due to a shortage of raw material. Total animal manure production in India is estimated at close to 450 million tonnes annually, with a potential nutrient supply of around 17.8 million tonnes. Even so, only about a third of the manure produced in major livestock states is actually recycled back into agricultural fields, with the rest lost to competing uses, limited storage capacity, and the additional labour that composting and field application require (Srivastava, 2011). Other organic sources such as crop residues, green manures, biogas slurry, and vermicompost add several million tonnes of nutrient potential each year.

CAN INDIA FEED ITSELF WITHOUT CHEMICAL FERTILIZERS?

Complete reliance on organic nutrient sources is not realistic at India's current scale. India's total fertilizer consumption reached around 601 lakh tonnes in 2023-24 (PIB, 2025), far larger than the estimated organic nutrient potential of roughly 7 to 18 million tonnes discussed above, even before accounting for the practical difficulty of collecting, transporting, and applying that material uniformly across the country. Nearly 44 per cent of India's land is also degraded or classified as wasteland, and the net sown area has stayed largely unchanged even as the population has crossed 1.2 billion (Government of India, 2017). Under these constraints, chemical fertilizers remain necessary to sustain current levels of food production and have played a role in preventing further conversion of forest and natural land to agriculture.

The more realistic goal, and the one supported by the evidence here, is not eliminating chemical fertilizers but rebalancing their use, meeting a meaningful share of crop nutrient requirements, such as around one-third of total NPK demand, through organic sources, while using soil-test data to apply the remaining chemical fertilizer more precisely.

BALANCED NUTRITION AND THE COST OF CULTIVATION

There is now reasonably good evidence on what soil-test-based, balanced nutrient application does to cultivation costs. A National Productivity Council study covering 76 districts, and 1,700 farmers found that over 90 per cent of surveyed farmers had never tested their soil before India's Soil Health Card scheme, and 92 per cent had not used balanced fertilizers or micronutrients for lack of information on their soil's nutrient status (National Productivity Council, 2017). Farmers who followed soil-test-based recommendations reduced chemical fertilizer use by roughly 8 to 10 per cent while achieving yield increases of about 5 to 6 per cent, a combination that lowers cultivation cost per unit of output even where the recommendations do not involve organic inputs directly.

Without organic inputs in the mix, farmers depend more heavily on chemical sources to sustain yields over time, and continuous, unbalanced chemical use tends to reduce nutrient-use efficiency, which means more fertilizer is needed to achieve the same result. Given that a large share of India's phosphatic and potassic fertilizer supply is imported and subject to global price volatility, this dependence also exposes cultivation costs to external shocks that organic nutrient sources, produced largely on or near the farm, do not carry.

RECENT GOVERNMENT INITIATIVES

These issues have been the focus of recent outreach programmes of the Indian Council of Agricultural Research (ICAR). Starting from the year 2023, in

consultation with the Department of Agriculture & Farmers Welfare, ICAR has been organizing nationwide month-long campaigns to sensitize farmers about the importance of soil health and balanced use of nutrient inputs, through its wide network of ICAR institutes, State Agricultural Universities, State Agriculture/Animal Husbandry Departments, and Krishi Vigyan Kendras. These campaigns emphasized soil test-based nutrient application, adherence to recommended fertilizer doses, and the integration of organic inputs such as farmyard manure, green manure, biofertilizers, and vermicompost alongside chemical fertilizers. The Vikasit Krishi Sankalp Abhiyan (VKSA) held in May-June 2025 and the Khet Bachao Abhiyan held through June 2026 are a few among these. As a further step towards optimizing fertilizer use, ICAR has also released a handbook on District-wise General Fertilizer Recommendations for Major Crops in India, offering district- and crop-specific nutrient guidance intended to help farmers move away from blanket fertilizer application and towards more precise, location-specific dosing.

CONCLUSION

In India, soil health decline has multiple, interacting causes such as imbalanced fertilizer use, reduced organic matter addition, cropping intensity, and limited soil testing among them; and no single input, including urea, can be treated as the sole explanation. What the evidence does support is that India's current nutrient mix is skewed further towards nitrogen than is agronomically ideal, that this skew is shaped in part by pricing and production structures that predate current soil health priorities, and that organic nutrient inputs capable of correcting part of this imbalance already exist in substantial quantities but remain underused. Feeding the soil rather than just the crop means combining soil-test-based, balanced chemical fertilization with a stronger role for organic inputs, a direction that recent national campaigns are already beginning to promote.

REFERENCES

Food and Agriculture Organization of the United Nations (FAO). 2005. Fertilizer Use by Crop in India.

Government of India. 2017. Agricultural Statistics at a Glance 2017. Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare.

ICRIER (Indian Council for Research on International Economic Relations). 2026. De-risking Fertiliser Supplies for India amid Rising Geopolitical Risks.

Ministry of Agriculture & Farmers Welfare, Government of India. 2025. Final Estimates of Production of Major Agricultural Crops for 2024-25. Department of Agriculture & Farmers Welfare.

Mujeri, M.K., Shahana, S., Chowdhury, T.T., and Haider, K.T. 2012. Improving the Effectiveness, Efficiency and Sustainability of Fertilizer Use in South Asia.

National Productivity Council. 2017. Soil Testing Infrastructure for Faster Delivery of Soil Health Card in India.

PIB (Press Information Bureau), Ministry of Chemicals & Fertilizers, Government of India. 2025. Empowering India's Farmers Through Strategic Fertilizer Policy.

Srivastava, S. 2011. Potential of different on-farm and off-farm organic resources in India. In: Singh, A.B., Reddy, K.S., Manna, M.C., Subba Rao, A. (eds.), Recycling Organic Wastes for Soil Health and Productivity. Agrotech Publishing Academy, Udaipur, pp. 218–233.

The World Bank. 2016. Fertilizer Consumption (% of Fertilizer Production), India. Food and Agriculture Organization electronic files.

***

Article Received on: 24 June 2026