

Sustainable Fertiliser Management

Frank Notes



Dr. Suresh Kumar Chaudhari

Together, fertiliser and agriculture account for nearly 2.5% of global greenhouse gas (GHG) emissions, underscoring the urgency of targeted nutrient management strategies. Across the globe, fertiliser industry is actively aligning efforts to address critical challenges of agricultural productivity, supply chain resilience, and climate-related risks. Governments and policy think tanks have been deliberating on pathways to balance productivity with sustainability. Across continents, policy drivers are converging on the promotion of precision farming, digital agriculture, and the decarbonization of fertiliser production.

India is in the forefront due to an agrarian economy, largest populous country, the second largest producer and consumer of fertilisers. Sustainability has always been the centre point of all discussions. The Government has been proactively formulating various schemes for restoring soil health, reducing environmental impacts, and supporting sustainable and organic farming systems promoted under government programs such as Prime Minister Program for Restoration, Awareness, Nourishment and Amelioration of Mother Earth (PM-PRANAM), Paramparagat Krishi Vikas Yojna (PKVY), National Mission for Sustainable Agriculture (NMSA), National Project on Organic Farming, National Mission on National Farming, Galvanizing Organic Bio-Agro Resources Dhan (GOBARdhan).

Soil is the foundation of agriculture and it is crucial to recognize that their vitality is fundamental to ensuring food security and advancing sustainable farming. Restoration of soil health is interlinked to the integrated nutrient management (INM) practices, site-specific nutrient management (SSNM), organic, natural farming, conservation and regenerative agriculture, adoption of modern technologies and practices, etc. Research has proven

that imbalanced nutrient application leads to a lower benefit-cost ratio compared to balanced fertilisation and INM practices across most of the crops. Precision agriculture ensures that inputs are applied in the right quantity at the right time, reducing wastage, lowering costs, and minimizing environmental impact. Moreover, precision irrigation techniques, such as drip irrigation and subsurface drip fertigation, optimize water use by delivering water directly to the root zone, thereby reducing water loss. Conservation agriculture and regenerative agriculture practices lead to restoration and enhancement of soil fertility, soil structure, and reduce soil erosion. Alternative fertilisers such as organic fertilisers, bio-fertilisers and new age fertilisers hold a great promise in promoting INM. Use of artificial intelligence (AI) and machine learning (ML) can further refine precision agriculture and enable farmers to make data-driven decisions. Therefore, there is a need to have a holistic approach towards application of nutrients from the sources as per the need of crop and soil for sustainable growth in agriculture. Further, strengthening the farmers in the value chain helps to improve the income.

The Government of India has been undertaking a series of initiatives aimed at enhancing fertiliser availability for farmers, rationalizing sectoral policies, and introducing new products. However, there is no respite and imbalance in use of fertilisers has been resulting in many problems to agriculture. The imbalance is partly due to distortion in price ratio of urea with respect to P&K fertilisers. This distortion has been created due to application of more nitrogen than phosphate and potash. The way out to promote balanced use of N, P and K is to make changes in pricing policies for urea and P&K sectors. Urea is governed by cost plus approach having a fixed MRP (very low) and variable cost of production (very high). To protect the farmers from high cost of production, the difference in cost of production and MRP is reimbursed in the form of subsidy to the industry. In the P&K sector, there is fixed subsidy, which is given based on the nutrient content in a product and MRP of P&K is market driven. However, in the last two years, due to geopolitical situations and supply-chain concerns, prices of raw materials and intermediates for production of DAP and other complex fertilisers have significantly risen. Further, the prices of finished product of DAP and other NP/NPK complex fertilisers have also increased. To insulate the

The Indian fertiliser industry has responsibly been ensuring availability of fertilisers across the country to the farmers. Fertiliser management in all aspects from production, distribution, marketing and application have to be aligned to the same objective of sustainability in each element of value chain.

farmers from any such price shocks, the government has capped the MRP of DAP through additional support. Government made timely interventions to secure supply agreements with countries such as Morocco, Saudi Arabia, and Qatar for the import of DAP. However, this has created an imbalance in the prices of DAP w.r.t. other NP/NPK fertilisers. There are guidelines for reasonableness of profitability for complex fertilisers. The operation within the boundaries exposes industry to viability risk. In case of urea sector, all the variable cost and fixed cost is calculated by the government. In the past, there has been tightening of energy norms. The non-revision of fixed cost and reduction in energy norms have limited the capacity of the plants to reinvest into modernization. Presently, the revision of energy norms and fixed cost are under review. The industry is looking forward for a revision that will safeguard the long-term sustainability of the urea sector.

The conventional fertiliser producing plants have been making efforts to decarbonize through energy efficiency improvement in the existing plant and equipment. The ammonia-urea plants have undergone a series of revamp and retrofit, change of fuel and feedstock from fuel oil and naphtha to natural gas to improve efficiency and reduce GHG emissions. Technological interventions are available for the plant and machines to improve processes, reduce energy consumption and GHG emissions. These have been successfully demonstrated in India and other countries. Green ammonia holds significant promise for decarbonization of fertiliser sector. The green ammonia production has a challenge of high cost and variability of power. Small-scale green ammonia plants are projected to be viable along with energy trading option. Large-scale ammonia plants designed with auto-thermal reforming process offers lower natural gas consumption and reduced GHG emissions compared to conventional steam reforming plants. As an interim measure, such

plants should be encouraged to bridge the gap of demand and supply.

The acid and complex fertiliser plants through strategic intervention can not only improve the conversion efficiencies of raw materials but also reduce material losses and emissions. The phosphoric acid production is limited due to disposal of phospho-gypsum. A large quantity of legacy stock has also been piling up. Phospho-gypsum should be viewed as resource, as there are numerous ways to utilize phospho-gypsum in cement manufacture, construction materials, mine backfilling, use as soil amendment for reclamation of alkali soils and also as a source of sulphur and calcium for the plants, etc. To make utilization of phospho-gypsum competitive, certain measures are required to rationalize customs duty structure and railways freight classification of phosphogypsum vis-à-vis natural gypsum. There is a need for strong advisory from regulatory authorities for its use in road construction and filling of low-lying areas.

The Indian fertiliser industry has responsibly been ensuring availability of fertilisers across the country to the farmers. Fertiliser management in all aspects from production, distribution, marketing and application have to be aligned to the same objective of sustainability in each element of value chain. Acceleration is required in promotion and use of latest farming techniques and technology, new products customized to meet the objective of food security and climate change. There are some challenges due to operation in controlled policy environment. Government has been running various policies for urea, P&K and alternative fertilisers. A holistic policy framework must prioritize farmer choice—over inputs, crops, and markets—as the foundation of empowerment and long-term agricultural transformation.

The FAI Annual Seminar 2025 was held on the theme **Fertiliser Management for Green Future: Catalysing Farmers' Empowerment** during 10-12 December 2025. There were 16 presentations, in four technical sessions, made by the eminent speakers from India and abroad. Current issue contains the proceedings of inaugural function, resume of technical sessions, valedictory session, etc. The comprehensive conclusions and recommendations of the Seminar have been drawn for the attention of the policy makers, industry, and other stakeholders. ■