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Assessing Macro Nutrient Trends in India: A Focus on Production, Consumption and Imports

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Abstract

As a cornerstone of agricultural productivity, fertilizers significantly contribute to India's food security and rural economy. The essential macronutrients—nitrogen (N), phosphorus (P), and potassium (K)—are critical for enhancing crop yields and maintaining soil health. This study examines the trends in production, consumption, and imports of these nutrients from 2010–11 to 2022–23, along with fertilizer policy developments up to 2024–25. Using secondary data and applying CGR, CAGR, and trend analysis, the findings reveal rising nitrogen and urea consumption surpassing production, fluctuating phosphorus and DAP usage, and a steady decline in MOP imports. These dynamics point to gradual progress in domestic self-sufficiency, shaped by evolving policy measures and changing agricultural practices. The study highlights the need for balanced nutrient use and sustainable fertilizer strategies to ensure long-term agricultural resilience.

Keywords: Fertilizer, Production, Consumption, Import, NPK

I. Introduction

Fertilizers are vital to India's agricultural productivity and food security, with key macronutrients—Nitrogen (N), Phosphorus (P), and Potassium (K)—playing a central role in enhancing crop yields and soil fertility. Over the decades, the shift from organic inputs to chemical fertilizers, accelerated by the Green Revolution, has transformed Indian agriculture.

Despite significant growth in production and government support through subsidies, India continues to face challenges such as fluctuating consumption patterns, reliance on imports, and environmental concerns. Policy measures like the nutrient-based subsidy scheme aim to address these issues by promoting balanced and efficient fertilizer use. This study examines the trends in production, consumption, and imports of major fertilizers in India from 2010–11 to 2022–23, offering insights into the sector's performance and the evolving policy landscape shaping sustainable nutrient management.

II. Objectives of the study:

- ✓ To examine the trends in production and consumption of macro nutrients in fertilizers in India.
- ✓ To analyse the import patterns of macro nutrients in fertilizers in India.

III. Methodology

In this study, the production, consumption and import data has been collected from the period 2010 – 11 to 2022 to 2023. The data has been collected from various secondary sources such as Fertilizer Association of India, Fertilizer India, Indiastat, Statista, etc.

Tools of Analysis

- CGR
- CAGR and
- Trend Analysis

IV. Review of Literature

Sharma et. al., (2011) analysed fertilizer consumption trends in India and identified key demand drivers. They found that non-price factors like irrigation and high-yielding crop varieties play a greater role than prices. The study stressed the importance of affordable fertilizer access to ensure agricultural self-sufficiency. Fertilizer policies have boosted both production and use, with near self-sufficiency achieved in nitrogen (N) and phosphorus (P). By 2020–21, demand was projected at 41.6 million metric tons, with rapid growth anticipated in eastern and southern regions. **Jaga et. al., (2012)** examined fertilizer consumption trends in India for 2020-21, noting wide regional disparities and lower usage compared to global averages. Non-price factors, like irrigation and high-yielding varieties, were found to have a greater influence on fertilizer demand than price factors. Affordable fertilizer prices had a stronger impact on demand than higher agricultural commodity prices. The study recommends prioritizing affordable fertilizer availability to ensure agricultural self-sufficiency. A stable policy environment, along with raw material access, capital resources, and price incentives, is crucial for meeting India's growing fertilizer needs.

V. Results and Discussions

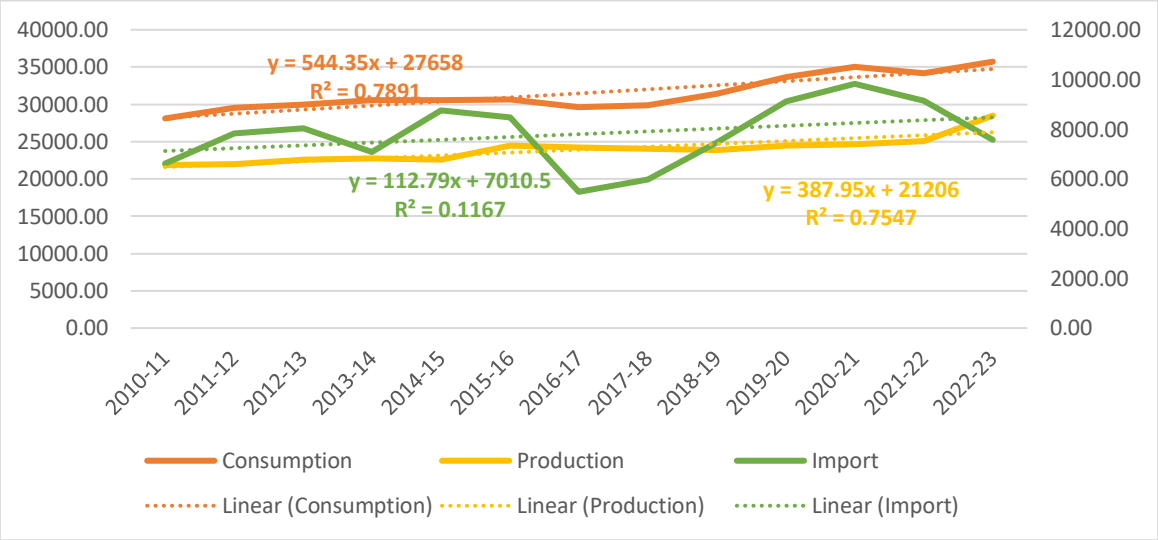
Table 1: Consumption, Production and Imports of Urea in India (In 000' metric tonnes)

Year	Consumption	Production	Import
2010-11	28,112.50	21,872.50	6,610.00
2011-12	29,565.30	21,992.30	7,834.00
2012-13	30,002.20	22,586.60	8,044.00
2013-14	30,600.50	22,718.70	7,088.00
2014-15	30,610.00	22,592.90	8,749.00
2015-16	30,634.80	24,461.30	8,474.00
2016-17	29,613.60	24,200.80	5,481.00
2017-18	29,894.40	24,026.00	5,975.00
2018-19	31,418.10	23,899.20	7,481.00
2019-20	33,695.40	24,455.20	9,123.00
2020-21	35,042.50	24,603.10	9,826.00
2021-22	34,180.10	25,075.70	9,136.00
2022-23	35,725.10	28,495.30	7,580.00

CGR	**1.71**	**1.60**	**1.01**
CAGR	**0.01**	**0.02**	**0.01**

Source: The Fertilizer Association of India

Figure 1: Consumption, Production & Imports of Urea in India



Source: The Fertilizer Association of India

Table 1 and Figure 1 show that urea consumption in India rose steadily from 28.1 to 35.7 million tonnes between 2010–11 and 2022–23, outpacing domestic production, which grew more modestly from 21.9 to 28.5 million tonnes. This gap sustained reliance on imports, which remained significant despite fluctuations. The graph confirms strong upward trends in consumption ($R^2 = 0.7891$) and imports ($R^2 = 0.7547$), while production shows a weak trend ($R^2 = 0.1167$). These patterns highlight India's ongoing dependence on imports to meet rising urea demand.

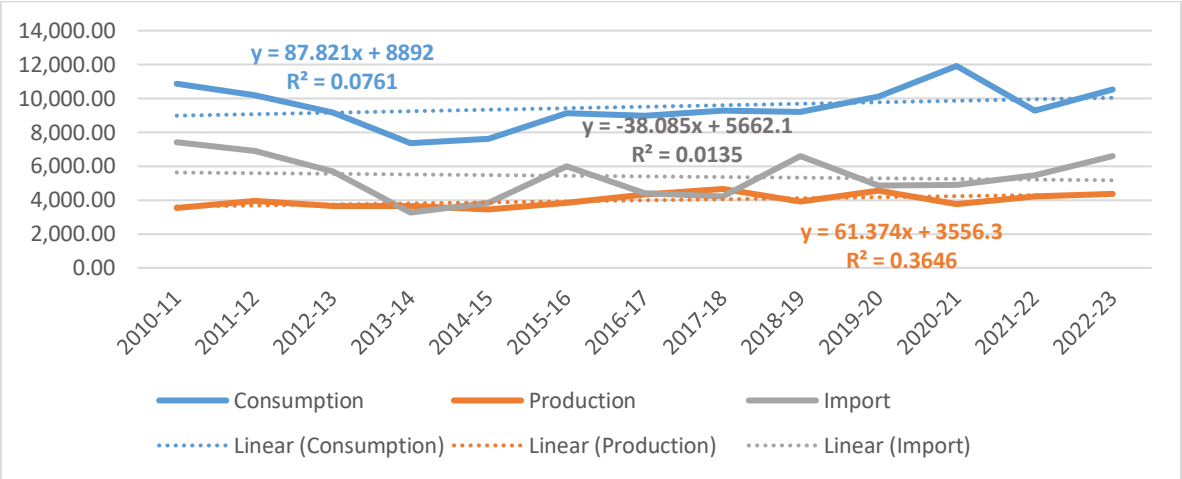
Table 2: Consumption, Production and Imports of Di-Ammonium Phosphate (DAP) in India (In 000' metric tonnes)

Year	Consumption	Production	Import
2010-11	10,869.90	3,545.60	7,411.00
2011-12	10,191.20	3,951.30	6,905.20
2012-13	9,154.10	3,646.80	5,702.30
2013-14	7,357.40	3,628.20	3,261.10
2014-15	7,625.60	3,445.40	3,853.00
2015-16	9,107.20	3,821.80	6,008.00
2016-17	8,963.50	4,333.40	4,385.00
2017-18	9,294.10	4,654.00	4,217.00
2018-19	9,211.10	3,898.60	6,602.00
2019-20	10,099.80	4,549.50	4,870.00
2020-21	11,911.50	3,773.80	4,882.00
2021-22	9,272.00	4,221.90	5,462.00
CGR	**0.96**	**1.55**	**-0.31**

CAGR	**-0.0024**	**0.01**	**-0.009**

Source: The Fertilizer Association of India

Figure 2: Consumption, Production and Imports of Di-Ammonium Phosphate (DAP) in India



Source: The Fertilizer Association of India

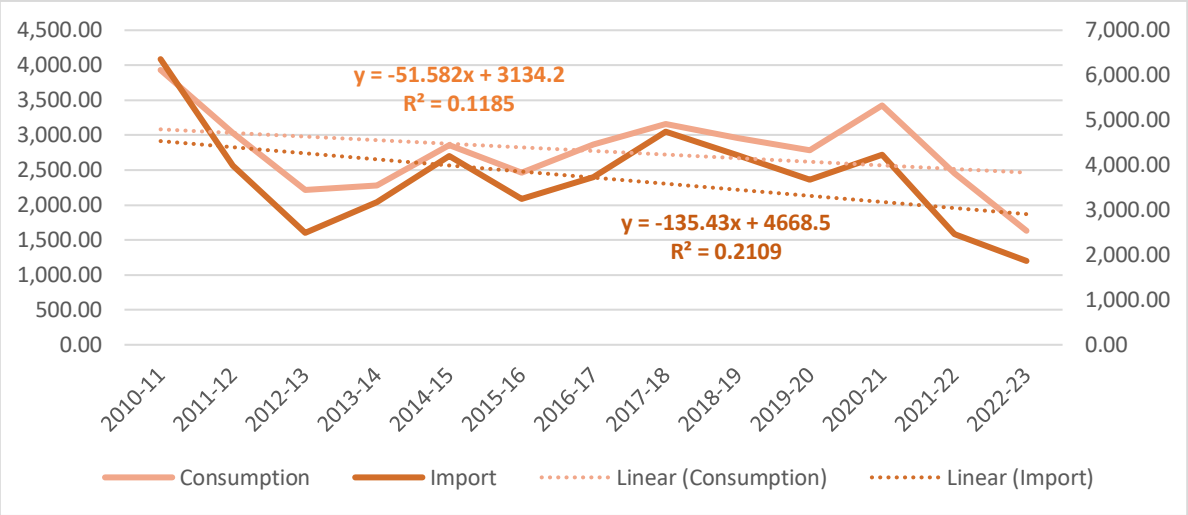
Table 2 and Figure 2 highlight the trends in DAP consumption, production, and imports in India from 2010–11 to 2022–23. Consumption fluctuated notably, peaking in 2020–21 but showing a slight overall decline (CAGR -0.0024). Production remained stable with minimal growth (CAGR 0.01), falling short of meeting demand. Imports varied widely and also declined marginally over time (CAGR -0.009). The graph shows weak trend lines for all three indicators, especially production (R^2 = 0.0135), reflecting inconsistent patterns and continued dependence on imports to fill the supply gap.

Table 3: Consumption and Imports of Muriate of Potash (MOP) in India
(In 000' metric tonnes)

Year	Consumption	Import
2010-11	3,931.60	6,357.00
2011-12	3,028.90	3,984.60
2012-13	2,211.00	2,496.10
2013-14	2,280.40	3,180.00
2014-15	2,853.40	4,197.00
2015-16	2,466.90	3,243.00
2016-17	2,863.20	3,736.00
2017-18	3,158.20	4,736.00
2018-19	2,956.60	4,214.00
2019-20	2,787.50	3,670.00
2020-21	3,424.90	4,227.00
2021-22	2,456.50	2,460.00
2022-23	1,631.50	1,866.00
CGR	**-1.98**	**-3.68**
CAGR	**-0.06**	**-0.08**

Source: The Fertilizer Association of India

Figure 3: Consumption and Imports of Muriate of Potash (MOP) in India



Source: The Fertilizer Association of India

Table 3 and Figure 3 show a declining trend in both consumption and imports of MOP in India from 2010–11 to 2022–23. After an initial drop until 2012–13, both metrics fluctuated mildly before falling sharply post-2020–21, with 2022–23 recording the lowest values. Consumption peaked in 2020–21, while imports were highest in 2017–18. Both showed negative growth over the period (CAGR: -0.06% for consumption, -0.08% for imports), with imports generally exceeding consumption. The narrowing gap suggests a shift towards reduced dependency, possibly due to changing demand, import substitution, or improved domestic availability.

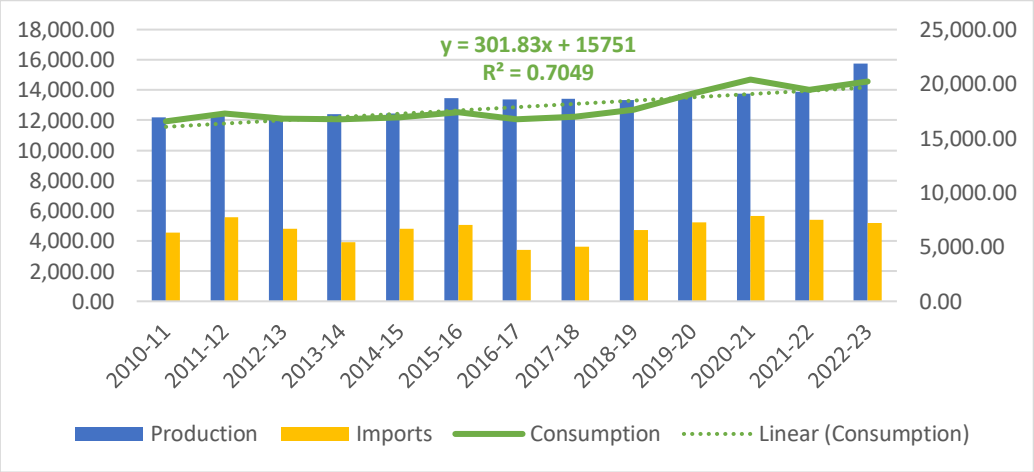
Table 4: Nitrogen Consumption, Production and Imports In India
(In 000' metric tonnes)

Year	Consumption	Production	Imports
2010-11	16,558.20	12,178.60	4,569.60
2011-12	17,300.30	12,288.30	5,577.60
2012-13	16,820.90	12,237.30	4,801.00
2013-14	16,750.10	12,408.60	3,920.30
2014-15	16,949.60	12,433.70	4,813.00
2015-16	17,372.30	13,475.90	5,081.30
2016-17	16,735.90	13,376.80	3,411.70
2017-18	16,959.30	13,422.60	3,618.40

2018-19	17,637.80	13,336.80	4,716.70
2019-20	19,101.30	13,722.20	5,209.00
2020-21	20,404.00	13,744.50	5,662.30
2021-22	19,438.30	13,870.20	5,384.20
2022-23	20,207.00	15,737.80	5,171.40
CGR	**1.66**	**1.68**	**0.93**
CAGR	**0.01**	**0.01**	**0.009**

Source: TheFertilizer Association of India

Figure 4: Nitrogen Consumption, Production and Imports in India



Source: TheFertilizer Association of India

Table 4 and Figure 4 depict trends in production, imports, and consumption from 2010–11 to 2022–23. Consumption consistently outpaced production and imports, reflecting strong demand. Production gradually increased, peaking at 15,737.80 units in 2022–23, while imports remained stable with slight fluctuations. The linear trend for consumption ($R^2 = 0.7049$) indicates steady growth. Both consumption and production grew at a similar rate (CAGR 0.01), while imports grew slightly slower (CAGR 0.009). These trends suggest increased domestic production and efforts to reduce import dependence, driven by rising consumption.

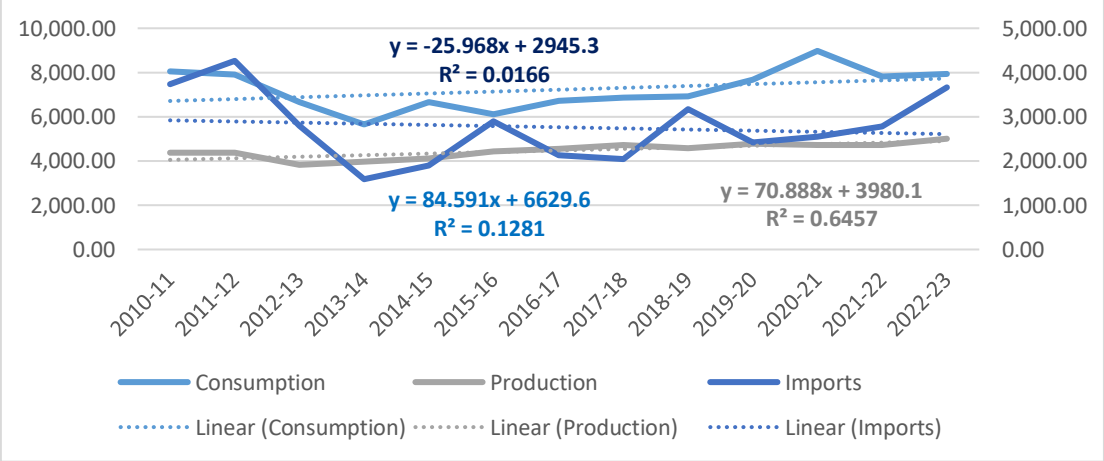
Table 5: Phosphorous Consumption, Production and Imports in India
(In 000'metric tonnes)

Year	Consumption	Production	Imports
2010-11	8,049.70	4,371.20	3,738.70
2011-12	7,914.30	4,363.70	4,263.60

2012-13	6,653.40	3,826.00	2,792.70
2013-14	5,653.30	3,972.00	1,588.20
2014-15	6,653.40	4,118.90	1,902.90
2015-16	6,098.40	4,425.80	2,899.50
2016-17	6,705.50	4,552.70	2,129.00
2017-18	6,854.40	4,724.40	2,044.60
2018-19	6,910.20	4,590.50	3,167.20
2019-20	7,662.00	4,790.70	2,413.20
2020-21	8,977.90	4,737.20	2,543.50
2021-22	7,828.50	4,711.70	2,781.10
2022-23	7,921.50	5,007.70	3,661.10
CGR	**1.18**	**1.60**	**-0.39**
CAGR	**-0.001**	**0.01**	**-0.001**

Source: The Fertilizer Association of India

Figure 5: Phosphorous Consumption, Production and Imports in India from 2010-11 to 2022-23



Source: The Fertilizer Association of India

Table 5 and Figure 5 show the dynamics of phosphorous consumption, production and imports. Production follows a steady upward trend with a CAGR of 0.01 reflecting gradual growth in domestic capacity. Consumption has fluctuated with a negligible negative growth rate and a weak trend indicating inconsistent demand. Imports showed volatility and a slight decline with a low correlation in the trend suggesting minimal predictability. Overall, the data highlights growing self-sufficiency, driven by increased production and reduced reliance on imports despite erratic consumption.

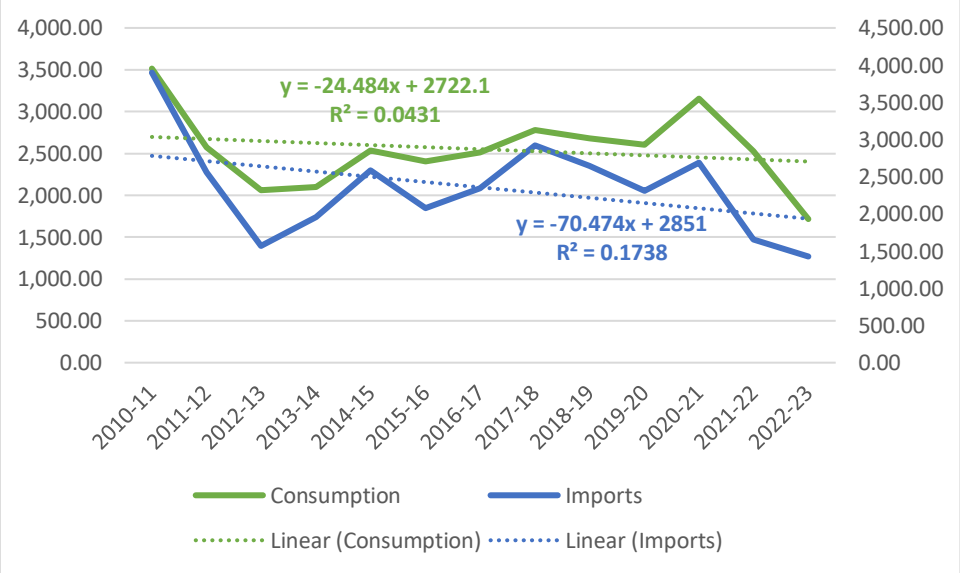
Table 6: MOP Consumption and Imports in India (In 000' metric tonnes)

Year	Consumption	Imports
2010-11	3,514.30	3,899.50
2011-12	2,575.50	2,557.80

2012-13	2,061.80	1,573.70
2013-14	2,098.90	1,954.40
2014-15	2,532.90	2,588.00
2015-16	2,401.50	2,075.90
2016-17	2,508.50	2,341.10
2017-18	2,779.70	2,925.20
2018-19	2,680.30	2,648.40
2019-20	2,607.00	2,309.40
2020-21	3,153.70	2,690.70
2021-22	2,529.50	1,658.70
2022-23	1,715.80	1,427.20
CGR	**-0.97**	**-2.79**
CAGR	**-0.05**	**-0.07**

Source: The Fertilizer Association of India

Figure 6: MOP Consumption and Imports in India



Source: The Fertilizer Association of India

Table 6 and Figure 6 show the consumption and import trends of potassium from 2010–11 to 2022–23. Both consumption and imports declined consistently with negative CAGRs of -0.05 and -0.07 respectively. Imports fell more sharply supported by a stronger trend line (R^2 = 0.455) compared to consumption (R^2 = 0.366). While consumption fluctuated slightly, imports steadily decreased, indicating increased domestic substitution or reduced demand. The overall trend suggests a contraction in market demand or shifts affecting import reliance and consumption.

VI. Conclusion

The comprehensive analysis of fertilizer consumption, production, and import data from 2010–11 to 2022–23 reveals a complex interplay between domestic demand, supply-side capacity and external dependency. While nitrogen consumption continues to rise, domestic production lags due to

unavailability of raw materials within the country and high cost of importing the raw materials which leads to sustaining import dependence. Phosphorus and potassium fertilizers exhibit volatile or declining consumption with moderate domestic production gains and tapering imports. These patterns indicate partial self-sufficiency and evolving input efficiency. Continued policy focus on production capacity, balanced nutrient application and reduced import reliance is essential for long-term agricultural sustainability.

VII. References

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