

Frank Notes

Sustainable Fertilizer and Agriculture

India's fertilizer sector, being pivotal in its agriculture transformation, has been playing a key role in moving the country from food deficit to self-sufficiency. Spurred by the Green Revolution in the 1960s, India rapidly increased food production through extensive use of fertilizers, high yielding variety of seeds, and improved irrigation. There has been considerable increase in use of fertilizers and HYV seeds along with area under irrigation. This strategy raised food grain production from 108 million metric tonnes (million MT) in 1970-71 to 332 million MT in 2023-24, positioning India as a major rice exporter and boosting farmers' income. Production of fruit and vegetable crops has increased from about 29 million MT to 112 million MT, and 59 million MT to 210 million MT from 1991-92 to 2023-24, respectively, showing a growth of more than 3½ times over the years. Same is the story for other crops.

The population of India is expected to be 1.46 billions by 2030 and 1.61 billions by 2050. This would translate to gross requirement of 353 million MT and 418 million MT of foodgrains at the end of respective years. The food grain production to meet the requirement would not be possible without contribution from fertilizers. An estimate of the production of nutrients through conventional fertilizers and alternate products like bio-fertilizers, city compost, nano-fertilizers, etc. were made by FAI. Considering the aggressive growth rate of alternative fertilizers, the major requirement of nutrients at the end of each year would be fulfilled by conventional fertilizers. It is estimated that for the year 2030 and 2050, the projected gross requirement of N+P+K nutrients would be 36 MMT and 50 million MT, respectively of which about 88% during 2030 and 81% during 2050 would be met by conventional fertilizers.

Sustainable growth in agriculture is of paramount importance to meet the growing need of burgeoning population in terms of food, feed, fuel and fibre. There has been inter-year and inter-state variation in agriculture growth over the years. Use efficiency of nitrogen is around

50% in upland crops and less than 35% in water logged rice, phosphorous 15-20%, and potash about 60%. Use efficiency of micronutrients varies from 2 to 5%. Many other challenges are cropping up such as limitation of soil and water resources, stagnation of net cultivated area, adverse effects of climate change, loss of biodiversity, floods in certain areas and droughts in other areas, deterioration of soil health, decline in crop response ratio to fertilizers, lack of capital investment, etc. It is a fact that there exists a direct correlation between fertilizer use and agriculture production and it will continue to be so in future. However, holistic approach has to be adopted to address the challenges.

Resource conservation is very important for sustainable agriculture. Development of new products, which are more apt to optimize nutrient use. Products like nano-urea, nano-DAP have low environmental footprint during its lifecycle and thus would play an important role in sustainable agriculture in coming years. Soil is the most important medium required for agriculture. Sustaining the quality of soil is very important for ensuring growth in the crop productivity. Use of bio-fertilizers and organic fertilizers needs to be given more impetus to supplement conventional fertilizers and improve nutrient use efficiency. Neem coated urea, made mandatory from 2015, has been helping to improve nitrogen use efficiency. Further, use efficiency of nitrogen through sulphur coated urea is higher than conventional urea and production of the same has started in one plant for use by the farmers.

India is largely dependent on imports for critical raw materials, such as natural gas, rock phosphate and potash where dependency is to the tune of 80%, 90% and almost 100%, respectively. Urea, DAP and NP/NPKs are also imported. In the past few years and more recently, the price volatility forced India to look for alternative sources for fertilizers and sustainability in agriculture. The domestic P&K industry has been supporting the demand but not able to fully utilize the capacity due to poor

For long-term sustainability in Fertilizer and Agriculture Sectors, a holistic approach is needed to enhance productivity and confronting climate related challenges

viability. The SSP fertilizer, which is manufactured indigenously, has been suffering due to higher cost and low realisation. The sustainable efforts in enhancing domestic phosphatic finished products would entail promotion and application of alternative fertilizers like Nano-DAP and phosphate rich organic manure supplement the demand. Government has launched schemes such as PM-PRANAM to encourage use of alternative fertilizers. As a long-term measure, exploration/exploitation of phosphate minerals from the existing mines needs to be accelerated. Indian mines are having low-grade phosphate reserves. Technologies for utilizing low-grade phosphate to produce phosphoric acid needs to be incentivized which can be utilized to produce customized and low analysis fertilizers.

The New Investment Policy 2012, resulted in six new urea plants adding a capacity of 7.6 million MT of urea. The additional capacity has resulted in reduction in import of urea. During 2023-24, import of urea was 7.0 million MT and at 2.5 million MT during first six months of 2024-25. One more urea plant is under construction, which will be able to further contribute to domestic production in 2025.

Fertilizer production and use also generate green house gases (GHGs). Production process have been revamped/retrofitted to improve efficiency & reliability along with measures to reduce emissions. Effectively, carbon dioxide emissions from ammonia-urea plants have reduced by almost 47% in last 36-year period. Further, Government of India has been promulgating use of renewable energy and green hydrogen & ammonia. The policy envisages replacement of imported grey ammonia with green. About 30% of the import requirement is expected to be replaced in the initial phase starting 2027-28. The cost of green ammonia is not viable at present and would need time before it becomes economical without fiscal support. Till such time,

natural gas can be a transient fuel towards green economy. The government has also been promoting natural gas as cleaner fuel and aims to increase its share in energy basket from 6% to 15% by 2030. Accordingly, a few urea projects based on natural gas can be planned which can help in meeting domestic requirement in a sustainable manner.

The concerns raised about the GHG emissions from application of fertilizers can be mitigated by adopting practices like precision agriculture, balance fertilization, digitalization, etc. Improving soil health would also help in sequestration of carbon. However, focussed research is required to develop technologies enhancing carbon sequestration by soil as well methodology to estimate the same. Investment is required for capacity building in terms of infrastructure and human resource. Extension services are the important link between the industry and the farmers. They have to play an active role to promote balance fertilization and adoption of latest technologies and digital agriculture for sustainable agricultural practices.

Notwithstanding the challenges, the industry has been responsibly making fertilizers available for use by farmers across the country over last 7 decades through meticulous planning of production and import. There are some policy related issues for urea and phosphatic sectors, which are under consideration of the government. Industry look forward to amicable resolution to make domestic production viable in the long-run and effectively contribute in supply of fertilizers to farmers on a sustainable manner.

FAI Annual Seminar 2024 has been devoted to the theme of **Sustainable Fertilizer and Agriculture**. Various areas concerning to the theme will be under discussion such as reforms in fertilizer sector towards sustainability; innovations in fertilizers; importance of digitalization in agriculture; use of bio-fertilizers and organic manure; key areas of sustainable fertilizer production; innovative fertilizer strategies, etc. It is hoped that conclusions and recommendations from the Seminar will be helpful to policy makers and other concerned to fertilizer and agriculture sectors. ■