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Review Article

An Analysis of Fertiliser Subsidies in India

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Abstract

This article examines total fertiliser use in India as well as the distribution of fertiliser subsidies granted by the Indian government to its farmers. The paper primarily studies the consumption of fertilisers (NPK) from 1950-51 to 2020-21. However, the information related to the distribution of fertiliser subsidies covers the period from 1980–1981 to 2021–2022. The author further went on to analyze the fertilizer subsidy distribution concerning the agricultural GDP and the overall GDP figures of the nation to get an idea of the effectiveness of investment on the fertilizer subsidies in India.

Keywords: fertilizer, (NPK), agricultural GDP.

1. INTRODUCTION

India is one of the major consumers of fertilizers all over the world after China. India's agriculture has relied largely on chemical fertilisers and pesticides since the Green Revolution in the 1960s. As a result of their extensive use over time, their marginal utility has decreased, which has caused farmers' net earnings to drop and their debt to increase. Their overuse also endangers soil health, groundwater purity, human health, and local biodiversity. Alternative agroecological farming methods, which promise a wide range of ecological and social advantages, are becoming more popular due to the inherently unsustainable nature of chemical-based agriculture and its role in the environmental and agricultural crises.

The data regarding the total consumption of fertilizers has been illustrated in figure 1. The line graph depicts the increasing trend of all-India consumption of fertilizers, including nitrogen (N), Phosphorus (P), and Potash (K), from 1950-51 to 2020-21. The total fertilizer consumption, which was 65.6 thousand tonnes in 1950-51, jumped to 26486 thousand tonnes in 2009-10. In the country's effort to become self-sufficient in food grains, the use of chemical fertilizers surged from roughly 785 thousand tonnes during the pre-Green Revolution period in 1965–1966 to about 28122 thousand tonnes in the year 2010–2011. The average amount of fertilizers used per hectare across India grew dramatically over time, although this increase was coupled with significant inter-state heterogeneity. During the recent year 2020-21, the all-India average consumption of total fertilizers stood at 137.15 Kg per hectare of the gross cropped area.

Fertilizer consumption in the nation reached its pinnacle at 28122.2 thousand tonnes during 2010-11 and then showed a decreasing trend after 2010-11 up till 2019-20 when the total consumption was 29369.3 thousand tonnes. During the year 2020-21, it further increased to 32536 thousand tonnes. The upward-moving line of total fertilizers shows that the consumption of total fertilizers has been fluctuating but continuously increasing in India over the years. Over the last decade, fertilizer utilization in the nation has increased by almost 16%. This also indicates a degrading soil quality of the land continuously.

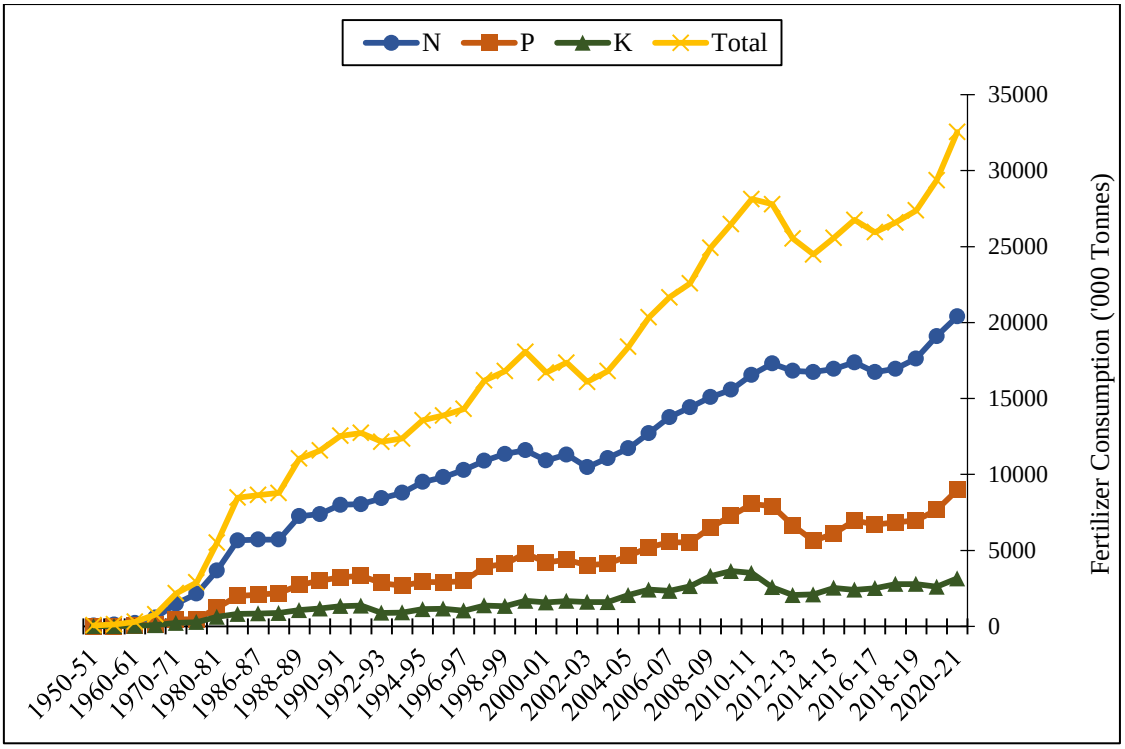

Figure 1: All-India Consumption of Fertilisers (NPK)
Source: Agriculture Statistics at a glance 2021, GOI, Ministry of Agriculture & Farmers Welfare

NPK, sometimes known as the "Big 3" primary nutrients, are what make up most chemical fertilizers. Each of these essential elements is crucial for plant nutrition. The total utilization of nitrogenous (N), phosphatic (P), and potassic (K) fertilizers in India are also depicted in graph 1. The recommended ratio of NPK in the nation primarily applies to food crops, primarily rice (the principal Kharif crop) and wheat (the major Rabi crop). The ideal NPK ratio varies based on the demands of the crop and the soil's nutritional composition for cash crops, plantations, and horticultural crops. The current graphical presentation shows a disproportionate use of the 3 primary nutrients in India. Compared to the optimal ratio of 4:2:1, the present NPK ratio is 6.7:2.4:1, which is heavily skewed towards nitrogenous fertilizers. This is true in the case of several states where the current ratio of fertilizer consumption is disproportionate and heavily inclined towards nitrogen.

There is an ever-increasing gap between the use of the other two (phosphatic & potassic) fertilizers and nitrogenous fertilizers in India. The consumption of P increased in multiple folds from 6.9 thousand tonnes in the year 1950-51 to 3321 thousand tonnes during 1991-92. It started to fall afterwards but further increased to 3914 thousand tonnes in 1997-98. Furthermore, the consumption surged to around 8050 thousand tonnes during the year 2010-11 and to the latest 8978 thousand tonnes in the year 2020-21.

Likewise, the consumption trend of K also shows a fluctuating but upward trend over the years. It continued to increase from 10.3 thousand tonnes during the year 1955-56 to 1360 thousand tonnes during the post-liberalization period of 1991-92. It later reduced to 908 thousand tonnes in the year 1993-94, but then continued to soar and reached its peak to 3632 thousand tonnes in the year 2009-10. Afterwards, it again shows a declining trend up till 2013-14 and then continues to increase up to 3154 thousand tonnes of its consumption in the year 2020-21.

The upward moving trend of the N depicts the dramatic hike in the consumption of nitrogenous fertilizers from 58.7 thousand tonnes during 1950-51 to 9823 thousand tonnes during 1995-96, to a further 15580 thousand tonnes in the year 2009-10. The consumption of N advanced from 16558 thousand tonnes in the year 2010-11 to 20404 thousand tonnes in the year 2020-21, which is around a 23 per cent increase in the last decade.

2. Reasons for the Lopsided Consumption of Fertilizers

The official recommended fertiliser consumption ratio of 4:2:1 state that nitrogen should account for 57.2% of total NPK usage, while P and K should make up 28% and 14.2%, respectively. Early in the 1970s, N accounted for around two-thirds of all fertiliser use, with P & K contributing 21% and 10%, respectively. In 1950–51, the share of N was as high as 89.5%. The share of N fluctuated but remained at about 65% for most of the years, which is 8% greater than the standard 4:2:1 ratio. Four levels can be employed to

broadly define the episodes of fertilizers composition change:

- The global oil price shock of 1973–1974 caused fertiliser prices to increase by two to four times in nominal dollars over the course of a single year. This increased N's percentage share from 68.64% in 1974–1975 to 74.3% in 1975–1976. Compared to P & K fertilizers, the price increase for N fertilizers (urea) was significantly larger. However, the effect was shown more with potassic and phosphatic fertilizers than with nitrogenous fertilizers.
- Following that, the share of N continued to fall, reaching its lowest point in the period in 1991–1992, at 63.2%. The government recognised the necessity to rationalise fertiliser subsidies to reduce the NPK imbalance and raise the proportion of P and K. As a result, phosphatic and potassic fertilisers were decontrolled as of August 25, 1992, excluding urea (N). However, this policy adjustment resulted in an increase in P and K prices that was both absolute and N-based. As a result, the share of N, which had been declining since 1975, abruptly increased after 1991–1992, significantly increasing the share of N while also decreasing the share of P and K. This disparity was caused by the government's skewed policy. Furthermore, according to the Joint Parliamentary Committee (JPC) report of August 20, 1992, the surge in subsidies was caused by an escalation in the price of imported fertilizer, as well as the devaluation of the Indian currency in July 1991 and the stagnating farmgate prices from 1980 to 1991.
- Following 1996–1997, the share of N began to decline again, and by 2009–10 it had dropped to 58.8%. At the national level, the ratio of the three NPK fertilizers was quite close to the 4:2:1 standard during this year, albeit there were anomalies amongst the states. On April 1st, 2010, the government implemented the NBS policy intending to guarantee balanced fertiliser consumption. This was made effective on P and K, but not on urea or nitrogenous fertilisers. Similar to previous patterns, this one also distorted prices in favour of N, which caused the national consumption of N to expand. Only three years after the programme was implemented, the share of N climbed by 9.5%, from 58.8% to 68.4%. As a result, this imbalance in fertiliser use was also proven to be policy-induced.

Indian soils lack potassium nutrients, possess low to moderate levels of phosphatic nutrients, and are deficient in nitrogen (FAO, 2005). These three fertilizers are considered to be the primary macronutrients for soil health and crop productivity. However, the overuse of chemical fertilizers has resulted in several concerns. “Growing concerns have been raised regarding the imbalance in the use of various fertilizers that is causing the soil to degrade.” The imbalance in fertilizers ratio is adverse not only if one or two nutrients are used more than the prescribed form but also in situations where all the nutrients are used below their normative levels (Chand & Pavithra, 2015). The imbalanced NPK application results in issues such as soil sickness, widespread micronutrient and secondary nutrient deficiencies, soil alkalinity, and soil salinity. It can also result in stagnant or declining productivity. Eventually, it leads to decreased fertiliser effectiveness, low yields, and low farmer profitability.

Furthermore, excessive fertiliser use has resulted in worrying levels of nitrogen pollution of surface and groundwater in several states. Nitrate (NO3) concentrations in shallow bore wells and dug wells in regions of Punjab, Haryana, and western Uttar Pradesh are many times higher than the WHO-recommended limits.

Prasad (2009) mentions that "part of the fertiliser N is lost as NH3, N2, and NOx fumes, which severely damage the ecosystem. While other NOx is responsible for the stratospheric ozone layer being destroyed, NH3, after being oxidised to NO3, also adds to soil acidity. The groundwater resources are contaminated when some of the fertiliser N that has been applied leaches down as NO3. Methemoglobinemia, also known as the "blue baby syndrome," is one of the dangerous consequences of NO3 poisoning groundwater. According to a study conducted in Rajasthan, the population of all ages, particularly those less than one year of age, suffers from severe methemoglobinemia (Gupta *et al.*, 2000).

3. Correlation between Food Grains Production & Fertilizer Consumption

Although it is extremely difficult to disentangle the impacts of fertilizers, HYV seeds, and irrigation on the country's food grain production, it cannot be denied that chemical fertilizers play a substantial part in the process. The data has been analyzed on the country's per-hectare fertiliser consumption (measured in kg per hectare) and food grain output (measured in million tonnes) from the years 1955–1956 to 2020–21. Figure 2 shows the rising trend of fertilizer use per hectare in India and a rising line representing food grain production. The quantum of fertilizers used per hectare (based on GCA) increased dramatically from 0.89 kg/ha in the years 1955–1956 to 137.15 kg/ha in the years 2020–21. Food grain production increased more than five times across the country over the same time period, from 66.85 MMT to 308.65 MMT, demonstrating a strong connection (0.97) between the two variables.

The 5 years CAGR (Compound annual growth rate) of food grains production stood at 3.6% during the

1950s. Later, the decadal CAGR was calculated by the author to bring out the fall in the growth of food grains production during the latest decennium to that of the earlier ones. It was 2.3% and 3.18% during the 1960s and 70s, respectively.

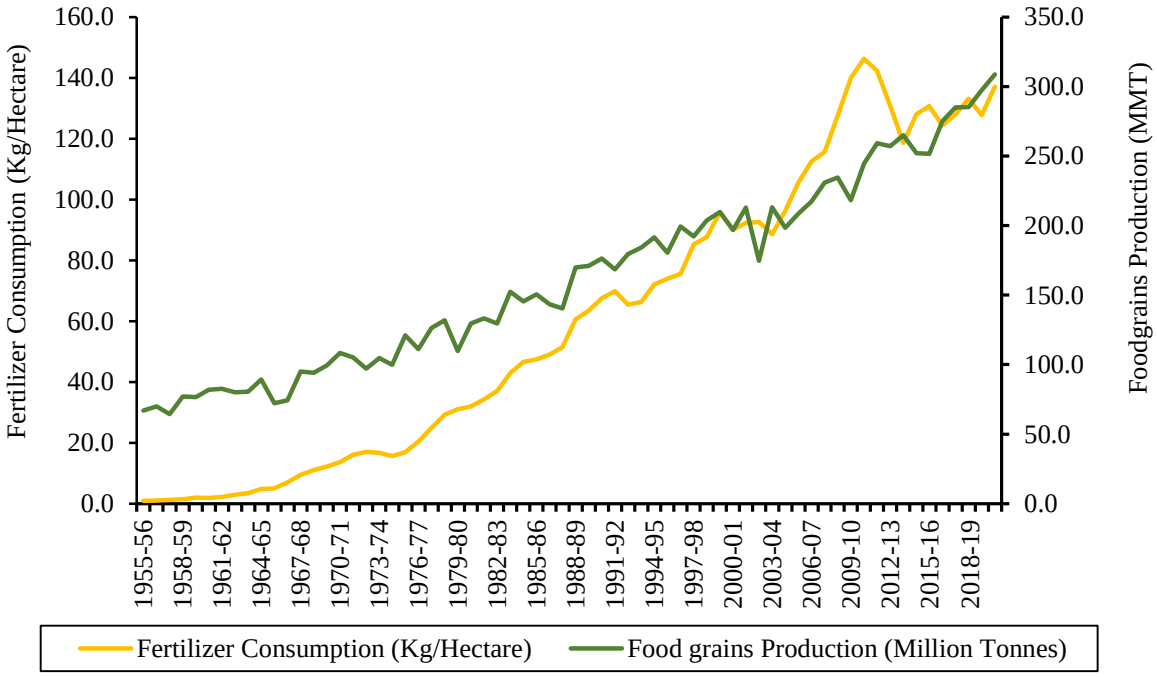

Figure 2: Fertilizer Consumption per hectare vs. Food grains Production in India
Source: Data compiled & calculated by the researcher from Agriculture statistics at a glance (various years)

With increasing consumption of fertilizers, the CAGR for food grains production reached a height of 4.9% during the 1980s but later dipped to only 1.9% and a mere 1.2% in the 1990s and 2000s. One of the major reasons behind this could be due to the over-utilization of fertilizers and their disproportionate ratio, declining soil quality, pilferage in fertilizer subsidies, bad quality seeds and irregular irrigation, to name a few.

However, during the past couple of years, along with the falling usage of fertilizers per hectare of GCA, the CAGR of grain production shows an improvement of up to 4.2 per cent in the country. According to the fourth advance estimate of production of principal crops for the year 2020-21, major crops in India have produced a record 308.65 million tonnes of food grains, which is 11.2 million tonnes more than the food grains production achieved in 2019-20.

4. Distribution of Fertilizer Subsidies in India

India ranked third in terms of phosphatic fertilizer production as of 2014 and second in terms of nitrogenous fertilizers after China. India is a significant customer as well; it is the second-and third-largest consumer of phosphatic and nitrogenous fertilizers, respectively, and the fourth-largest consumer of potassic fertilizers. Being the second-highest consumer, imports of these nutrients help to fill the gap in fertilizers supply and the growing demand for them. India is the world's second-largest importer of N & P and the world's fourth- largest importer of potassium-rich nutrients, trailing the United States, Brazil, and China. India imported over 9.7 million metric tonnes of urea in 2019, making it the world's largest urea importer by far.

Farmers have access to subsidised fertilizers, including Urea and 24 kinds of P&K fertilizers, through fertilizer makers and importers. Farmers are supplied with urea at a statutorily mandated Maximum Retail Price (MRP). Regarding Phosphatic and Potassic (P&K) fertilizers, the government has implemented the Nutrient Based Subsidy (NBS) Scheme as of 1 April 2010. Under this programme, each grade of subsidised Phosphatic and Potassic (P&K) fertilizers receive a subsidy based on its nutrient content.

Fertilizer subsidy accounts for large fiscal subsidies, the second-highest after food subsidy. The fertilizer subsidies in India are provided by the Central government, and the quantum of subsidies distributed over the decades to make it available at affordable rates to the farmers is discussed in table 1. The period of data dealing with the fertilizer subsidy distribution ranges from the actual and revised budget expenditures from 1980-81 to the latest budget estimates for the year 2021-22.

Table 1: Essential components of fertilizer subsidy in India since 1980-81

Year	Subsidy on Urea		Sale of Decontrolled fertilizers with the concession to farmers	Subsidy provided through bond	Total
	Indigenous	Imported			
In Billion Rupees (₹100 Crore)					
1980-81	1.70	3.35	-		5.05
1990-91	37.30	6.59	-		43.89
1996-97	47.43	11.63	16.72		75.78
1997-98	66.00	7.22	25.96		99.18
1998-99	74.73	1.24	37.90		113.87
1999-00	86.70	0.74	45.00		132.44
2000-01	94.80	0.01	43.19		138.00
2001-02	73.70	0.59	45.15		119.44
2002-03	74.99	0.10	35.00		110.09
2003-04	81.40	0.01	36.56		117.97
2004-05	101.43	4.73	50.46		156.62
2005-06	104.10	10.94	57.49		172.53
2006-07	114.00	27.04	83.48		224.52
2007-08	129.50	66.06	129.34	75.0	399.90
2008-09	179.69	100.79	485.55	200.0	966.03
2009-10	175.80	46.03	390.81		612.64
2010-11	150.81	64.54	407.67		623.01
2011-12	202.08	137.16	360.89		700.13
2012-13	200.00	151.33	304.80		656.13
2013-14	265.00	115.38	293.01		673.39
2014-15	382.00	122.23	206.53		710.76
2015-16	504.78		219.38		724.15
2016-17	474.70		188.43		663.13
2017-18	442.23		222.44		664.68
2018-19	465.14		240.90		706.05
2019-20	547.55		263.69		811.24
2020-21*	949.57		389.90		1339.47
2021-22**	587.68		207.62		795.30

Note: *Revised Estimates, ** Budget Estimates

Source: Union Expenditure Budget, Volume 1, various years, GOI

Table 1 details the rising fertilizer subsidies in India. Over the past 41 years, the size of fertilizer subsidies has increased by about 265 times at current prices, from a paltry sum of ₹5.05 billion in the year 1980–1981 to a record-breaking staggering figure of ₹1339.47 billion in 2020–21, which is around ₹1.3 trillion. This alone demonstrated a 65% increase in fertiliser subsidies in a single year, designed to mitigate shortages in the face of sharp rises in global chemical prices. According to the estimated fertilizer subsidy budget for 2021- 22, fertilizer subsidies have increased approximately 158-fold since 1980-81, reaching ₹795.30 billion.

Considering the hike in fertilizer subsidy from the turn of the century, it expanded around 10 times, from ₹138 billion in 2000-01 to ₹1340 billion during 2020-21. A deceitful trait of the fertilizer subsidy is that the budget allocations do not always indicate the true picture of the fertilizer subsidy distribution, specifically in the year 2007-08 and 2008-09. During this period, a part of the fertilizer subsidy was dispersed through bonds. In the year 2007-08, fertilizer subsidies stood at ₹399.90 billion, including bonds worth ₹75 billion. The following year, fertilizer subsidies reached a height of ₹966 billion, along with the issuance of bonds valued at ₹200 billion. This happened due to the hike in fertilizer prices in the global market.

Talking about the various entrails of fertilizers, subsidy on urea has always grabbed the biggest slice of the cake except for the tenure of 4 years, where the share of subsidies for the sale of decontrolled fertilizers with the concession to farmers was ruling at around 50.3 per cent, 63.8, 65.4% and 51.6% of the total fertilizer subsidy during the year 2008-09, 2009-10, 2010-11, and 2011-12 chronologically. Howbeit, after the introduction of the NBS scheme in 2010, its share started declining to reach a level of 46.5 per cent and 43.5% during 2012-13 and 2013-14, subsequently. The government's subsidy burden climbed exponentially by roughly 500% between 2005-06 and 2009-10 under the concession regime, with 94% of the increase related to the rise in global prices of fertilizers and fertilizer inputs and 6% owing to the increased consumption.

Since India is a significant importer of all macronutrients and lacks a recognized potentially extractable source of potassic nutrients, the country is entirely relying on imports in the potassic sector and, to a greater extent, around 90% in the phosphatic sector in the form of finished goods and raw materials. With government subsidies being fixed under the concession regime, any global price spike affects domestic P and K fertilizers prices as well. Urea and (DAP) are currently trading at $1,200 and $1,300 per metric ton, respectively, compared to $400 and $500 the year before. Likewise, the landed price of (MOP) shipped into India has soared from $247 to $592 per metric ton, as have the prices of other inputs such as phosphate (from $795 to $1,530), Sulphur ($225 to $450), and ammonia ($475 to $1,150). Russian and Ukrainian nitrogen and potash fertilizers have been completely cut off from the global market due to Russia's war in Ukraine and the sanctions that accompanied it. This will likely result in a supply-demand imbalance, with tightening global N and K supplies pushing up prices and rising inflationary pressures. This can already be seen in today's markets.

The researcher expects a hike in revised estimates of fertilizer subsidy during 2021-22 due to the ongoing Russian-Ukrainian war and the ultimate increase in global fertilizer prices. A report by an Indian- Ratings (Ind-Ra) also predicts that higher food, fertiliser, and oil prices will put pressure on the Indian government's allocation of fertiliser and LPG subsidies. It goes on to say that if the government does not raise the fertiliser subsidy, the deficit will have to be funded by the balance sheets of fertiliser companies, potentially reducing their credit metrics.

5. Fertilizer Subsidy as a Percentage of Macro Variables

Any relevant temporal examination of fertilizer subsidies must go beyond absolute numbers and be evaluated in relation to other macroeconomic variables, such as the overall GDP, agricultural GDP, or total national tax revenues. The author has also analyzed the percentage change in fertilizer subsidy over the decades concerning the overall GDP of the economy and also the agricultural GDP. The GDP data is considered at the current prices. Such data is illustrated in figure 3 for a period of around 42 years, stretching from the financial year 1980-81 to the year 2021-22. Over the entire period, the percentage of fertilizer subsidies analogous to GDP continued to rise and marked up from 0.38% in 1980-81 to 0.68 % in the year 2020-21. It touched its lowest level (0.37 % of the GDP) in 2018-19 and the topmost (1.8 per cent) during the year 2008-09.

Concerning the agricultural GDP, the percentage of fertilizer subsidies increased from 1.08 per cent in 1980-81 to 3.71 per cent in 2020-21. The lowest share of fertilizer subsidy as against the agricultural GDP stood at 2.22% during 2003-04 and reached the highest at 10.24% in the year 2008-09 (Figure 3).

Fertilizer subsidies ranged from 6.33 per cent in 2003-04 to 21.79% in 2008-09 as a percentage of Central government tax collection, which serves as a proxy for the true ability to pay for these subsidies. When measuring the average fertilizer subsidy during the latest three years period of the data ranging from 2018-19 to 2020-21, it showed up to be 0.5 per cent of the overall GDP of the nation and 2.8 per cent of the agricultural GDP.

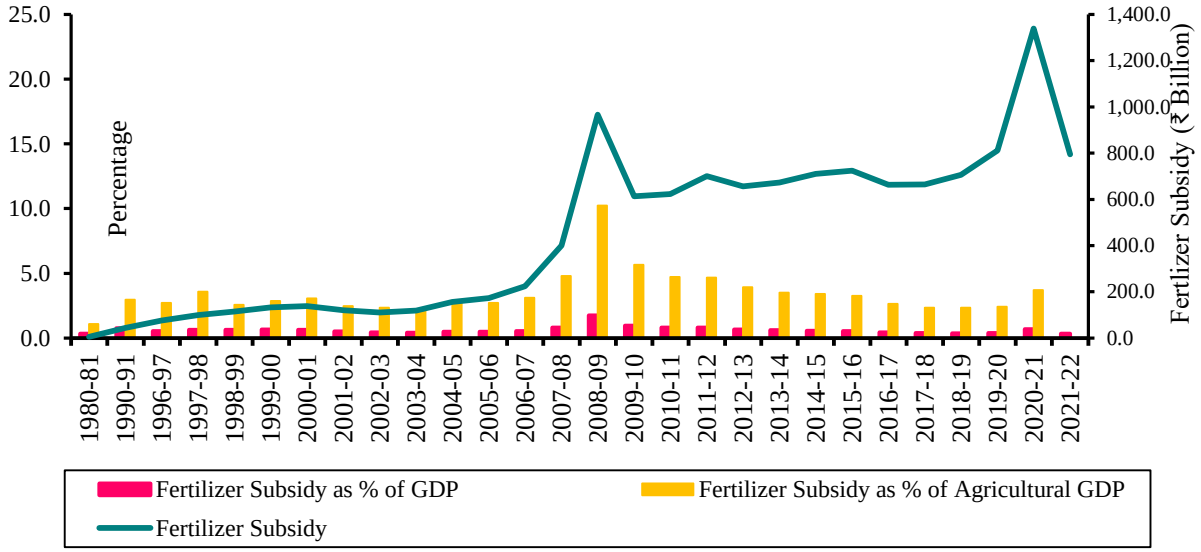

Figure 3: Fertiliser subsidy as Percentage of GDP & Agricultural GDP
Source: 1. Expenditure Budget (Volume 1), 2. National Account Statistics (various years)

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6. CONCLUSION

This paper discusses the total consumption of fertilizers in India and the reasons behind the irregular ratio of NPK use in the nation, which demonstrates that Indian soils lack potassium nutrients, possess low to moderate levels of phosphatic nutrients, and are deficient in nitrogen. The findings of the paper state that the imbalanced NPK application results in issues such as soil sickness, widespread micronutrient and secondary nutrient deficiencies, soil alkalinity, and soil salinity. It can also result in stagnant or declining productivity. Eventually, it leads to decreased fertiliser effectiveness, low yields, and low farmer profitability. Fertilizer subsidies also account for large fiscal subsidies, the second-highest after food subsidies.

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