Economic Liberalisation and Fertilizer Policies in India

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1 Introduction

The use of chemical fertilizers has been key to agricultural growth in India since the 1970s. The widespread adoption of chemical fertilizers along with other modern inputs became possible because of specific policies that were introduced in the wake of the Green Revolution. Fertilizer policies following the Green Revolution were designed to meet the dual objectives of expanding domestic capacity for fertilizer production and making fertilizers available to farmers at affordable prices. During this period, state policy ensured an increase in the supply of raw materials required for manufacturing fertilizers. The public sector and cooperatives led the production of fertilizers, and both fertilizer prices and the distribution of fertilizers across states were regulated by the government. The system of controls and subsidies was designed to provide assured returns to fertilizer manufacturers as well as keep fertilizer prices low for farmers.

Significant changes were brought about in these policies after the 1990s. These have had profound implications for Indian agriculture. Decontrolling the prices of all non-urea fertilizers was the most significant change brought about during the post-liberalisation period. This resulted in a surge in the prices of fertilizers and a bias towards urea consumption. This paper analyses how the decontrolling of fertilizer prices and distribution was brought about in different phases by the government. The paper also shows the effect of decontrolling on the prices, consumption, production and imports of these fertilizers.

Continuing with its efforts to decontrol fertilizer prices, the Indian government introduced a shift in the subsidy regime with a scheme called the Nutrient Based Subsidy scheme in 2010. This scheme delinked the subsidy regime from the prices of chemical fertilizers and consequently made possible the complete decontrolling of non-urea fertilizer prices. This policy change has resulted in a massive rise in the prices of non-urea fertilizers, which has severe implications for the Indian peasantry. This paper attempts to critically review these policy changes. This paper also discusses the major urea-related policies that the Indian government has implemented since 1991. The Indian state has given a differential treatment to the use of urea fertilizers, which is important to examine in order to understand the political economy of fertilizer sector reforms.

The paper is organised as follows. Section 2 reviews the major debates on fertilizer subsidies in India. Section 3 discusses the different stages in which the decontrolling of the prices and distribution of fertilizers took place after 1991. These include the Concession Scheme (Section 3.1), the Nutrient Based Subsidy Scheme (Section 3.2) and policies related to urea (Section 3.3). Section 4 discusses the recent implementation of the Direct Benefit Transfer Scheme. Section 5 briefly discusses three recent policy changes: the requirement that urea be coated with neem oil, the reduction in the size of urea bags and the imposition of GST. Section 6 provides a brief comparison of fertilizer use in agriculture in India and other regions and countries of the world. This comparative analysis provides insights into some of the problems that the recent policy changes have created in the pattern of fertilizer use in India. Section 7 summarises the main findings of the paper.

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Box 1. Plant Nutrients: An Introduction

There are three main nutrients – called macro-nutrients – that are required for plant growth.

Nitrogen: A deficiency of nitrogen can lead to stunted growth, appearance of light-green to pale-yellow colour on old leaves, reduced flowering and lower protein content. While, an excess of nitrogen in the soil can lead to loss in the quality. It can take the form of malting barley, where the percentage of nitrogen in the grain is increased and in sugar beet where there is a depression in sugar content. There can be lodging of cereal crops and susceptibility to fungal diseases. Deep green luxuriant growth is a sign of good nitrogen supply.

Phosphate: Phosphate helps in the early growth of seedlings, hasten maturity and improve root and seed development. It also stimulates flowering. In case of acute deficiency, cereals may almost fail, plant growth may be stunted and usually the surviving plants are purplish in colour. There can be lack of or poor seed and fruit development.

Potash: Potash is required for plants which needs storage of starch and sugar, thus plants that lay up large quantities of carbohydrates such as potato and sugar beets. Potash builds the plant's ability to resist cold and cloudy weather. It also improves the size of grains or seeds and improves the quality of fruits and vegetables. Potato reveals serious potash deficiency when growth is restricted, leaves have dull coppery appearance with brown spots. Early leaf fall, death of the tops follow and the tuber yields are greatly reduced. The plants tend to lodge easily and seeds or fruits can be shrivelled. It is particularly important for these crops to have an appropriate balance of N and K. When heavy doses of N are provided, we should also provide corresponding amounts of potash.

In addition, plants also need a number of micro-nutrients such as zinc, boron, manganese, iron, copper and chlorine.

Source: FAO (1984) and Mengel *et al.* (1996)

2 Major Debates on Fertilizer Subsidy

Fertilizer subsidies were introduced in India during the Green Revolution period with the dual objective of providing a fillip to domestic production of fertilizers and to keep fertilizers affordable for farmers as their use was considered indispensable for achieving agricultural growth and food self-sufficiency. With the adoption of the Structural Adjustment Programme in 1991, the debate on fertilizer subsidies shifted to the fiscal burden of these subsidies. India's joining the WTO in 1995 and the enactment of the Fiscal Responsibility and Budget Management Act in 2003 added to the pressure for cutting agricultural subsidies.

Critics of India's fertilizer policies have faulted these on various grounds including the rising fiscal burden of subsidies, the lopsided pattern of nutrient use, the overuse of fertilizers leading to the excess nitrification of soil, the low productivity of fertilizers and low fertilizer use efficiency. A number of official policy documents as well as scholars have argued that fertilizer subsidies should be reduced or terminated (see, for example, Ashra and Chakravarty, 2007; Bathla, Joshi and Kumar, 2020; Dev, 2011; Gulati, 1990; Gulati and Narayan, 2000; Planning Commission, 2015; Pratap Rao Bhosale Committee (JPC), 1992; Shanta Kumar Committee, 2015; Vaidyanathan, 2000).

Gulati and Narayan (2000), Gulati and Sharma (1995) and Vaidyanathan (2000) argued that subsidies have resulted in inefficiencies in production as well as in the use of fertilizers and should be withdrawn in a phased manner. Sagar (1991) argued that a part of the reduction in fertilizer subsidies could be absorbed by improvements in the efficiency of fertilizer production and use, and a part via increases in food prices combined with targeted food subsidies.

The Pratap Rao Bhosale Committee (JPC) (1992) argued that fertilizer subsidies should be reduced and farmers should instead be compensated through higher Minimum Support Prices (MSP).[1] More recently, the 12th Plan Document also argued that increasing MSP and crop-specific packages with additional price incentives may be sufficient to address the issue of loss of income on account of a rise in the prices of inputs (Planning Commission, 2015). However, this argument, has not found favour even with most critics of fertilizer subsidies as such a change would result in increased expenditure on food subsidies (Meenakshi, 1992; Parikh, Kumar and Darbha, 2003). Acharya (2000) has discussed many problems with the proposal to reduce input subsidies and compensate farmers by raising support prices. First, since the government procures only a few crops, merely increasing the MSP will not benefit all farmers. Second, to the extent that such a move will be effective, the policy change is likely to be highly inflationary, with food inflation having a cascading effect on inflation in prices of other goods as well. Third, with the highly unequal distribution of land and production, most rural households in India are net buyers of food. As a result, high food inflation not only hurts the urban poor but also a vast majority of rural households. Finally, substituting fertilizer subsidies with higher food subsidies may not even result in a decline in the fiscal burden unless the overall level of support is reduced in the process.

One of the strongest arguments against input subsidies has been that these have crowded out investment in agriculture (Dev, 2011; Kumar, Sen and Kurien, 2004; Parikh *et al.*, 1995; Planning Commission, 2002). Jha (2007) attributes the poor performance of agriculture in the post-reform period to the prioritisation of agricultural subsidies as a way to meet recurring expenditure over agricultural investment that would improve productive capacity in the long-run. Parikh *et al.* (1995) used an Applied General Equilibrium Model to argue that agricultural growth would rise if reductions in input subsidies were used to finance irrigation investments.

There are three problems with the argument that fertilizer subsidies should be replaced with investments in irrigation. First, fertilizer use and irrigation are complementary inputs for agricultural growth and not substitutes. Complementary investments are also required for improving nutrient management at the farm-

[1]The Minimum Support Price is the floor price at which the government guarantees to procure crops from farmers.

level. More generally, investment in infrastructure and fixed capital has to be combined with the optimum deployment of different variable inputs to achieve higher productivity. Given this, policies for ensuring that farmers get modern inputs at affordable prices and investment in irrigation development (and other kinds of investment) have to be treated as complementary rather than alternative strategies. Second, the level of public expenditure on agriculture in India is relatively low. In 2012–15, while agriculture (including crops, livestock, and fisheries) accounted for about 12.6 per cent of gross value added in the country, the share of agriculture in total budgetary expenditure was only about 7.5 per cent. This points to the need for increasing the total public expenditure on agriculture. Third, the argument that higher input subsidies have prevented the state from investing more in agriculture stems from the idea that the fiscal deficit must not be allowed to rise because, under the standard neoclassical assumption of full-employment and full capacity utilisation in the economy, a higher fiscal deficit can be inflationary. However, in a demand-constrained economy that is characterised by high unemployment and a high degree of unutilised capacity, increasing public expenditure in sectors such as agriculture is likely to be expansionary rather than inflationary (Patnaik, 2003, 2006).

While most of these studies have merely asserted that fertilizer subsidies can be substituted by investment to achieve growth, Storm (1994) examined the macroeconomic impact of expenditure on subsidies and irrigation on growth. Using a dynamic nine-sector CGE model, he estimated marginal returns per rupee of public expenditure for three policy options: a rise in public agricultural investment, a rise in fertilizer subsidies and a rise in public food grain procurement. The model showed that, of the three policies, marginal returns from expenditure were highest for fertilizer subsidies in the short run. In the medium run, an additional rupee put into the economy in the form of public investment raised the GDP by Rs 5.3, an additional rupee spent on fertilizer subsidies raised the GDP by Rs 3.14 and an additional rupee spent on public procurement of foodgrain raised the GDP by Rs 3.58. His simulations showed that the highest growth in GDP is obtained when an increase in public investment in agriculture is combined with an increase in input subsidies.

3 Decontrolling the Fertilizer Industry

The post-liberalisation period saw a distinct change in the direction of fertilizer policies, from uniform and controlled prices towards a regime of decontrolled fertilizer prices. Until 1991, fertilizer prices were controlled through the Retention Price Scheme (RPS) and the distribution of fertilizers was controlled under the Essential Commodities Act. The RPS was introduced in 1977 in the wake of a sharp increase in the cost of fertilizer production due to the oil crisis. Under the RPS, the value of fertilizers produced was estimated by adding a twelve per cent post-tax rate of return on the net worth to manufacturing cost which, in turn, was estimated for all manufacturers depending on the technology used, levels of capacity utilisation and norms for inputs required. The Retention Price Scheme initially covered urea, ammonium sulphate (AS) and calcium ammonium nitrate (CAN). In 1979, phosphatic fertilizers were also brought under the scheme and in 1985, ammonium chloride (ACL) was brought under the RPS (G V K Rao Committee, 1987; Hanumantha Rao Committee, 1998). The RPS ensured that fertilizer manufacturers received an assured return by compensating them for the difference between the value of fertilizers produced and the subsidised price. Along with this, the system of price controls kept the prices of fertilizers low for farmers.

With the increase in the production and use of fertilizers, expenditure on fertilizer subsidies under the RPS increased from 0.22 per cent of agricultural GDP in 1976–77 to 2.64 per cent of agricultural GDP in 1986–87.

The initial changes made to the fertilizer policies were ad-hoc and some of these had to be reversed immediately. In July 1991, soon after the process of economic liberalisation began, the government announced a forty per cent increase in the price of urea. However, this was, partially rolled back (by 10 percentage points) in August 1991. At the same time, ACL, AS and CAN were removed from the RPS and their prices were decontrolled.

These changes, however, could not be sustained and the focus shifted to decontrolling the prices and distribution of fertilizers other than urea. This was done in two stages: through the Concession Scheme introduced in the early 1990s and then through the Nutrient Based Subsidy Scheme launched in 2010. Although several official committees have recommended ways of decontrolling urea prices, these could not be implemented.

The Concession Scheme

The decade 1980–1991 was marked by stagnation in the prices of fertilizers. However, the subsidy burden was increasing and so were the input costs for manufacturing fertilizers. There was also an increase in the cost of imported fertilizers. The aftermath of this crisis and the government's immediate introduction of ad-hoc changes required a comprehensive review. Thus, the government constituted a Joint Parliamentary Committee on Fertilizer Pricing (JPC) under the chairmanship of Pratap Rao Bhosale in December 1991. The committee submitted its report in August 1992. It recommended that the prices (along with movement and distribution) of fertilizers containing phosphate and potash be decontrolled. It also recommended that the prices of urea be reduced by ten per cent and that other nitrogenous fertilizers, which had been removed from the RPS, be brought back under the scheme.

The motive behind decontrolling phosphatic and potash fertilizers was that these were imported (or manufactured using imported raw materials), and thus required a considerable outlay of foreign exchange. In 1990–91, about half of DAP and almost all potash fertilizers were imported (Table 1). The committee also argued that, unlike urea, these fertilizers were mainly used for commercial crops and by rich farmers, and therefore need not be subsidised. The class of farmers who used phosphatic and potash fertilizers could also be partially compensated, the Bhosale Committee argued, through higher Minimum Support Prices for the high value crops that such farmers grew (Pratap Rao Bhosale Committee (JPC), 1992).

Decontrolling the prices of fertilizers containing phosphate and potash on the basis of the Bhosale Committee recommendations in August 1992 resulted in a surge in the prices of these fertilizers. In light of this, the government was forced to introduce a new system of price controls and concessions in October 1992 to partially mitigate the price rise. However, the level of prices was allowed to remain higher than it was under the Retention Price Scheme. The new system of controls and concessions worked in an ad-hoc manner between October 1992–93 and 1996–

Table 1: Consumption and import of P and K fertilizers in 1990–91

Fertilizer	Quantity imported ('000 tonnes)	Quantity consumed ('000 tonnes)
Di-ammonium Phosphate (DAP)	2155	4248
Muriate of Potash (MoP)	2120	1630
Sulfate of Potash (SoP)	59	32

Source: Based on data from Fertiliser Statistics, 2016–17, The Fertiliser Association of India, New Delhi

97. During this period, state governments fixed the Maximum Retail Prices of different fertilizers in their states, and the central government provided a certain amount as concession per tonne of fertilizer to fertilizer manufacturers to cover losses incurred on account of these new state-level price controls. In 1996–97, the central government provided a concession of Rs 1,000 per tonne each for DAP and MoP, and Rs 435-999 per tonne for other complex NP and NPK fertilizers. Since the rates of concession were fixed in an ad-hoc and arbitrary manner until 1996–97, this scheme came to be known as the Ad-hoc Concession Scheme.

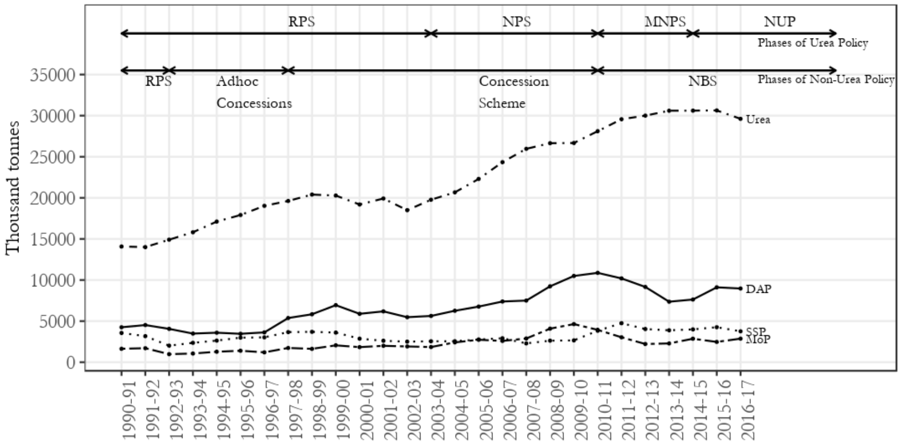
With the implementation of the Ad-hoc Concession Scheme, the price of DAP increased from Rs 4,680 per tonne in 1991–92 to Rs 9,450 in the kharif season of 1995–96 and Rs 9,938 per tonne in the rabi season of 1995–96.[2] Similarly, the price of Single Super Phosphate (SSP) rose from Rs 1,440 per tonne in August 1991 to Rs 2,954 per tonne in the rabi season of 1995–96. The price of MoP more than doubled, from Rs 1,700 in August 1991 to Rs 3,714–4,300 per tonne in the rabi season of 1995–96. Over the period of the Ad-hoc Concession Scheme, urea emerged as the cheapest fertilizer of all (see Appendix Tables A 1 and A 2).

This distortion in prices led to a fall in the consumption of P- and K-based fertilizers. Figure 1 shows the impact of the decontrolling and the ad-hoc concessions on the consumption of DAP, SSP and MoP. Consumption of DAP declined by about a million tonnes between 1992 and 1995. Correspondingly, production of DAP also fell from 2,874 thousand tonnes in 1991–92 to 1,952 thousand tonnes in 1993–94. Total production of DAP and other NPK fertilizers fell from 6,368 thousand tonnes in 1991–92 to 4,859 thousand tonnes in 1993–94. Total production of SSP also declined from 3,650 thousand tonnes in 1990–91 to 2,257 thousand tonnes in 1993–94 (Figure 4 and Appendix Table A 3). Urea consumption, on the other hand, as shown in Figure 1, continued to rise during this period.

In 1996–97, the central government introduced a system of a uniform national prices for P&K fertilizers (except SSP) and a system for calculating the concessions to be given to fertilizer manufacturers. The method of estimating the rates of concession under the new scheme was developed by the Bureau of Industrial Costs and Pricing. Under this scheme, the rates of concession were estimated quarterly and were based on an estimation of cost that covered not just the cost of raw materials and other inputs but also marketing costs and cost of raising capital. The

[2]'Kharif' refers to the monsoon season (June-November in most parts of India) and 'rabi' refers to the winter season (November-April in most parts of India). MRP of DAP and MoP are average MRPs of the MRP ranges that prevailed in the kharif and rabi seasons for the year 1995–96 across different states.

Figure 1: Consumption of Urea, DAP, SSP and MoP, 1990–91 to 2016–17 (thousand tonnes)



Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

concessions for complex NP and NPK fertilizers were determined in proportion to the different nutrients contained in these fertilizers using the concession for domestic DAP as the reference. The rates of concession were revised frequently to account for changes in input costs.

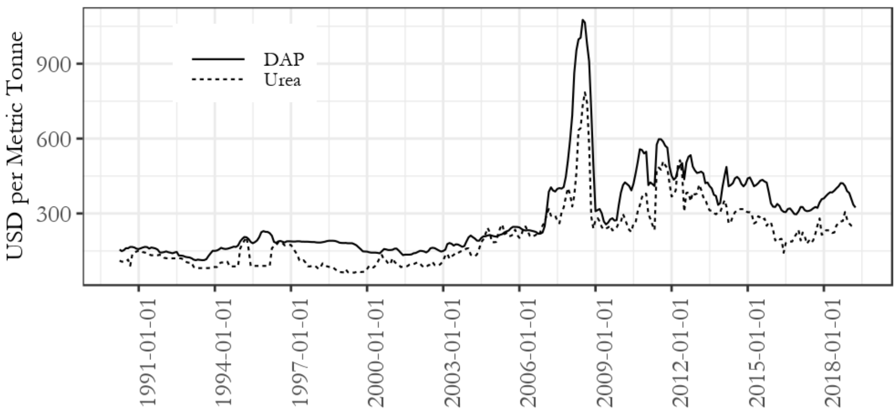
In 2000, the responsibility for implementing this scheme was transferred from the Department of Agriculture & Cooperation to the Department of Fertilizers. It is noteworthy that, while most of the domestic production of DAP was based on imported phosphoric acid, a few plants were set up in this period with captive production of phosphoric acid. The Tariff Commission conducted a study in 2003 on the differences in manufacturing costs between plants having captive production of phosphoric acid and plants using imported phosphoric acid. On the basis of this study, the commission recommended that different rates of concession should be used for plants with captive production of phosphoric acid and plants using imported phosphoric acid (Planning Commission, 2006). India's consumption of phosphoric acid in the year 2000–01 was 3.2 million tonnes out of which only about 1 million tonnes were produced domestically. India was (and continues to be) world's biggest importer of phosphoric acid and accounted for about 55 per cent of global phosphoric acid trade.

An expert group headed by Abhijit Sen was set up in 2005 to review the cost and pricing structure of phosphatic fertilizers. The major recommendation of the expert group was to link the price of phosphoric acid to the international price of DAP, and use this as a reference in negotiations of prices of phosphoric acid by the Phosphoric Acid Consumer Group (FAI, 2017; Standing Committee on Chemicals and Fertilizers, 2007).

The international prices of P and K fertilizers, and of the inputs required for manufacturing these fertilizers, increased steeply in 2007–08 and 2008–09 (Figure 2). Since concessions during this period were directly linked to import parity prices, and this was a period in which oil prices and international prices of fertilizers shot up, the rates of concessions went up year after year. Table 2 shows that the average concession rate reached a peak of Rs 36,488 per tonne on average in 2008–09. In contrast, the price of DAP had to be controlled and remained at Rs 9,350 per tonne since 2001–02. This increase in rates of concession, necessitated by a sharp rise in international prices, meant a huge increase in the subsidy, from about 3.5 per cent of agricultural GDP in 1992 to about 8.12 per cent in 2008–09 (Figure 3). According to the Department of Fertilizers (2014), about ninety-four per cent of the increase in subsidy outgo between 2005 and 2010 was on account of increase in international prices and only six per cent was due to a rise in consumption of fertilizers. As shown in Figure 3, the increase in subsidy bill was much steeper for P and K fertilizers (which had been shifted to the Concession Scheme), than for urea (which was still under th1e RPS).[3]

The decontrolling of P and K fertilizers post-liberalisation had a serious impact on the consumption of these fertilizers. The increase in prices was only partially contained due to the provision of concessions since 1997. Decontrolling fertilizer prices resulted in an increase in the retail prices of fertilizers other than urea, accentuation of nutrient imbalance and a slow-down in the use of non-urea fertilizers. While the cost to the farmer went up, paradoxically, the policy change did not result in any reduction in the fiscal burden of fertilizer subsidies.

Figure 2: International prices of urea and DAP, 1990–2019 (USD per Metric Tonne)



Source: Based on monthly data from World Bank Commodity Price Data (The Pink Sheet)

Nutrient Based Subsidy Scheme

The increase in international prices in 2007–08 and 2008–09 was the primary reason for the increase in the fertilizer subsidy bill during this period which was primarily absorbed through increasing concessions.

[3]A part of the rise in the subsidy bill may have been on account of a shift in fertilizer consumption towards urea because of an increase in the prices of fertilizers that had been moved to the Concession Scheme.

Table 2: Average concession for domestically produced DAP, 2001–02 to 2009–10 (Rs per tonne)

Year	Rs/tonne
2001-02	3510
2002-03	2570
2003-04	3254
2004-05	4826
2005-06	5759
2006-07	6392
2007-08	8489
2008-09	36488
2009-10	10532

Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

This changed in 2010 with the introduction of the Nutrient Based Subsidy (NBS) Scheme which took the process of decontrolling prices of fertilizers further. The NBS was introduced with the intent of improving the nutrient balance by bringing some parity between the subsidies given for nitrogen and for other nutrients. However, when implemented, the scheme excluded urea, the most important nitrogenous fertilizer. The scheme, which is in operation till date, covers twenty-one different kinds of fertilizers, of which DAP, MoP and SSP are the most important.

The NBS Scheme introduced three main changes in the system of fertilizer subsidies.

First, the subsidy given to manufacturers was delinked from international prices and the cost of production.

Secondly, the subsidy was specified by the national government in terms of nutrient content per unit of nitrogen(N), phosphorus(P), potash(K) and sulphur (S) rather than for different fertilizer products.

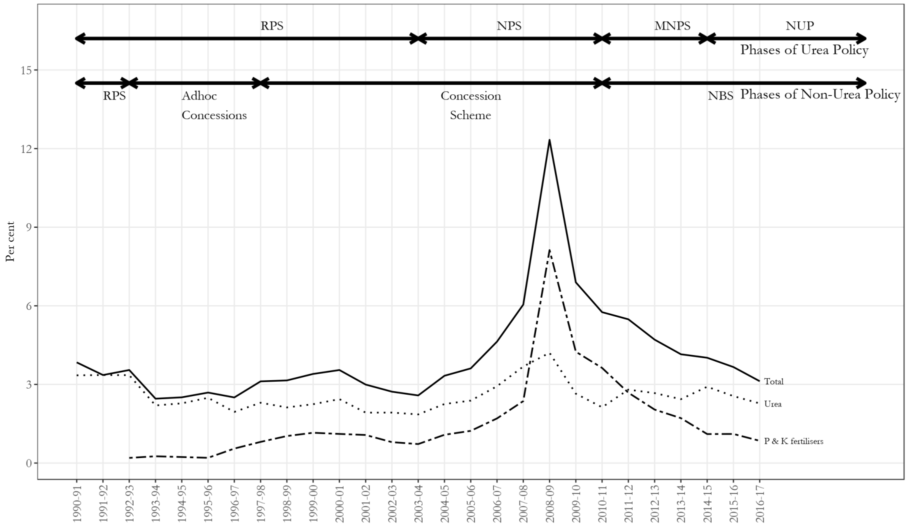
And thirdly, under the NBS, fertilizer manufacturers were given the freedom to set the retail prices of the fertilizers and the system of government regulation of prices of fertilizers (other than urea) was dismantled.

Along with these changes in the system of subsidies, the movement and distribution of twenty per cent of the production and imports of P&K fertilizers were back under the purview of the Essential Commodities Act.

Under the NBS regime, the government has progressively reduced the rate of subsidy for P and K fertilizers (Figures 3 and 5). However, under the NBS regime, this subsidy is simply a top-up over and above decontrolled prices, and goes into the pockets of fertilizer companies (as they are not required to pass it on to farmers in the form of reduced prices).

It is not surprising that the introduction of such a scheme resulted in a surge in the prices of fertilizers other than urea (Figure 6). The price of MoP increased from Rs 4,455 per tonne in 2009–10 to Rs 12,040 per tonne in 2011–12 (December), and has remained around that level since then. The price of DAP more than doubled

Figure 3: Expenditure on fertilizer subsidies as a proportion of agricultural GDP, 1991–92 to 2016–17 (per cent)



Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

Note: Agricultural GDP is based on NAS series 2004–05 for the years 1990–91 to 2010–11 and NAS series 2011–12 for the years 2011–12 to 2016–17

from Rs 9,350 per tonne in 2009–10 to Rs 20,297 per tonne in 2011–12 (December) and to Rs 24,826 per tonne in 2018–19.

Figure 7 shows that after the implementation of the NBS scheme, Indian prices of DAP rose to the same level as international prices, and the movement of prices in India was closely aligned with the movement of international prices.

Implementation of the NBS scheme resulted in a sharp rise in the ratio of prices of non-urea to urea fertilizers. In 2018, DAP was 4.5 times more expensive than urea and MoP was 2.5 times more expensive than urea. SSP, which used to be cheaper than urea until 2010 and was the main phosphatic fertilizer used by poor farmers, was 1.4 times more expensive than urea in 2018 (Table 3).

Planning Commission (2013) pointed out that keeping urea out of the purview of NBS scheme was a major flaw as it led to increasing, rather than correcting, the bias towards urea consumption and worsened the nutrient balance of the soil.

Decontrolling the prices of fertilizers other than urea under the NBS regime has accentuated the urea bias in Indian agriculture and resulted in a sharp decline in the consumption of DAP, SSP and MoP after 2010. Although DAP consumption started to rise slowly after 2014, the fall in MoP consumption has not been arrested (See Figure 1). Imports of MoP fell from 6.3 million tonnes in 2010–11 to 2.4 million tonnes in 2012–13 and have remained around that level since then (Figure 4).

In conclusion, with the introduction of the NBS scheme, the state put into place a framework of fertilizer policies under which fertilizer manufacturers were allowed to sell fertilizers at profit-maximising prices and were still given a substantial subsidy. The scheme provided no mechanism to ensure that the benefit of these

Table 3: Ratio of DAP, MoP and SSP prices to urea prices, 1991–2018

Year	DAP to Urea	MoP to Urea	SSP to Urea
1991	1.50	0.50	0.57
2000	1.93	0.92	0.64
2003	1.93	0.92	0.69
2010	1.76	0.95	0.60
2018	4.53	2.44	1.40

Source: Based on data from Fertiliser Statistics, 2016–17, The Fertiliser Association of India, New Delhi and Monthly Bulletins from Department of Fertilizers, Government of India.

Note: SSP prices refers to the prices of granular SSP.

subsidies was passed on by fertilizer manufacturers to farmers. The fluctuation in the prices of non-urea fertilizers on a very regular basis (almost monthly) implies that there is high instability in the market. Various decisions, including stock maintenance by the seller or the farmer, are influenced by this instability of prices.

Policies Related to Urea

The New Pricing Scheme: 2003 to 2014

Urea remained under the RPS until March 2003. In 2000, the Expenditure Reforms Commission (ERC) chaired by K P Geethakrishnan examined the issue of rationalising fertilizer subsidies. The ERC recommended that movement and distribution of urea should be decontrolled with immediate effect, and that prices of urea should be decontrolled in a phased manner over a period of about five years. It was suggested that urea should be brought under the Concession Scheme with different rates of concession for urea plants using different kinds of feedstock, and the real prices of urea should be allowed to increase by about seven per cent annually between 2001 and 2006. It was envisaged that the concessions would be reduced over time, to be covered by a gradual shift to natural gas-based plants, improvements in efficiency, and a gradual rise in urea prices.

In consideration of these recommendations, the Department of Fertilizers appointed another committee under the chairmanship of A V Gokak to look into the possibility of introducing group-based concessions for urea. Based on the recommendations of this committee, in December 2002, a new scheme for urea units, called the New Pricing Scheme (NPS) was implemented by the government. However, rather than changing the system of pricing and subsidies, the focus of the NPS was on decontrolling the distribution of urea and creating conditions for the technological modernisation of the urea manufacturing industry.

The NPS was implemented in three phases.

Stage I was introduced on April 1, 2003 and lasted for one year. During this period, urea manufacturers were permitted to sell up to half of urea produced anywhere in the country while movement and distribution of the remaining half continued to be regulated by the ECA.

A Working Group was constituted in December 2004, with Y K Alagh as Chair, to evaluate the performance of NPS. The Alagh Committee opposed the idea of decontrolling urea prices as envisaged by the ERC on the grounds that this would result in a huge increase in urea prices for farmers. The committee provided a roadmap of measures to shift urea manufacturing from naphtha-based to natural gas-based so that the cost of production could be brought down, which was argued to be a precondition for the eventual decontrolling of urea prices. In addition, the committee also recommended that the movement and distribution of urea be decontrolled completely.

Consequently, Stage II of the NPS, which ran from April 1, 2004 to September 31, 2006, focused on shifting urea production from being naphtha-based to natural gas-based and increasing the efficiency of energy used per unit production of urea. The government invested in the domestic production and distribution of natural gas as well as in the creation of infrastructure for the assured supply of natural gas through joint ventures with gas-rich countries such as Oman and Iran. The norms used for the calculation of subsidies were modified to provide incentives to energy-efficient and natural gas-based production and dis-incentivise production based on naphtha.

Stage III of the NPS ran from October 2006 to March 2010. The government notified a New Investment Policy in September 2008 for investments in urea manufacturing (for expansion of capacity in existing units as well as for the creation of new units). Under this policy, the government used an import parity price (with a floor of 250 USD/MT and a ceiling of 425 USD/MT) rather than the normative cost of production of urea to calculate the rate of subsidy for new urea plants or when additional capacity was created in existing plants. This incentive resulted in an increase in 2.3 million tonnes of capacity in existing plants. However, the policy failed to attract investments for new urea plants mainly because of shortage in availability of natural gas (Planning Commission, 2011).

Policy changes under the NPS resulted in a sharp decline in the use of naphtha as feedstock in urea production. Figure 8 shows that the consumption of naphtha by the fertilizer industry fell from 3 million tonnes in 2002–03 to 0.8 million tonnes in 2009-10. During the same time, the offtake of domestically produced natural gas for fertilizer manufacturing increased from 7955 million cubic meters in 2002–03 to 13168 million cubic meters in 2009–10 (Figure 8). In order to meet the requirements of natural gas, the imports of Liquified Natural Gas (LNG) were also encouraged. The Ministry of Petroleum and Natural Gas also expanded the gas pipeline network during these years.

The Modified NPS and the New Urea Investment Policy

Stage III of the NPS was extended up to September 2014 along with some modifications. The most important change introduced at this stage was the revision of norms for the estimation of costs other than that of raw material. These norms — termed as norms for "fixed costs" although these also covered several components of variable costs — had remained unchanged since 2003.[4]

[4]Under the Modified NPS, the concessions to urea units included the minimum fixed cost of Rs 2,300 per tonne or actual fixed cost prevailing in 2012–13, along with an additional incentive of Rs 350 per tonne to existing urea units if their fixed cost is less than the minimum

In 2012, a New Urea Investment Policy (NUIP) 2012 was announced in which additional incentives were provided in the form of compensation for the increase in gas prices.[5] NUIP also included a provision for assured buyback of urea for eight years starting from the date of production. However, this provision was, withdrawn in 2014.[6]

New Urea Policy, 2015

In June 2015, the Government of India notified the New Urea Policy (NUP) for existing gas-based urea manufacturing units. The main components of the NUP were the introduction of a uniform gas price that was a weighted average price of imported and domestic gas and a further lowering of energy norms (Standing Committee on Chemicals and Fertilizers, 2017).

The focus of urea policies since 2003 has been to create conditions for shifting the domestic urea industry from naphtha-based production to the use of natural gas as the feedstock. While this has been achieved, the policies during this period failed to expand the domestic production of urea. At the same time, with the prices of fertilizers other than urea rising sharply, the government was forced to keep the prices of urea low and compensate for increasing costs through higher subsidies (Figure 3). The prices of urea have remained fixed at Rs 5,360 per tonne since 2012. Contrary to the stated objectives of achieving self-sufficiency in the production of urea, the policies have resulted in greater dependence on imports to meet the demand for urea. Import of urea rose to 9,199 thousand tonnes in 2019–20. This was 37.4 per cent of total urea production in that year (Figure 9 and Appendix Table A 4).

The focus of urea policies has been to create the conditions for an eventual decontrolling of urea prices. This has not been possible so far because of the huge political implications it would have for the Indian state given that urea is the most widely used and the cheapest fertilizer available to farmers. The government has successfully shifted the domestic production of urea from naphta-based to natural gas-based, however, no substantial increase in the domestic production of urea has taken place.

4 Direct Benefit Transfer Scheme for Fertilizer Subsidy

Various scholars have criticised fertilizer subsidies on the grounds that these disproportionately benefit rich farmers, farmers in irrigated regions and farmers growing irrigated/commercial crops (Ashra and Chakravarty, 2007; Dev, 2011; Gulati, 1990; Gulati and Banerjee, 2015; Jha, 2007; Vaidyanathan, 2000). This has been used to argue for targeting fertilizer subsidies at only the poorer sections of

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fixed cost of Rs 2,300 per tonne. Special compensation were announced for gas-based urea plants at Rs 150 per tonne for units which have completed thirty years of operation.

[5]The major addition this policy provided was that for each $1 increase in gas price beyond $6.50 per million Btu for new projects and $7.5 per million Btu for revamp projects, compensation to the manufacturer increases by $20 per tonne for new urea units and $22 per tonne for revamped units.

[6]The Modified NPS also notified the shutting down of the three remaining naphtha-based units by September 30, 2014. However, these plants were re-opened in June 2015 and were allowed to operate using naphtha.

the peasantry. Targeted fertilizer subsidies have also been advocated as a means of reducing the fiscal burden of fertilizer subsidies (Aadil and Rautela, 2018; Ministry of Finance, 2016). While a few scholars argued for targeting fertilizer subsidies using coupons (Ashra and Chakravarty, 2007), more recent contributions have argued for direct benefit transfers to small and marginal farmers. Although proponents of direct benefit transfers to farmers have talked of a flat household-level transfer (as in the PM-KISAN scheme introduced in 2019), a per hectare transfer (Dalwai Committee, 2018; Gulati and Banerjee, 2015; Shanta Kumar Committee, 2015) and as in the Rythu Bandhu Scheme in Telangana introduced in 2016) or transfers linked to the quantity of actual purchases of fertilizers (as sought to be implemented by the NITI Aayog), the relative merits of these have not been analysed.[7]

In October 2016, the government of India introduced a Direct Benefit Transfer scheme for fertilizer subsidies on a pilot basis in seventeen districts. The NITI Aayog constituted a committee in September 2017 to prepare a roadmap for shifting to targeted cash transfers in lieu of fertilizer subsidies. In March 2018, the scheme was extended to the entire country.[8] In the first phase, Point of Sale (PoS) machines with Aadhaar-based biometric authentication were installed in fertilizer shops across the country and their use was made mandatory. Although the subsidy continued to be given to private companies, it was now computed on the basis of fertilizer sales recorded by the PoS machines rather than on the basis of the dispatch of fertilizers by fertilizer companies. During Phase I of the scheme, from October 2016 to July 2019, the fertilizer subsidy was paid to fertilizer companies. In this phase, by installing infrastructure to enable the biometric authentication of buyers and tying fertilizer subsidies to sales recorded through PoS machines, the government put in place the mechanism for targeted fertilizer subsidies.

There were no independent evaluations of the functioning of the DBT scheme during this phase. The only evaluation of the scheme, done by MicroSave, was commissioned by the NITI Aayog, which is spearheading the rollout of the DBT scheme (MicroSave, 2018). The study showed that eighty-one per cent of sales were Aadhaar-authenticated.

Since no independent systematic evaluations of the DBT scheme were available, we travelled to Patiala (Punjab), Karnal (Haryana), Fatehabad (Haryana) and Bulandshahr (Uttar Pradesh) in August and September, 2019, and interviewed about fifteen fertilizer dealers to inquire into the functioning of the DBT scheme. All the dealers we interviewed had PoS machines and reported using them. While the PoS machines required the Aadhaar numbers of the buyers to be recorded using finger print authentication, we found that no prospective buyer is turned away because they lack Aadhaar card. Since no subsidy was being transferred directly to customers and since there was no restriction on the amount of fertilizer that could be sold against a single Aadhaar number, it was common for dealers to record the sales of some customers against somebody else's Aadhaar information. Some dealers also reported problems like poor internet connectivity and the failure of biometric authentication by the PoS machines. Given that the subsidies were not being transferred directly to buyers, these problems were being dealt with by making

[7]See `http://www.pmkisan.gov.in/` for details of the PM-KISAN Scheme and see `http://rythubandhu.telangana.gov.in/` for details of the Rythu Bandhu Scheme.

[8]`http://fert.nic.in/page/direct-benefit-transfer-dbt`

entries in the PoS machines whenever internet connectivity was available and using the Aadhaar-authentication of any person available.

In July 2019, the government of India announced Phase II of the DBT scheme.[9] In this phase, the government intends to shift to transferring the subsidy directly to the bank accounts of farmers, and to link fertilizer sales with land records and Soil Health Cards.[10] The PoS machines have been updated to provide area and crop-specific recommendations based on Soil Health Card data though these are not yet used to fix the subsidy entitlements of farmers. It must be noted that the shift in fertilizer subsidies from fertilizer companies to farmers necessarily requires the deregulation of fertilizer prices. The government has not yet announced whether the DBT will first be implemented for non-urea fertilizers only, or if there will be a phased deregulation of urea prices as well. No such roadmap has been made public by the government yet. The deregulation of urea prices would result in a dramatic rise in the prices of urea and the cost of cultivation. If implemented, this will add to already intense agrarian distress.

Targeting fertilizer subsidies using land records and Soil Health Cards would also be fraught with several problems. Given that land records in many states are not updated or computerised, that tenancy relations are informal, that the availability of formal sector credit is limited, and that rural markets are informal and interlocked, any system of targeting is likely to be fraught with errors and result in large-scale exclusion. Linking the transfer of subsidies to the mandatory use of Aadhaar-based authentication and PoS machines may result in large-scale exclusion in remote areas because of poor network connectivity and other technical constraints.

5 Other Recent Policy Changes

Over the last five years, three other changes have been introduced in the fertilizer policies. These are: making the neem oil coating of urea mandatory, the reduction in the size of the urea bags and a change in the taxation regime for fertilizers. In this section, we discuss the implications of these changes.

Neem Coating of Urea

The policy of introducing neem oil coated urea started in June 2008, when the Fertilizer Control Order, 1985, was amended to allow fertilizer manufacturers to add micronutrients such as boron and zinc as well as neem oil to up to twenty per cent of their urea production. In January 2011, the Fertilizer Control Order 1985 was again amended to increase the production of neem oil coated urea to thirty-five per cent of subsidised urea production. However, the actual production of neem oil coated urea remained limited because fertilizer manufacturers were not compensated for the cost of neem oil coating through higher pricing of urea or increased subsidies. In September 2015, this policy was extended by making neem oil coating mandatory. Although neem coating was initially made mandatory only

[9] https://pib.gov.in/pressreleaseiframepage.aspx?prid=1578063

[10] The Soil Health Card Scheme was launched by the Government of India in 2015. Under the scheme, a large number of private testing facilities have been used to test soils, and farmers have been provided with Soil Health Cards bearing the results of soil tests for their land and recommendations on the appropriate dosage of fertilizers to be used. For more information, see https://soilhealth.dac.gov.in/Content/blue/soil/index.html.

for domestically produced urea, the regulation was extended to all imported urea in December 2015. Manufacturers and importers were allowed to increase the price of urea by five per cent to cover the cost of neem oil coating.

Two arguments were given for making neem oil coating mandatory. The main argument was that neem oil would work as a nitrification inhibitor — that is, it would slow down the conversion of nitrogen into nitrates, which are highly soluble and reduce the loss of nitrogen through leaching — and thus improve absorption of urea by plants. Because of this, neem oil coating was argued to increase yields and lead to a reduction in the use of urea. In addition, it was also argued that the coating of urea with neem oil would check the diversion of subsidised urea for non-agricultural uses.[11]

A review of literature on the use of nitrification inhibitors suggests that this policy of mandatory coating of urea with neem oil is based on thin scientific evidence. Internationally, there are two broad approaches towards denitrification (Coskun *et al.*, 2017; Subbarao *et al.*, 2006). The first is the use of synthetic nitrification inhibitors such as Nitrapyrin, DCD and DMPP. These compounds are known to inhibit nitrification for a few weeks though their efficacy is higher in soils with low organic matter and at relatively low temperatures.

The second is through the use of Biological Nitrification Inhibitors (BNI). The roots of several plants, and in some cases, specific varieties of plants, have been found to release nitrification inhibitors. Incorporating such crops into cropping systems through, for example, crop rotations or intercropping, or developing cultivars that have BNI properties, is an emerging area of research. There is, however, no large-scale experience of deployment of Biological Nitrification Inhibitors.

Although there are no equivalent studies on the use of plant extracts as nitrification inhibitors internationally, several studies have been done by Indian scholars on the efficacy of neem oil (as well as the extracts of a few other plants) as nitrification inhibitors. It is also noteworthy that this technique (of using extracts of neem or other plants as nitrogen inhibitors) has not been tested or used in any other country. Almost all the studies are entirely empirical and there is no documented scientific work to understand the biochemistry of the process through which neem oil inhibits nitrification.

Based on a review of the literature, our assessment is that the scientific evidence on the impact of neem oil coated urea on yields is very week and limited. Almost all studies on the impact of neem oil coating have been conducted in experimental conditions and almost no evaluation exists of the impact in actual field conditions

Singh (2016) did a detailed review of studies on the efficacy of neem oil coated urea for improving yields and increasing nitrogen use efficiency. He showed that for the fifty-five studies on paddy, the average increase in yields because of neem oil coating was 6.3 per cent. For wheat, the author reviewed seven studies that found an average yield increase of 5.3 per cent as a result of using neem oil coated urea. In about thirty per cent of the studies for paddy and wheat, neem oil coated urea did not outperform uncoated urea. The average percentage increase in yield on account of neem oil coated urea was 10.5 per cent in potato, 8.7 per cent in sugarcane, 4.3 per cent in cotton and 5.4 per cent in finger millet. The studies on maize found no increase at all. Many of these studies showed that the nitrification inhibition process is less effective in soils with high pH levels.

[11] `http://www.pib.nic.in/Pressreleaseshare.aspx?PRID=1559069`

The review showed that the effect of neem oil coating on nitrogen use efficiency was positive but small. To estimate the efficiency of nitrogen use, Singh (2016) reviewed studies that calculated the apparent recovery efficiency, which is defined as the nutrient uptake in above-ground parts of the plant relative to the quantity of nutrient applied. The review concluded that, at an application rate of 120 kg of nitrogen per hectare, the rise in recovery efficiency because of use of neem oil coated urea was 3.4 per cent for paddy and 6.7 per cent for wheat cultivated in sandy loam soil. On the other hand, when cultivated in clayey soil, there was no increase in recovery efficiency for rice and only a 2.5 per cent increase in recovery efficiency for wheat because of the use of neem coated urea. These differences between the recovery efficiency of uncoated and neem oil coated urea diminished further at higher application rates of nitrogen.

Based on the detailed review, Singh (2016) concluded that the increase in yields and nitrogen use efficiency achieved on experimental fields, under highly controlled conditions, was small, and that even these benefits may not be realised on farmer's fields.

Be that as it may, in 2015, the government made it mandatory for all domestically produced and imported urea to be coated with 800 gm of neem oil per tonne of urea. It is noteworthy that this requires an annual supply of over 26,000 tonnes of neem oil which, in turn, requires about 0.26 million tonnes of neem seed.

It has been reported that the availability of neem oil is only about fifteen per cent of the quantity required for coating all indigenous and imported urea.[12] Given the shortage of supply and the high price of neem oil, there are also reports of mixing of other oils, industrial chemicals, and synthetic dyes to give urea the appearance of it having been coated with neem oil (Damodaran, 2017; Financial Express, 2017).

Although the practice has been deployed for over a decade, there is little empirical evidence to show the actual impact of neem coating. There has been no rigorous evaluation of the efficacy of neem oil coated urea in field conditions in terms of either a decline in the use of urea or of an increase in yields on account of improved absorption of nitrogen from neem coated urea. There is only one study, commissioned by the Department of Fertilizers, which has examined the impact of the use of neem coated urea on yields (Ramappa and Manjunatha, 2017). The study was however done in the kharif season of 2015, soon after the policy of mandatory neem oil coating was announced, and faced the problem of farmers being unable to differentiate neem oil coated urea from uncoated urea. There are various issues with the methodology of the study, and it is very evident that the study vastly overstates the benefits of neem oil coated urea. This study has been used by the Department of Fertilizers as evidence for the success of the policy of requiring the mandatory coating of urea with neem oil.

Reduction in Size of Urea Bag

In April 2018, Ministry of Chemicals and Fertilizers introduced a change in the size of urea bags, replacing the fifty kg bag with a forty-five kg bag. It was argued that "since farmers mostly assess the requirement of urea in terms of bags for agriculture purpose, it is estimated that the availability of urea in a 45 kg bag instead of a 50

[12] `https://www.downtoearth.org.in/news/governance/towards-a-bitter-end-india-s-neem-shortage-63978`

kg bag may bring down consumption of urea by 10 per cent."[13] It is not clear on what basis such a claim and policy decision were made. No reference was made to any pilot study which might have been done to estimate the impact of such a change on urea consumption and to test if such an impact was likely to be sustained over time. While there is no evidence that shifting to smaller bags resulted in a decline in urea consumption, the shift does seem to have resulted in a higher cost of bagging and transportation. Fertilizer companies have been demanding that they be compensated for this increased cost.

Imposition of GST on Fertilizers

The Indian government introduced a major change in the country's indirect taxation system with the introduction of the Goods and Services Tax (GST) on July 1, 2017. GST is a centralised value-added tax that replaced all central and state-level VAT/sales taxes.

In the Indian context, the imposition of GST on fertilizers as part of central taxes is fundamentally perverse given that fertilizers are provided subsidies by the government. The new system of taxation simply means that the government provides a subsidy on fertilizers and then takes away a part of it through GST.

In addition, three specific problems have arisen because of the imposition of a centralised GST on fertilizers.

First, unlike varying levels of taxation in the pre-GST period, finished fertilizers have been subject to a five per cent GST since July 2017. The rates of VAT in the pre-GST period varied across states from no taxation to up to 5.5 per cent tax. In several states, for example Punjab, Haryana, Tamil Nadu and Kerala, fertilizer sales for agriculture were tax free. The introduction of a five per cent GST in these states resulted in an increase in fertilizer prices (Deshpande, 2017).

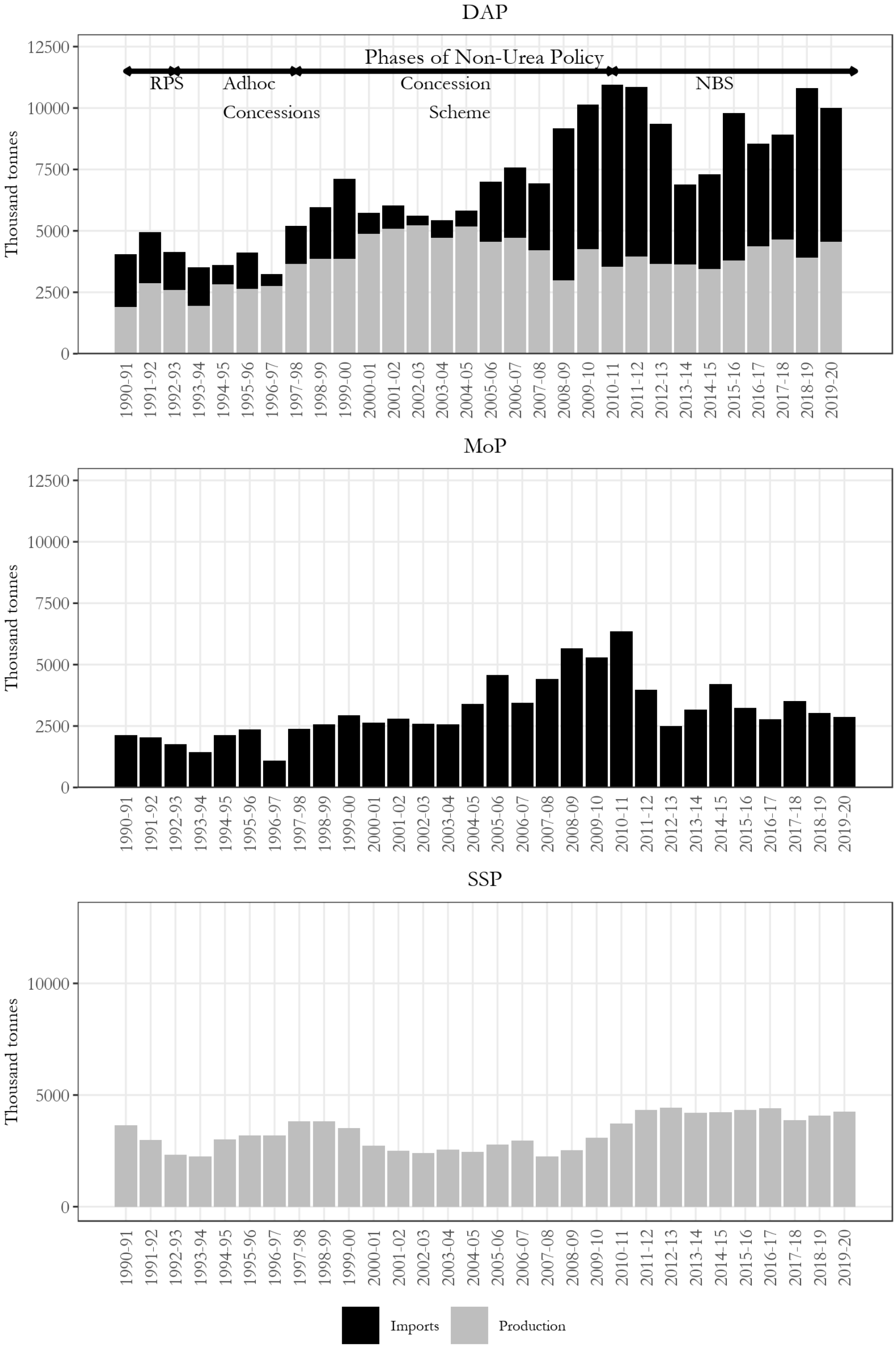
Secondly, while fertilizers are taxed at five per cent, imported raw materials for manufacturing fertilizers carry a higher tax (ranging from twelve to eighteen per cent). This results in manufacturers having to pay a higher tax on raw materials, and then claim a refund of excess payment towards input tax. Delays in input tax credit refunds create problems for domestic manufacturers.

Finally, Naphtha is taxed at eighteen per cent while natural gas is taxed at five per cent. This has disadvantaged naphtha-based urea production over natural gas-based urea production. Under the earlier system of VAT, naphtha used for urea manufacturing was subject to only four per cent tax (Deshpande, 2017).

All these problems have meant that, on the whole, the imposition of GST has contributed to increasing the retail prices of fertilizers.

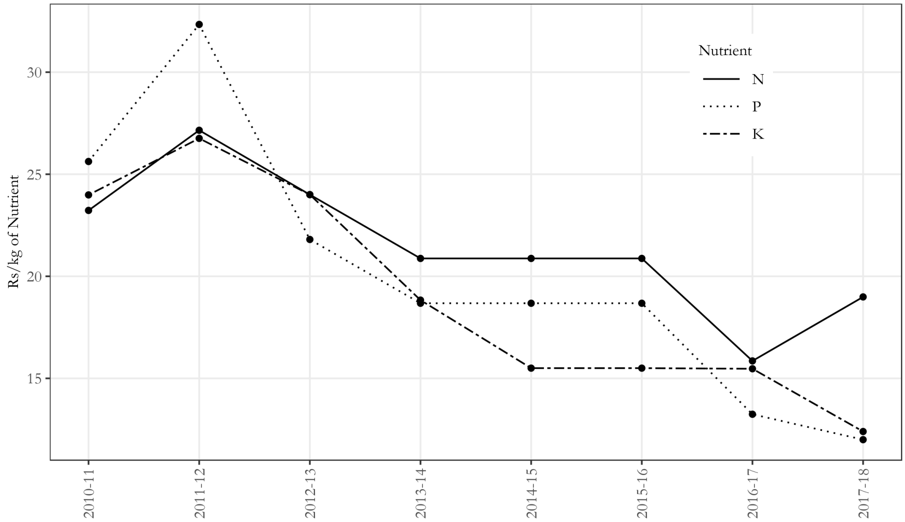
[13]Ministry of Chemicals and Fertilizers, Government of India, Rajya Sabha Unstarred Question No 2131, Savings with the usage of reduced quantity in urea bags, asked by C M Ramesh, Answered by Rao Inderjit Singh, Minister of State (Independent Charge) on January 5, 2018.

Figure 4: Production and import of DAP, MoP and SSP, 1990–91 to 2019–20 (thousand tonnes)



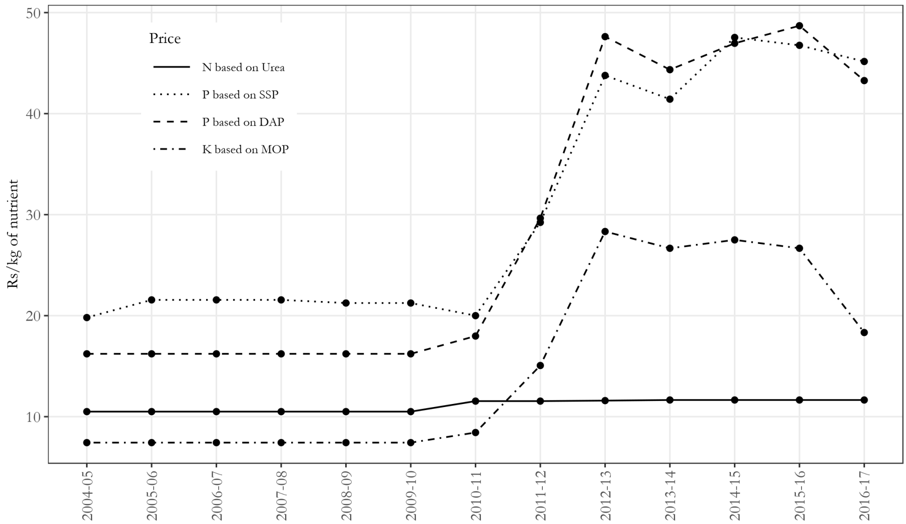
Source: Based on data from Fertiliser Statistics, 2016–17, The Fertiliser Association of India, New Delhi and `https://reports.dbtfert.nic.in/mfmsReports/getMonthWiseProductionAndImportDetails.action`.

Figure 5: Subsidy for nitrogen, phosphorus and potash under Nutrient Based Subsidy Scheme, 2010–11 to 2017–18 (Rs per kg of nutrient)



Source: Based on data from Fertiliser Statistics, 2016–17, The Fertiliser Association of India, New Delhi

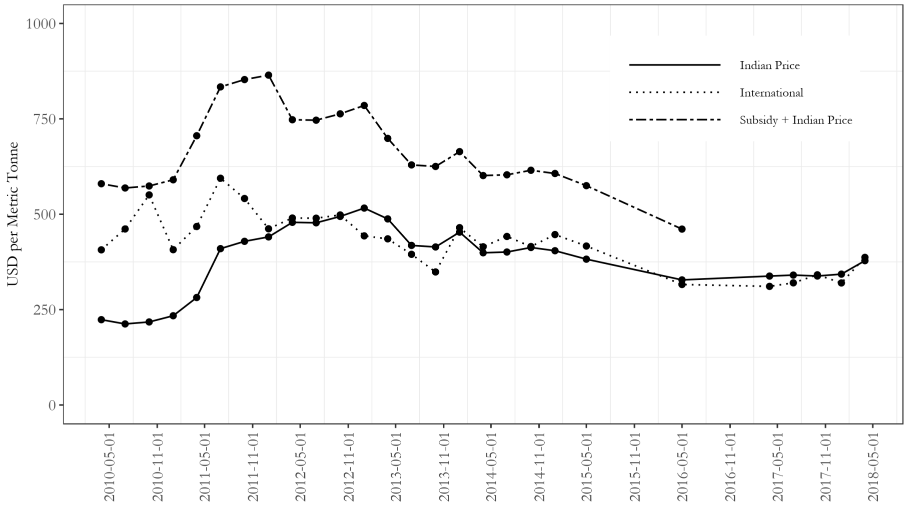
Figure 6: Price of fertilizers in terms of nutrients, 2004–05 to 2016–17 (Rs per kg of nutrient)



Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

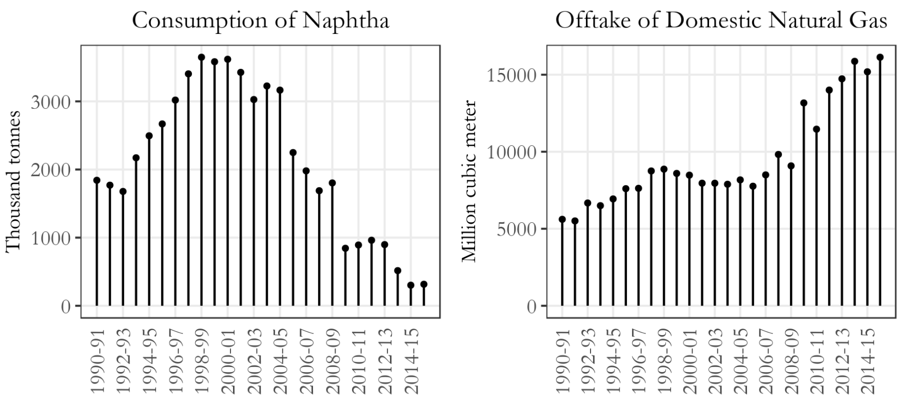
Note: Under NBS, retail prices are open and announced by the individual companies. The prices shown for 2010-11 to 2016-17 are indicative average prices.

Figure 7: Indian and international prices of DAP, 2010–2018 (USD per Metric Tonne)



Source: Based on data from World Bank Commodity Price Data (The Pink Sheet), Monthly Bulletins of Department of Fertilizers, Government of India and Federal Reserve Economic Data

Figure 8: Consumption of naphtha (thousand tonnes) and offtake of domestically produced natural gas (million cubic meter) by fertilizer industry, 1990–91 to 2016–17

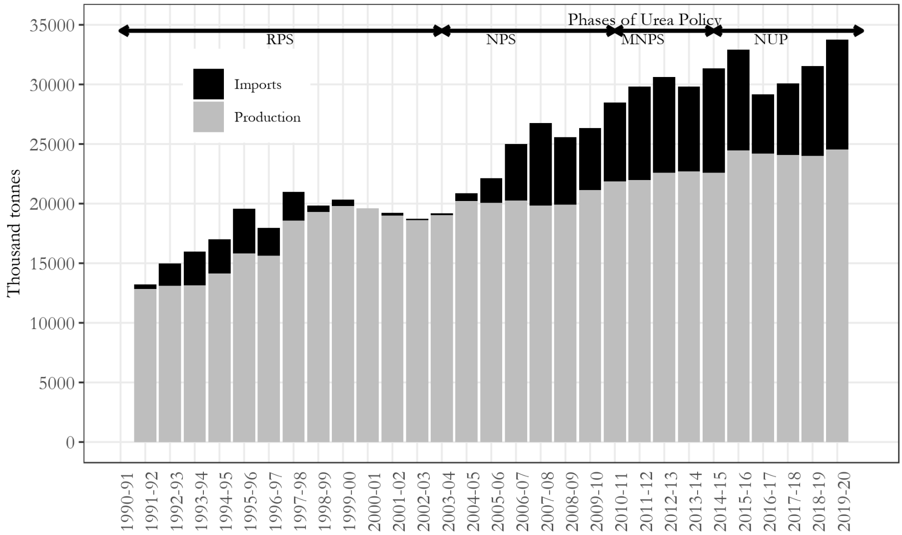


Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

6 Fertilizer Use and Fertilizer Productivity: Impact of Policy Changes

The use of chemical fertilizers has increased greatly across the world over the past half century. The pattern of fertilizer use vary across regions and crops. Table 4 shows the global use of nutrients applied through fertilizers, in kilograms per hectare of cropland, for Triennium Ending (TE) 1971, 1981, 1991, 2001, 2011, and 2016. The table shows that consumption of nitrogen (N), phosphate (P) and potash (K) increased from forty-eight kg per hectare in TE 1971 to ninety kg per hectare in TE 1991. In the next decade, there was a minor rise in total NPK consumption to ninety-one kg per hectare. The total consumption of fertilizer per hectare of land has grown rapidly after the 2000s. In TE 2016, the total NPK consumption per hectare of land increased to 116 kg. It is noteworthy that though the consumption of all nutrients has risen, the consumption of nitrogen per hectare of land has grown three times from twenty-two kg in TE 1971 to sixty-six kg in TE 2016, the consumption of phosphate has almost doubled from fifteen kg per hectare in TE 1971 to twenty-eight kg per hectare of cropland in TE 2016 and consumption of Potash doubled from eleven kg in TE 1971 to twenty-two kg per hectare of cropland in TE 2016. In recent years, the consumption of nitrogen has been found to be much higher than the total consumption of phosphate and potash.

Figure 9: Production and import of urea, 1990–91 to 2019–20 (thousand tonnes)



Source: Based on data from Fertiliser Statistics, 2016-17, The Fertiliser Association of India, New Delhi

The application of nutrients in appropriate balance is important for plant growth. The amount and composition of fertilizers required for optimal plant growth depends on many factors including the crop, the stage of plant growth, nutrient content of the soil and other agro-ecological factors. The absorption of nutrients also depends on farming practices including techniques of fertilizer

Table 4: Global use of nutrients, trienniums ending 1971, 1981, 1991, 2001, 2011 and 2016 (kilograms per hectare of cropland)

Year	Nitrogen	Phosphate	Potash	Total NPK
1971	22	15	11	48
1981	41	22	16	79
1991	50	24	16	90
2001	54	22	15	91
2011	63	26	17	106
2016	66	28	22	116

Source: Data for total nutrients taken from `https://www.ifastat.org/databases/plant-nutrition` and data for cropland taken from FAOSTAT `http://www.fao.org/faostat/en/#data/RL`.

application, which in turn depend on farmers' access to technology, technical know how and investment. As a result of almost three decades of policies that have prioritized cutting down the fiscal burden of fertilizer subsidies over promoting balanced use of fertilizers, Indian agriculture today is marked by the excessive and imbalanced use of fertilizers resulting in extremely low fertilizer productivity.

The overall level of fertilizer use in India is higher than the global average. Table 5 shows that, in TE 2016, the average per hectare use of fertilizers in India was 154 kg per hectare. In comparison, average fertilizer use at the global level was 116 kg per hectare. It may be noted that, of all the regions of the world, Asia has the highest levels of fertilizer use. In TE 2016 the average fertilizer use in Asia was 199 kg per hectare (Table 5). This high average use for Asia is primarily on account of East Asia (and in particular, China and Vietnam), which has a very high level (466 kg per hectare in TE 2016) of fertilizer use. In TE 2016, East Asia's average fertilizer use was about four times the global average. In South Asia, India ranks second to Bangladesh (260 kg per hectare in TE 2016) in its average use of fertilizers. The average level of fertilizer use in India is much higher than the average level for Africa and Eastern Europe and Central Asia. In terms of average use of fertilizers, India ranks higher than North America and Latin America (and the Caribbean), and lower than East Asia, Western Europe and Central Europe.

It may also be noted that while India's use of nitrogen and phosphate are much higher than the global average, India's use of potash is much lower than the global average. In TE 2016, the average N:P:K ratio of fertilizer use in India was 6.7:2.7:1 while the global average N:P:K ratio was 3:1.3:1.

It must be stated at this point that this difference in the pattern of fertilizer use is likely to be a combined result of variations in nutrient requirements (on account of variations in cropping pattern, soil conditions, and other agro-climatic variations) as well as variations in relative fertilizer prices, farming practices and technological adoption. While a detailed empirical evaluation of role of these different factors in determining fertilizer application rates across the countries is extremely challenging because of the paucity of data, we have attempted to look at fertilizer application rates separately for a few crops to get a more granular understanding of these variations.

Table 5: Average rates of fertilizer use in different regions of the world, triennium ending 2016 (kilograms of nutrients per hectare of cropland)

Region	Nitrogen	Phosphate	Potash	Total
India	100	39	15	154
South Asia	91	35	13	139
East Asia	246	117	103	466
Oceania	38	26	8	72
Eastern Europe and Central Asia	21	6	5	32
Western and Central Europe	126	28	32	186
Africa	13	6	2	21
North America	71	25	25	121
Latin America & the Caribbean	43	35	36	114
World	66	28	22	116

Source: As in Table 4.

In this section, we look at the data for three major crops — wheat, rice and maize — from countries that are among the biggest producers of these crops. Tables 6, 7 and 8 summarise the cross-country data on fertilizer application rates, yields and fertilizer productivity for these three crops.[14] It is noteworthy that, for all the selected crops, India's use of fertilizer ranks amongst the highest while, in terms of fertilizer productivity, India ranks among the lowest.

In the case of rice, while Indian average yields (2,391 kg/ha) are lower than the world average (4,523 kg/ha), average fertilizer use is higher in India (170 kg/ha) than the world average (125 kg/ha). Of all the major rice producing countries, India has the lowest fertilizer productivity for rice (output of rice per unit of nutrients). It is interesting to note that countries such as Japan and Vietnam, which have high paddy yields, use much lower quantities of nitrogenous fertilizers than India (Table 6). While Japan's NPK ratio for fertilizer application in rice was 1:1:0.76, India's NPK ratio for fertilizer application was 1:0.33:0.17. The differences in the pattern of fertilizer use suggest that more than the level of application of fertilizers, nutrient imbalance explains the lower productivity of fertilizer application in rice cultivation in India.

In the case of wheat, of the major producers, fertilizer application rates are highest for China, Pakistan, and India. While the global average use of NPK is 127 kg per hectare, the use in China is more than double the global average at 265 kg per hectare, the use in Pakistan is higher than the global average by seventy-one kg per hectare and the use of fertilizers in India is higher than the global average by fifty-three kg per hectare. We may note that while fertilizer application rates in India and Pakistan are higher than the world average, both countries have lower yields than the world average. Once again, India's fertilizer productivity in wheat is lower than that of all the major producers.

[14] In these tables, fertilizer productivity is defined as crop output per unit of fertilizer nutrients.

Table 6: Fertilizer use (kg of nutrients/ha), crop yields (kg/ha) and fertilizer productivity (kg of crop/kg of nutrients), rice, India ond other major producing countries, 2014-15

Country	Yield	Nitrogen	Phos phate	Potash	Total NPK	Fertilizer productivity
China	6810	127	58	38	223	31
Pakistan	3634	172	40	2	214	17
Vietnam	5754	104	57	45	206	28
Japan	6698	73	73	56	202	33
India	2391	112	38	20	170	16
Brazil	5201	78	36	31	145	36
Bangladesh	4538	90	31	0	142	32
Thailand	3059	92	23	24	139	22
Indonesia	5135	86	29	13	128	40
Philippines	4002	71	15	10	96	42
World	4523	95	35	22	152	30

Source: Data for total nutrients were taken from Heffer, Gruère and Roberts (2017). Data for area harvested and yields were taken from FAOSTAT. Data on yields for India were taken from the Ministry of Agriculture, Government of India.

With maize, India's fertilizer productivity is much lower than fertilizer productivity in maize of the major producers (Table 8). While the average fertilizer application rate in India is about fifteen per cent lower than the world average, India's yields of maize are less than half the world average.

This analysis suggests that fertilizer use in India is high and extremely imbalanced, and that these imbalances in the application of fertilizers, along with poor nutrient management practices, are the key reasons for low fertilizer productivity in India. As discussed in detail earlier, the problem of imbalance in the application of fertilizers has been accentuated greatly by fertilizer policies in the post-liberalisation period. Decontrolling the prices of fertilizers other than urea, lack of investment in technological improvements in farm-level nutrient management, and the collapse of extension services are the major causes of this malaise.

It is noteworthy that, for all the selected crops, India's use of fertilizer ranks amongst the highest while, in terms of fertilizer productivity, India ranks among the lowest.

Table 7: Fertilizer use (kg of nutrients/ha) and yields (kg/ha), wheat, India and other major producing countries, 2014-15

Country	Yield	Nitrogen	Phos phate	Potash	Total NPK	Fertilizer Pro- ductiv- ity
China	5243	141	84	40	265	20
Pakistan	2824	148	49	1	198	14
India	2750	130	42	9	180	15
European Union	5884	123	22	18	163	36
United States of America	2938	83	30	9	122	24
Canada	2895	82	26	11	118	25
Turkey	2429	80	31	1	112	22
Australia	2006	44	23	3	69	29
Ukraine	4012	53	7	7	67	60
Russia	2498	25	9	3	38	66
World	3303	85	30	11	127	26

Source: As in Table 6.

Table 8: Fertilizer use (kg of nutrients/ha), crop yields (kg/ha) and fertilizer productivity (kg of crop/kg of nutrients), maize, India and other major producing countries, 2014-15

Country	Yield	Nitrogen	Phos phate	Potash	Total NPK	Fertilizer Pro- ductiv- ity
United States of America	10,733	166	61	61	287	37
European Union	8098	157	42	42	241	34
China	5809	125	49	22	196	30
Indonesia	4954	116	35	19	170	29
Mexico	3296	126	20	3	149	22
Brazil	5176	69	37	40	146	35
South Africa	5301	100	35	7	142	37
India	2631	90	32	14	135	19
Ukraine	6159	72	10	10	92	67
Argentina	6841	44	25	0	69	99
World	5593	98	34	26	158	35

Source: As in Table 6.

7 Conclusions

The economic reforms which were started in 1991 shifted the focus of fertilizer policies away from playing a leading role in building the fertilizer industry and ensuring the availability of fertilizers at affordable prices to farmers. Under the neo-liberal policy framework, reducing the fiscal burden of fertilizer subsidies and the foreign exchange burden of fertilizer-related imports became the overriding concerns of the state. Interestingly, the post-liberalisation policies have not only spectacularly failed in both these objectives, they have also resulted in a surge in the prices of fertilizers other than urea, and vastly accentuated the urea bias in nutrient application in Indian agriculture. The analysis in this paper shows that the decontrolling of the prices of fertilizers other than urea through the NBS scheme has resulted in a situation in which, while the state continues to incur a huge amount of expenditure on subsidies for these fertilizers, fertilizer companies are not required to pass on the benefits to farmers.

Fertilizer policies in the post-liberalisation period have resulted in the high and wasteful use of fertilizers in Indian agriculture. The productivity of fertilizer use is remarkably low in India because of imbalance of nutrient application, lack of investment to improve farm-level nutrient management, and the collapse of agricultural extension.

The shift to DBT for the disbursement of fertilizer subsidies is likely to have far-reaching effects on the Indian agriculture. With the pan-India roll-out of the DBT scheme in 2018, the government has put in place a framework for targeted fertilizer subsidies. Although mechanisms for the targeting of subsidies have not yet been enforced, the current policy has provisions for denying the benefit of fertilizer subsidies to farmers who do not have land registered in their own names or have not registered under Aadhaar. The government is already preparing a road-map for eliminating fertilizer subsidies and shifting to targeted cash transfers in lieu of fertilizer subsidies through PM-KISAN, a new scheme for cash transfers to farmers that was introduced in March 2019. If implemented, the shift from fertilizer subsidies to targeted direct benefit transfers would adversely affect the remunerativeness of agriculture and deepen the agrarian crisis.

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Appendix Tables

Table A 1: Administered retail price of Urea, 50 kg bag, 1981–2020 (Rs per tonne).

Price effective from	Price
July, 1981	2350
June, 1983	2150
Jan, 1986	2350
July, 1991	3300
Aug, 1991	3060
Aug, 1992	2760
June, 1994	3320
Feb, 1997	3660
June, 1998	4160
June, 1998	3660
Jan, 1999	4000
Feb, 2000	4600
Feb, 2002	4830
Feb, 2003	5070
Mar, 2003	4830
Apr, 2010	5310
Nov, 2012 until 2020	5360

Source: Fertiliser Statistics and `http://fert.nic.in/urea`.

Table A 2: Retail prices of DAP, 1971–2018 (Rs per tonne)

Effective date	Prices
Administered prices	
May, 1971–Apr, 1972	1354
Apr, 1972–Apr, 1973	1402
Apr, 1973–Sep, 1974	1402
Sep, 1974–Jul, 1975	3052
Jul, 1975–Jul, 1981	2852
Jul, 1981–Jun, 1983	3600
Jun, 1983–Jan, 1986	3350
Jan, 1986–Jul, 1991	3600
Jul, 1991–Aug, 1991	5040
Aug,1991–Oct, 1992	4680
Partial decontrol	
Rabi, 1992–93	6500 to 6800
Kharif & Rabi, 1993–94	6200 to 7000
Kharif, 1994–95	6900 to 7770
Rabi, 1994–95	7544 to 8799
Kharif, 1995–96	9099 to 9800
Rabi, 1995–96	9629 to 10247
Kharif, 1996-97	7575 to 8740
Rabi, 1996–97	8161 to 9100
1997–98 to 29.02.2000	8300
29.02.2000 to 28.02.2002	8900
28.02.2002 to 28.02.2003	9350
28.02.2003 to 12.03.2003	9550
12.03.2003 to 2009–10	9350
Average prices after deregulation under the NBS Scheme	
Q1, 2010–11	9950
Q2, 2010–11	9950
Q3, 2010–11	9950
Q4, 2010–11	10750
Q1, 2011–12	12500
Q2, 2011–12	18200
Q3, 2011–12	20297
Q4, 2011–12	20000
Q1, 2012–13	24800
Q2, 2012–13	26500
Q3, 2012–13	26500
Q4, 2012–13	26500
Q1, 2013–14	26520
Q2, 2013–14	25000
Q3, 2013–14	24607
Q4, 2013–14	24607
Q1, 2014–15	24080
Q2, 2014–15	24080

Continued on next page

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Effective date	Prices
Q3, 2014–15	25220
Q4, 2014–15	25100
Q1, 2017–18	21796
Q2, 2017–18	21946
Q3, 2017–18	21952
Q4, 2017–18	23352
Q1, 2018–19	24826

Source: Fertiliser Statistics

Table A 3: Production and import of DAP, MoP and SSP, 1990–91 to 2019–20 (thousand tonnes).

Year	DAP (Production)	DAP (Imports)	MoP (Imports)	SSP (Production)
1990-91	1905	2155	2120	3650
1991-92	2874	2077	2040	2985
1992-93	2599	1533	1761	2329
1993-94	1952	1569	1428	2257
1994-95	2820	792	2120	3025
1995-96	2645	1476	2356	3202
1996-97	2765	475	1101	3187
1997-98	3666	1536	2380	3832
1998-99	3864	2091	2580	3816
1999-00	3861	3268	2946	3533
2000-01	4882	861	2646	2742
2001-02	5091	933	2810	2505
2002-03	5236	383	2603	2408
2003-04	4709	734	2579	2543
2004-05	5172	644	3410	2461
2005-06	4554	2438	4578	2795
2006-07	4713	2875	3448	2972
2007-08	4211	2724	4421	2246
2008-09	2992	6192	5672	2534
2009-10	4246	5889	5286	3093
2010-11	3541	7411	6357	3713
2011-12	3951	6905	3985	4324
2012-13	3647	5702	2496	4435
2013-14	3628	3261	3180	4212
2014-15	3445	3853	4197	4230
2015-16	3787	6008	3243	4330
2016-17	4365	4180	2782	4418
2017-18	4650	4269	3507	3875
2018-19	3899	6918	3027	4072
2019-20	4550	5444	2868	4253

Source: Fertiliser Statistics and `https://reports.dbtfert.nic.in/mfmsReports/getMonthWiseProductionAndImportDetails.action`.

Table A 4: Production and import of Urea, 1990–91 to 2019–20 (thousand tonnes).

Year	Production	Imports
1990-91	12836	—
1991-92	12831	391
1992-93	13126	1857
1993-94	13150	2840
1994-95	14137	2884
1995-96	15806	3782
1996-97	15629	2328
1997-98	18594	2389
1998-99	19292	556
1999-00	19808	533
2000-01	19624	—
2001-02	19003	220
2002-03	18621	119
2003-04	19038	143
2004-05	20239	641
2005-06	20085	2057
2006-07	20271	4719
2007-08	19839	6928
2008-09	19923	5667
2009-10	21121	5210
2010-11	21872	6610
2011-12	21992	7834
2012-13	22587	8044
2013-14	22719	7088
2014-15	22593	8749
2015-16	24461	8474
2016-17	24204	4971
2017-18	24092	6011
2018-19	24000	7556
2019-20	24551	9199

Source: Fertiliser Statistics and `https://reports.dbtfert.nic.in/mfmsReports/getMonthWiseProductionAndImportDetails.action`.

The economic reforms which were started in 1991 shifted the focus of fertilizer policies away from building the fertilizer industry and ensuring the availability of fertilizers at affordable prices to farmers. Under the neoliberal policy framework, reducing the fiscal burden of fertilizer subsidies and the foreign exchange burden of fertilizer-related imports became the overriding concerns of the state. Interestingly, the post-liberalisation policies have spectacularly failed in both these objectives. At the same time, they have also resulted in a surge in the prices of fertilizers other than urea, and vastly accentuated the urea bias in nutrient application in Indian agriculture.

With the pan-India rollout of the Direct Benefit Transfer scheme in 2018, the government has put in place a framework for targeted fertilizer subsidies. If implemented, the shift from fertilizer subsidies to targeted direct benefit transfers would further deepen the agrarian crisis and will have far-reaching effects on the Indian agriculture.

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Key words

fertilizer, subsidies, nutrient based subsidies, fertilizer productivity, direct benefit transfer, agriculture, agrarian crisis, liberalisation

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