

Executive Summary

Economic Policy Reforms *and* Indian Fertilizer Industry

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Introduction

Agriculture sector is the mainstay of the Indian economy, contributing about 17 per cent of national Gross Domestic Product (GDP) and more importantly, more than half of India's workforce is engaged in agriculture as principal occupation for their livelihood and employment. Successive Five Year plans have stressed on self-sufficiency and self-reliance in foodgrains production and concerted efforts in this direction have resulted in substantial increase in agricultural production and productivity. The main source of this growth was through improvement in yield per unit of cropped area through better seeds, fertilizers, irrigation, rural credit, extension services, product price support, and other institutional and policy interventions. The yield of foodgrains has increased from more than three times from 522 kg per hectare in 1950-51 to 1854 kg per hectare ha in 2007-08, and foodgrains production increased from about 51 million tonnes in 1950-51 to about 231 million tonnes in 2007-08. Production of oilseeds, sugarcane, and cotton have also increased more than four-fold over the period, reaching 29.75 million tonnes, 348 million tonnes and 25.88 million bales, respectively.

Chemical fertilizers are key element of modern technology and have played an important role in the success of Indian agriculture. During the decades of 1970s and 1980s, both foodgrains production and fertilizer consumption registered significant growth but in the 1990s there has been a slow down in growth rates in foodgrains production as well as fertilizer consumption. This deceleration in agricultural sector, although more prominent in dryland areas, occurred in almost all States and almost all sub-sectors such as horticulture, livestock, and fisheries where growth was expected to be high. However, during the last 3-4 years there has been some improvement in their growth but is still less than expected. In order to achieve 4 per cent growth in agriculture during the XIth Five Year Plan, there is a need to sustain this momentum and put these vital sectors on a high growth trajectory.

With the limited arable land resources, and burden of increasing future population, development of new technologies and efficient use of available technologies and inputs will

continue to play an important role in sustaining food security in India. It is expected that India's available arable land might drop below the current level of about 140 million hectares, if the use of farmland for commercial/non-agricultural purpose is not restricted in the near future. Therefore, the only way to improve food security is to increase crop yields through the scientific use of fertilizers along with other inputs like high yielding variety seeds, irrigation, etc. using the limited arable land, with an emphasis on protecting the environment.

The Government of India has been consistently pursuing policies conducive to increased availability and consumption of fertilizers in the country. Over the last five and half decades, production and consumption of fertilizers has increased significantly. The country had achieved near self-sufficiency in urea and DAP, with the result that India could manage its requirement of these fertilizers from indigenous industry and imports of all fertilizers except MOP were nominal. However, during the last 4-5 years there has been a significant increase in imports of urea and DAP as well because there has not been any major domestic capacity additions due to uncertain policy environment. India imported 6.9 million tonnes of urea and 2.72 million tonnes of DAP in 2007-08 to meet their indigenous demand. Imports of fertilizers (N+P₂O₅+K₂O) have increased significantly during the last 5 years, from about 1.9 million tonnes in 2002-03 to nearly 7.8 million tonnes in 2007-08

The significance of fertilizer industry and its related policy in the country arises from the fact that agriculture still contributes a sizeable share of country's GDP and more importantly, it supports nearly two-third of population. Therefore, fertilizer policy in India has been mainly driven by the socio-political objectives of making fertilizer available to farmers at affordable prices and increasing fertilizer consumption. Given the socio-political importance of fertilizer pricing on one hand and ever increasing subsidies on the other hand, the need for streamlining the sector has been felt for a long time. However, fertilizer has become the most contentious issue in reforming Indian economy exposing deep contradictions between economics and politics in the democratic set-up. The economic reforms initiated in 1991 marked the first major attempt at fertilizer sector reforms in India and set the stage for major policy changes in the sector. The government decontrolled prices, distribution and movement for phosphatic and potassic fertilizers in 1992. The low analysis nitrogenous

fertilizers were also decontrolled in June 1994. However, urea, the main nitrogenous fertilizer continued to remain under government controls.

In view of importance of fertilizers in agricultural growth and the changing policy environment, there is need to have an overview of the technical, economic, and policy issues of relevance to fertilizer policy design and implementation for achieving the targeted growth in agricultural sector. The present study attempts a comprehensive and in-depth analysis of the Indian fertilizer sector under the new economic policy regime and its impact on agricultural sector.

Methodology

The study is based in secondary time series data related to fertilizer production, consumption, and imports along with fertilizer prices, output prices, area under irrigation, high yielding varieties, rainfall, subsidies, etc. for global, national and state level in order to examine trends and pattern of growth of fertilizers. In order to identify determinants of fertilizer demand and project future demand for fertilizers, ordinary least square model was used. A comprehensive review of fertilizer policy was done based on synthesis of major policy documents related to Indian fertilizer industry.

Main Findings

Capacity, Production and Trade

The Indian fertilizer industry with a capacity of about 12.28 million tonnes of nitrogen (N) and 5.86 million tonnes of phosphatic (P_2O_5) fertilizers is one of the largest in the world and has played an important role in development of agricultural sector. The Green Revolution in the late sixties and introduction of RPS in the seventies gave an impetus to the growth of fertilizer industry in India and the 1970s and 1980s witnessed a significant addition to the fertilizer production capacity. However, there has not been any substantive capacity addition to fertilizer production during the last 10 years.

Urea is the largest straight nitrogenous fertilizer in terms of capacity and accounted for 78.8 per cent of installed capacity while share of other straight nitrogenous fertilizers such as Ammonium Sulphate, Calcium Ammonium Nitrate and Ammonium Chloride is about 3 per

cent. The share of public sector in N capacity has declined over time while share of private and cooperative sector has increased. However, an important issue confronting the N sector is with respect to the feedstock because natural gas which is the main feedstock for production of nitrogenous fertilizers is available in limited quantities and the industry competes with the power sector for its share. With the Government policy favoring conversion to gas based units, the demand for gas is expected to go up in the future, which may in turn lead to further shortages.

In case of phosphatic fertilizers, DAP constitutes about 55 per cent of total capacity and share of SSP is about 21 per cent and rest is constituted by NP/NPK complexes. The capacity of phosphatic fertilizers, which remained stagnant during the 1950s and early part of 1960s, increased significantly during the seventies and eighties and has stagnated during the last few years. Over the years public sector has lost its share to private and cooperative sectors and today about two-third of the phosphatic fertilizer capacity is in the private sector. Due to limited availability of phosphatic raw materials/intermediates such as phosphoric acid and rock phosphate in the country, domestic units are highly dependent on imports. The high dependence on imports of raw materials exposes the Indian phosphatic industry to highly volatile markets.

In early eighties, N fertilizer capacity was more evenly distributed in all regions. However, due to availability of natural gas and naphtha in western region and Hazira-Bijapur-Jagdighpur (HBJ) gas pipeline in northern region led to more capacity addition in these two regions. In the case of phosphatic fertilizers the maximum capacity creation is in western region accounting for about 47 per cent while north zone accounted for less than 2 per cent of total installed capacity in 2007-08.

Fertilizer production, which grew at an impressive growth rate of over 10 per cent during the 1970s and 1980s, suffered a lot in the post-reforms period. The production increased at an annual compound growth rate of about 5.5 per cent during the 1990s (1991-92 to 2000-01) and growth rate decelerated to one per cent between 2001-02 and 2007-08. Fertilizer production grew at a much faster rate compared to consumption in the pre-reforms period but in post-reforms period growth in fertilizer consumption was higher than production resulting in increased dependency on imports.

The total investment in the fertilizer industry at the end of first plan was Rs. 64.9 crore and reached a level of Rs. 25,644 crore by the end of the 9th Plan. The growth in investment was much faster during the fourth, fifth, sixth and seventh plan periods. However, there was hardly any investment during the 10th Plan which led to a big gap between demand and supply. The cooperative sector which entered fertilizer sector during the fifth plan witnessed a significant increase in its share. The share of private sector also increased significantly, while share of public sector declined.

During 1950s and 1960s, about two-third of domestic requirement of N fertilizers was met through imports. With the introduction of the high yielding varieties of wheat and rice in mid-1960s, the fertilizer imports increased significantly in 1966-67 and thereafter. During the 1980s and 1990s imports were at low levels with few exceptions. However, during the last few years imports have increased significantly due to low addition in domestic capacity coupled with rise in demand for fertilizers. India imported 7.767 million tonnes of fertilizer nutrients (N+P+K) in 2007-08 as against 1.931 million tonnes in 2002-03. In addition, imports of raw materials and intermediates have also increased substantially. The unprecedented volatility and increase in world fertilizer prices mainly due to increased demand for fertilizers in cereal producing countries and rising crude oil prices, affected the cost of imported fertilizers adversely for India. The total value of imports in India increased from Rs. 7423.83 crore in 2005-06 to Rs. 18454.10 crore in 2007-08, an increase of nearly 150 per cent, whereas the total quantity of imported fertilizers increased by about 47 per cent – from 5.3 million tonnes in 2005-06 to 7.7 million tonnes in 2007-08.

Trends and Patterns in Consumption

Total Fertilizer consumption in India is also among the top in the world with total consumption (in nutrient terms) of about 22.57 million tonnes in 2007-08. However, India ranks low in terms of intensity of fertilizers use (kg/ha) in comparison to most of the developing and developed countries in the world. The overall consumption of fertilizers has increased from 65.6 thousand tonnes in 1951-52 to 22.57 million tonnes in 2007-08. Accordingly, per hectare consumption of fertilizers, which was less than one kg in 1951-52, has gone up to the level of 117 kg in 2007-08.

Fertilizer consumption in India is highly skewed, with wide inter-regional, inter-state, inter-district and inter-crop variations. About 18 per cent of the districts in the country accounted for half of total fertilizer use while bottom 53 per cent of the districts accounted for only 15 per cent of total fertilizer used in the country. The intensity of fertilizer use varied greatly from 45 kg per hectare in Rajasthan to 210 kg per hectare in Punjab. Intensity of fertilizer use has generally been higher in northern (82 kg/ha average) and southern (75.1 kg/ha average) region and lower in the western (35.6 kg/ha) and eastern (38.3 kg/ha) regions. The average intensity of fertilizer use in India remains much lower than most countries in the world but in certain states/districts fertilizer use is consistently high. For example in the TE 2007-08, 85 out of 526 districts (16.1%) consumed more than 200 kg per hectare, 62 districts between 150-200 kg, 99 districts between 100-150 kg and 144 districts between 50-100 kg per hectare. On the other hand about one-fourth of the districts had less than 50 kg per hectare fertilizer use much lower than recommended levels. Therefore, there is a need have two pronged strategy, to monitor districts with high intensity of consumption and take corrective actions to check environmental degradation and on the other hand efforts to promote fertilizer consumption in low-use districts to improve crop productivity

One of the major constraints to fertilizer use efficiency in India is imbalance of applied nutrients partly as the result of a difference in price of nutrients, and partly due to the lack of knowledge among farmers about the need for balanced fertilizer applications. The N:P:K ratio was little skewed towards N in mid-1970s but started improving in the late 1970s and 1980s and reached a level of 5.9:2.4:1 in 1991-92. However, decontrol of P and K fertilizers and steep increase in prices in the early 1990s resulted in decline in their consumption and consequent imbalance in the use of fertilizers. The NPK ratio which was at 5.9:2.4:1 during 1991-92 widened to 9.7:2.9:1.0 during 1993-94 and reached a level of 10.0:2.9:1 in 1996-97. However, due to concerted efforts of the government like increase in concessions on phosphatic and potassic fertilizers and an increase in price of urea in 1997 led to improvement in NPK ratio and reached a level of 5.5:2.1:1.0 in 2007-08. There are wide inter-regional and inter-state disparities in N:P:K ratios. Greatest degree of N:P:K imbalance was seen in case of Haryana (37.7:10.7:1.0) followed by Rajasthan (37.4:14.3:1.0) and Punjab (27.7:7.6:1.0) in 2007-08 but the ratio has improved over time.

There is a high degree of inequality in fertilizer consumption among crops and rice, wheat and sugarcane are the prime beneficiaries. Rice is the largest user of fertilizer (36.8% of total consumption), followed by wheat (23.8%). Fruits, vegetables, and sugarcane combined represented another 10 per cent of fertilizer use. Given the importance of foodgrains and recent efforts of the government to bring more area under foodgrains, they will be particularly important crops for stimulating the use of fertilizer. In addition rising demand for high-value crops (fruits and vegetables) due to increasing income level, urbanization, changing lifestyle, demand for fertilizer is also expected to increase as these crops are fertilizer-intensive crops. Fertilizer consumption also varies across farm sizes but there is a fair degree of inter-farm size equity in fertilizer consumption. The share of small and marginal farmers in gross cropped area was 42.6 per cent and they consumed 52 per cent of total fertilizer used in the country. On the other hand, share of medium and large farmers in gross cropped area was nearly one-third and consumed over one-fourth of total fertilizers. Significantly over 77 per cent of gross cropped area was fertilizer on marginal farmers while less than half of the cropped area was fertilizer on large holdings. Moreover, intensity of fertilizer use was higher on small and marginal farms as compared to medium and large farmers.

Fertilizer Policy, Prices and Subsidies

The Indian Fertilizer industry, given its strategic importance in ensuring self-sufficiency of foodgrains production in the country, has been under strict government control for most of the period since independence. Major controls on prices and distribution of fertilizers were introduced in 1973 (Fertilizer Movement Control Order) and movement of fertilizer was brought under the Essential Commodity Act (ECA). A price and distribution control system was considered to be necessary not only to ensure fair prices and equal distribution all over the country but also to provide incentives for more intensive use of fertilizers. In 1977, the Retention Price cum Subsidy Scheme (RPS) was implemented, which encouraged investment in the sector by assuring a 12 per cent post-tax return over net worth to the fertilizer producers. Though the government interventions helped in meeting the objective of

ensuring creation of capacities and ultimately achieving self-sufficiency in foodgrains production, it did not encourage improving efficiencies in the sector.

With the burgeoning subsidy bill and the need to focus on fiscal prudence, government policies in the post-reforms period were aimed at encouraging efficiencies in the sector. The economic reforms initiated in 1991 marked the first major attempt at fertilizer sector reforms in India and set the stage for major policy changes in the sector. In August 1992, government decontrolled prices, distribution and movement for phosphatic and potassic fertilizers, while the low analysis nitrogenous fertilizers were also decontrolled in June 1994. However, urea, the main nitrogenous fertilizer continued to remain under government controls. The government's efforts at initiating reforms in fertilizer sector in general and urea in particular has involved the appointment of a number of committees including High Powered Fertilizer Pricing Policy Review Committee (1997-98), Y.K. Alagh Committee (2000), Expenditure Reforms Commission (2000), and Group of Ministers (GoM, 2002). The recommendations of the GoM formed the basis for the New Pricing Scheme (NPS) announced in 2003, which aims at inducing urea units to achieve efficiency besides bringing transparency and simplification in subsidy administration. The NPS is being implemented in stages (3 stages) and phased decontrol of urea has been undertaken under the NPS. In the case of phosphatic fertilizers, based on the recommendations of the Expert Group on Phosphatic Fertilizer Policy the pricing of the phosphatic fertilizers were linked to price in the international market and future scenario and the pricing of indigenous DAP to the price of imported DAP in the international market. The partial decontrol/deregulation of phosphatic and potassic fertilizers, complete decontrol of complex fertilizers and controls on urea have led to imbalanced use of fertilizers. However, in order to promote balanced use of fertilizers and improve soil health, government took a positive step and introduced nutrient-based pricing of subsidized fertilizers including complex fertilizers in June 2008, which is expected to increase use of complex fertilizers, thereby promote balanced use of nutrients. The policy encourages the joint venture projects in raw material surplus countries through committed off-take contracts with pricing decided on the basis of prevailing market conditions and in mutual consultation with the joint venture partners.

While world fertilizer prices have been rising gradually since 2004 and in 2007 and 2008 the world witnessed an escalating phenomenon with prices reaching four digit figures. Prices were mainly driven up by an imbalance between supply and rapidly increasing demand mainly in Asia, particularly strong in China and India. Another factor was increased demand for fertilizers to produce biofuels in the United States, Brazil and Europe. High energy prices led to an increase in the price of natural gas (main raw material for nitrogenous fertilizer production), and sulphur and phosphoric acid (used for production of phosphatic fertilizers) which also caused the fertilizer prices to rise. World fertilizer prices started falling significantly in late-2008 after reaching all time highs in 2008 mainly due to low demand because of slow down in world economic growth and declining energy prices. The results clearly showed that fertilizer prices are driven by agricultural commodity prices as well as feedstock prices

As against high volatility in world prices of fertilizers, domestic prices have remained fairly stable in the country. Prices of major fertilizers like urea, DAP and MOP remained constant during the decade of 1980s. During the decade of 1990s prices of all fertilizers witnessed large increases but have remained at the same level since 2002-03. Relative prices of N, P and K are important as they affect the consumption pattern. The results of relative prices of fertilizers to foodgrains (wheat and paddy) revealed that whenever the parity ratio between wheat/paddy and fertilizer increased, there was either decline in consumption of fertilizers or consumption almost remained stagnant. In the post reforms period (1991-92 to 2007-08) the parity ratio between crop and fertilizer prices favored crop and became more favorable overtime. Consequently, these years witnessed significant increase in consumption of fertilizers

The burden of fertilizer subsidies on the budget of central government has grown dramatically over the years, from Rs. 505 crore in 1980-81 to a historical high of about Rs.75849 crore in 2007-08. Fertilizer subsidy as a proportion of GDP at current prices after expanding from 0.24 per cent in the 1981-82 to a peak of 1.03 per cent in 1989-90, started to decline and reached at 0.62 per cent in 1993-94. In a subsequent reversal of trend, it reached almost 0.74 per cent in 1999-2000, but declined since and was estimated at 0.47

per cent in 2003-04. However, it started increasing from 2004-05 onwards and reached a record level of 1.52 per cent in 2008-09.

The distribution of fertilizer subsidy among states showed that a large share of total fertilizer (54.5%) subsidy is cornered by top five states, namely, Uttar Pradesh, Andhra Pradesh, Maharashtra, Madhya Pradesh and Punjab. The per hectare subsidy in Punjab (Rs. 3924) was more than four times compared with states like Orissa (Rs. 824) and Rajasthan (Rs. 894). The average subsidy on per hectare basis more than doubled between 1992-93 and 1999-00 (from Rs. 331/ha to Rs. 703/ha) and almost tripled between 1999-00 and 2007-08. Overtime, however, the inequalities in fertilizer subsidy among states have declined sharply. The benefits of fertilizer subsidy have spread to unirrigated areas as the share of area treated with fertilizers has increased from 41 per cent in 1996-97 to 53.5 per cent in 2001-02 on unirrigated lands. It is evident that benefits of fertilizer subsidy are not restricted to only resource-rich areas but have spread to other areas as well. Among crops, paddy and wheat are the major users of fertilizer subsidy accounting for over half of the total subsidy. The inter-farm size distribution of fertilizer subsidy showed that subsidy is distributed more equitably among different farm sizes compared with crop-wise and state-wise distribution of fertilizer subsidy. The average subsidy as well as share in total subsidy was the highest on marginal farms and the lowest on large farms. Moreover, the share of small, marginal and semi-medium farms has increased between 1996-97 and 2001-02.

There is a lot of debate in the literature about fertilizer subsidy. Various economic and non-economic arguments (to promote technology adoption, stimulate rapid market development, market failure, to control output prices, etc.) have been advanced to justify the use of fertilizer subsidies. In contrast many arguments have been invoked against the use of subsidies on fertilizer. For example fertilizer subsidy schemes tend to have extremely high fiscal costs that make them financially unsustainable, high administrative costs, and lead to inefficiency at farm level and corruption in the system. The issue of distribution of subsidies between farmers and fertilizer industry has been a matter of debate. Gulati and Narayanan (2003) estimates showed that the share of subsidy going to farmers varied from 24.54 per cent in the TE 1983-84 to 127.83 per cent in the TE1995-96 with an average of

67.5. However this simple comparison between farm-gate cost of imported fertilizers and the actual price paid by the farmer is not a good indicator due to the following reasons:

- i. The assumption of world fertilizer markets being perfectly competitive market is not a valid assumption as fertilizer market is not perfect market and has always been dominated by a small number of buyers and sellers.
- ii. The assumption that India's entry into the world market, as an importer of fertilisers would not have affected world price is also not a realistic assumption. There is evidence that entry of major importers like China and India influences the world price significantly.

Agricultural Production and Fertilizer Use

There has been a decline in agricultural NDP in the post-reforms period. The growth rate of net domestic product from agriculture has declined from over 11.5 per cent during the 1980s and 1990s to 3.4 per cent in 2000s. While there has been a decline in agricultural NDP in the post-reforms period, there are considerable regional variations across the country. With regard to the period 2001-02 to 2007-08, the state wise analysis showed wide variations in growth of NDP from agriculture ranging from 10.9 per cent in Gujarat to -4.6 per cent in Jharkhand. Majority of the states had a very high correlation between total NSDP and agricultural NSDP, there is a need to focus on agricultural growth to promote more broad-based and inclusive growth.

The association between foodgrains production/productivity and fertilizer use was strong during the 1970s and 1980s (correlation coefficient 0.94) but weakened thereafter and the reached a level of 0.84 during the 1990s and further to 0.72 during the 2000s. The state-wise trends in association between fertilizer consumption and foodgrains production and productivity revealed that the share of states having strong association declined from about 41 per cent in 1990s to 23.5 per cent in 2000s. Andhra Pradesh registered the highest association (0.94), followed by Maharashtra (0.90) and Gujarat (0.88). Apart from these states, Karnataka (0.85) and Tamil Nadu (0.80) showed strong relationship. States like Punjab, Uttar Pradesh, West Bengal, Madhya Pradesh, Rajasthan and Bihar had correlation coefficient lower than all-India average of 0.72. The results clearly showed that the linkages

between agricultural production/productivity and fertilizer use in the country have weakened during the past few years. This is a major challenge and needs an urgent attention of policy planners and industry to reverse this trend.

Demand for Fertilizers

While examining major determinants of fertilizer use, it was found that non-price factors were more important in influencing demand for fertilizers. Among the non-price factors, irrigation was the most important factor influencing fertilizer demand, followed by cropping intensity. The price of fertilizers was the third important determinant of fertilizer use in the country. Price of output was less important compared with input price. The results clearly indicated that increase in area under irrigation, and cropping intensity will accelerate fertilizer consumption in the country. In case of pricing policy instruments, between prices of fertilizers and prices of crops, the former are more important than the latter in determining demand for fertilizers. Therefore, prices of fertilizers which have inverse relationship with fertilizer demand should be kept at affordable levels to promote rapid growth in fertilizer use in different parts of the country. The role of product price support policy in generating growth in effective demand for fertilizers and consequently higher growth in agriculture, however, was overemphasized during the 1990s. Despite very favorable output price conditions during the 1990s, agricultural sector had a low growth rate. Therefore, it is necessary to prioritize input price policy mechanism over higher output prices.

The projections of fertilizer nutrients under different scenarios/assumptions show a range of demand figures of total nutrients between 24 and 28.5 million tonnes by 2011-12, the terminal year of 11th Plan and between 26 and 34 million tonnes by 2015-16. If variables affecting fertilizer use grow at the rate of last five years, the total nutrient requirement will amount to about 34 million tonnes, which includes 20.4 million tonnes of N, 8.9 million tonnes of P and 4.7 million tonnes of K by the end of 2015-16. The N:P:K ratio, which was 5.5:2.1:1.0 in 2007-08 is projected to be 4.3:1.9:1.0 in 2015-16. The demand for urea is projected to be around 30.85 million tonnes by 2011-12 and 36.27 million tonnes by 2015-16 under scenario I (based on last five year growth) while the corresponding figures under

scenario II (based on last 10 year growth) were 26.02 and 28.25 million tonnes , respectively. The demand for DAP, complex fertilizers (excluding DAP) and SSP would be nearly 9.86, 8.9, and 3.86 million tonnes, respectively under scenario I and 8.1, 7.32 and 3.17 million tonnes under scenario II by 2011-12. The demand for MOP would be around 4.2 and 3.39 million tonnes under scenario I and II, respectively.

World Markets

Global consumption of fertilizer (N+P+K) has risen from 116.1 million tonnes in 1980-81 to about 169 million tonnes during 2007-08, representing an annual compound growth rate of just over one per cent. The growth rate in N consumption was maximum (1.62%), followed by P fertilizers (0.48%) and the lowest in K fertilizers (0.11%) between 1980-81 and 2006-07. The share of nitrogenous fertilizers in total fertilizer use is the highest (57.6%), followed by P₂O₅ (24%) and K₂O (18.4%). The share of N fertilizers has increased between during the last two and half decades while share of P and K fertilizers has declined in the world.

During 2007-08 global fertilizer consumption rose sharply due to strong agricultural commodity prices during the first half of 2008 and strong policy support in many developing countries (Figure 6.3). Because of the economic slow down during the second half of 2008, global fertilizer consumption in 2008-09 is expected to decline by about 2.2 per cent, to 165 million tonnes nutrients. It is expected that after a likely depressed first half of 2009, fertilizer demand could recover during the second half of the year.

Demand for nitrogenous fertilizers continues to be high in East and South Asia, which accounted for about 57 per cent of world consumption, North America accounted for 13.9 per cent of world consumption and Western and Central Europe 11.8 per cent. The other regions (Africa, Eastern Europe, Central Asia and Oceania) each account for about 2-3 per cent of world N fertilizer consumption. About two-third of N consumption is concentrated in three countries, namely, China, USA and India. Urea is the most commonly used nitrogenous fertilizer product and represented about 54 per cent of all nitrogenous fertilizer products consumed globally.

In the case of phosphatic fertilizers, Asia (East and South Asia) is the largest consumer accounting for 53.5 per cent share, followed by Latin America (13.1%) and North America

(12.5%). China, USA and India are the top consumers of P fertilizers and accounted for over 60 per cent of global consumption. The ammonium phosphates (mono- and di-ammonium) accounted for 47.8 per cent of global fertilizer phosphate fertilizer consumption in 2005. The share of NPK complexes was 22.9 per cent, SSP 17.4 per cent and TSP 6.3 per cent.

East Asia accounted for about one-third of world K₂O consumption while Latin America and North America each with 17.9 per cent share were the second largest consumers of K₂O. Other important K₂O consuming regions are West and Central Europe (13.7%) and South Asia (9.3%). China ranks number one in K consumption with a share of 26.4 per cent, followed by USA (19.4%) and Brazil (11.4%). India is the fourth largest consumer with a share of 7.9 per cent. The muriate of potash (MOP) is the most popular potassium fertilizer with an estimated share of 88 per cent, followed by Potassium sulphate (8%) and Potassium nitrate (4%).

Fertilizer application rates vary widely among the major world regions and countries. Per hectare fertilizer use varies from about 9 kg in Sub-Saharan Africa to 278 kg in East Asia. Wide variations are also prominent among different countries of the world. For example, fertilizer use varies from a low of about 18 kg per hectare in Nepal to a high of about 666 kg per hectare in Netherlands. The world average application rate is about 109 kg per hectare.

China is the world's largest producer and accounts for 25.1 per cent of world production, the U.S. 10.5 per cent, Russian Federation 9.2 per cent, Canada 8.9 per cent and India 8.8 per cent and the top five producers account for about 62 per cent of global fertilizer production.

Total exports of N fertilizers increased from 19.7 million tonnes in 1991-92 to about 27.6 million tonnes in 2006-07 at a growth rate of about 1.7 per cent. The growth in exports of N fertilizers was marginally higher (2.7%) during the 1990s compared with 2000s (2.3%). The exports ranged from 19.7 million tonnes to about 27.7 million tonnes.

Russian Federation, the largest exporter of nitrogenous fertilizers, accounts for 17.5 per cent share in global exports. Ukraine was the second largest exporter with a share of 6.1 per cent. The top five exporting countries controlled about 44 per cent of global exports. USA was the largest importer of nitrogenous fertilizers with a share of 17.4 per cent in world

imports. Brazil was the second (6.1%) and India the third largest (5.7%) importer of nitrogenous fertilizers in TE2006.

USA is the largest exporter of phosphatic fertilizers, which accounts for nearly one-third of the global trade. Russian Federation is the second largest exporter (17%), followed by Morocco (7.8%) and Tunisia (7.1%). The top five exporters control over 70 per cent of global trade in phosphatic fertilizers. The largest markets for P₂O₅ are Brazil, China, India, Pakistan and Argentina with a combined share of over 37 per cent of world imports. World exports are more concentrated in a few countries while imports are more dispersed around the world.

Africa with 60.7 per cent share is by far the largest exporter of rock phosphate. Middle East with 22.6 per cent share in world export comes second. The major markets for rock phosphate are Western Europe (19.4%), South Asia (18.5%) and East Asia(16.2%) with more than half of global imports. Latin America, Central Europe and North America are other major importers of rock phosphate.

Morocco remains the world's largest rock exporter with a 45.5 per cent share of global exports while Jordan is the second largest exporter with about 11 per cent share, followed by Syria (9.8%) and Russia (8.8%). India is the world's leading consumer of rock phosphate accounting for about 19 per cent of world imports. The world exports are concentrated while imports are more diversified.

The six leading potash producing countries (Canada, Russia, Belarus, Germany, Israel, and Jordan) accounted for over 90 per cent of global potash trade during the TE 2006. The export shares were 33.9 per cent for Canada, 20.1 per cent for Russia, 15 per cent for Belarus, 11.1 per cent for Germany, 6.8 per cent for Israel and 3.8 per cent for Jordan. Asia is the largest potash-consuming and importing region with two leading potash consumers, China and India.

Global fertilizer demand increased sharply in 2007-08, boosted by strong agricultural commodity prices during the first half of 2008. However, unprecedented rise in prices of fertilizers due to high raw material costs, freight rates, and slow down in the global and national economies adversely affected the demand for fertilizers in 2008-09. The softening

of oil prices, fall in ocean freight rates and improvement in market conditions in some regions might improve prospects for global fertilizer demand.

Important Policy Implications

What are the policy implications of the above conclusions to generate sustainable rapid growth in fertilizer use to ensure national food security?

There is undisputable need for continuous rapid growth in fertilizer use especially in less-consuming regions in the country in the coming years to increase agricultural production and productivity at the desired rate. In order to meet the additional demand, there is a need to increase fertilizer supplies and generate effective demand. Sustained growth in fertilizer demand mainly depends on increase in supplies (domestic vs. imports), creation of adequate and efficient distribution network and increase in effective demand for fertilizers at farm level. Major policy recommendations in these three areas are given below:

Enlargement of Domestic Capacity and Production

With rising demand for fertilizers and no major domestic capacity addition during the last few years, the industry has been exposed to world markets, which are not perfectly competitive and thus highly volatile. The rising imports of fertilizers are a cause of concern and require an urgent attention. India being one of the largest consumers of fertilizers in the world has significant impact on world trade and prices.

Several academicians have criticized the Indian fertilizer industry for its inefficiencies (Gulati, 1990, Gulati and Narayanan, 2003, Srivastava and Rao, 2002). However, some of these studies have not taken into account the nature of world fertilizer markets and role of fertilizers in achieving broad-based employment-led economic growth. First, the world fertilizer market is not perfectly competitive as production and trade are highly concentrated in few countries/players, which leads to high volatility in world prices. Moreover, entry of large countries like India and China influences the world markets greatly as the world fertilizer markets (mainly N and P) are thin markets. For example, there was an increase in imports of fertilizers by India in the recent years and these imports influenced the world prices and imports were costlier than domestic costs. The import parity price of

urea increased from Rs. 7240 per tonne in July-September 2003 to about Rs. 25717 per tonne in April-June 2008 (more than 350% increase). Likewise, the average concession on imported DAP fertilizer increased from about Rs. 6000 per tonne in early-2007 to Rs. 15795 per tonne in March 2008 and Rs. 50081 per tonne in June 2008 (more than 800% increase). Second, fertilizer subsidies benefit small and marginal farmers more than large farmers and also farmers in less-developed regions as fertilizer use has increased in unirrigated areas over time.

The above discussion clearly suggests that domestic markets need to be insulated from world markets. Therefore it is necessary to encourage domestic capacity additions to achieve self-sufficiency in fertilizer production in the country.

Another important issue confronting the sector is with respect to the feedstock. Natural gas which is the main feedstock for production of nitrogenous fertilizers is available in limited quantities and the industry competes with the power sector for its share. With the Government policy favoring conversion to gas based units, the demand for gas is only expected to go up in the future, which may in turn lead to further shortages. There is a need to ensure stable supplies of gas to fertilizer sector and also promote investments in gas-surplus countries. It is true that gas is the most efficient feedstock for urea production but some plants using mixed feedstock like gas as well as naphtha (although less efficient) would promote efficient utilization of available naphtha and enlarge the choice of raw materials. In the case of phosphatic fertilizers due to limited availability of domestic phosphoric acid and rock phosphate, the industry is dependent to a large extent on imports. In view of the limited domestic availability of the feedstock, promoting joint ventures in surplus countries would improve the efficiency of the sector.

Promote Effective Demand for Fertilizers at Farm Level

The findings suggest that non-price factors mainly irrigation, and high yielding varieties are the most important factors affecting fertilizer demand in the country. Therefore, important measures required to increase demand for fertilizers include development of irrigation facilities at an accelerated rate, rapid promotion of fertilizers under rainfed conditions, and more coverage of area under high yielding varieties particularly in central and eastern

regions of the country. Rapid expansion of fertilizer use in rainfed areas will reduce the disparities between irrigated and unirrigated areas as well as increase production of certain crops which are mainly grown under rainfed conditions. Availability of credit is also important determinant of fertilizer use in the country, and hence, easy availability of credit would facilitate rapid growth in fertilizer. Therefore, there is a need to prioritize technological/non-price factors over the price policy instruments.

Price Policy Instruments

Price factors, fertilizer prices and crop prices, influenced fertilizer consumption but were less powerful in influencing fertilizer demand than non-price factors. The price of fertilizer had adverse impact on fertilizer use while output prices had a positive impact on fertilizer consumption. Between prices of fertilizers and prices of crops, the former were more important than the latter in determining demand for fertilizers. The prices of fertilizers which have negative affect on fertilizer demand should be kept at affordable levels to promote rapid growth in fertilizer use in different parts of the country. Therefore, it is necessary to give priority to input price policy mechanism over higher output prices.

Fertilizer Pricing Policy

In order to promote efficient and balanced use of fertilizers, an appropriate fertilizer pricing policy is a prerequisite. Current pricing and subsidy schemes generally do not include secondary and micronutrients, which are deficit in Indian soils. The pricing policy should address the issue and promote balanced use of macro, secondary and micro nutrients. The government has taken a good step by moving from the product-based subsidy and pricing mechanism to a nutrient-based subsidy and pricing mechanism. There is also a need to keep parity between N, P and K prices. The unchanged fertilizer prices over a period of time also cause adverse impact on viability of the industry and increase subsidy burden. Therefore, a long-term fertilizer pricing policy that promotes fertilizer use as well as production is needed. The fertilizer prices should be increased marginally periodically but not completely linked to procurement prices as high procurement prices benefit the large farmers while input subsidies benefit all categories of farms in general and small and marginal farmers.

Fertilizer Subsidies

The burden of fertilizer subsidies has increased substantially during the last few years but these subsidies are justified on several grounds. Although there is a high degree of inequity in distribution of fertilizers across states and crops, there is a fair degree of equity in distribution of these subsidies across different farms sizes. Small and marginal farmers are key beneficiaries of fertilizer subsidies but they do not benefit from higher output prices. Moreover, benefits of fertilizers subsidies are not restricted to only irrigated areas but have spread to rainfed areas. A reduction in fertilizer subsidy is, therefore, likely to have adverse impact on the income of marginal and small farmers. Increase in fertilizer prices would lead to reduction in fertilizer use on these farms and consequently lower production and productivity. An increase in prices of fertilizers is also likely to have adverse impact on agricultural production in low-fertilizer using regions growing mainly coarse cereals, pulses and oilseeds.

The targeting of fertilizer subsidies (geographical targeting between regions, states and districts, and farm size targeting between different categories of households) is a critical and sensitive issue. Since it is practically not feasible to develop an effective targeting system that reaches poorer households/regions, comprehensive coverage of all farm households is a better alternative than ineffective targeting. However, efforts are required to contain subsidies through periodic revisions of farm-gate prices of fertilizers and reducing costs of production of fertilizers. If there is a significant reduction/withdrawal of fertilizer subsidy, it would have serious adverse affect on agricultural production and consequently threaten the national food security. On the other hand no change in prices of fertilizers over a period of time and disparity in prices of different nutrients also lead to adverse impact on fertilizer production and land productivity.