

Potential of New-Age Fertilisers in Indian Agriculture

Frank Notes



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Agriculture has been the foundation of human civilization for over 10,000 years. The development of farming allowed early human beings to transition from a nomadic hunter-gatherer existence to permanent settlements. In view of less population, there was no problem of food. However, human population continued to be on rise. Furthering sustainable agricultural practices are of paramount importance to optimize long-term food production, preserve natural resources, build resilience against climate change, and conserve the ecosystems. Advances in farming technologies comprising use of fertilisers, high yielding variety seeds, irrigation water, farm mechanisation, pesticides & herbicides, and better agri.-practices have revolutionised the agriculture sector by tremendous increase in crop yields to keep pace with the growing needs of the population in terms of food, feed, fibre and fuel. Among the inputs, mineral fertilisers alone contribute to 40-50% crop yield increase. In India, this can be accentuated from marvellous increase in production of all crops over the time in line with increased use of mineral fertilisers.

However, deterioration of soil health; decline organic carbon – a vital constituent of soil health; low fertiliser & water-use efficiency due to imbalance in use of fertiliser nutrients; exploitation of natural resources; low farm factor productivity; more contribution to environmental footprints due to more increased use of selective fertiliser; threat of climate change; etc. are the challenges being witnessed in Indian agriculture. How these challenges be addressed have been the area of debate at every quarter? Finding a way out of the problems requires a holistic and pragmatic approach to be implemented at the grass root level for benefit of the farmers and the nation. To supplement and complement traditional use of fertilisers, use of new-age fertilisers needs to be popularized by all concerned to face the challenges. Strategic government

frameworks and proactive approach of fertiliser companies have helped introduce new-age fertilisers for benefit of the farmers.

There are good numbers of such innovative fertilisers in FCO 1985 encompassing 100% water soluble fertilisers (WSFs), micronutrients, bio-fertilisers, fortified and customized fertilisers, organic fertilisers, bio-stimulants, nano N, nano phosphorus, nano NP with or without K, nano zinc, nano copper, beneficial element fertilisers, etc. from Schedules I to Schedule VIII of FCO. In addition, the other products of WSFs can be produced or imported with general specifications of 100% water soluble mixture of fertilisers containing 40% NPK or 30% two primary nutrients with or without secondary or micronutrients (Zn, B, Mn, Fe, Cu, Mo).

The 100% WSFs have witnessed swift growth worldwide including India. It is mainly driven by fast development of micro-irrigation systems and precision agriculture to produce high quality cash crops, vegetables, fruits and flowers. Pursuant to central and state government supports and initiatives for promotion of drip and sprinkler irrigation systems with polyhouse technology, there has been about 5.7 times increase in consumption of WSFs from 2011-12 to 2024-25. Area under micro-irrigation systems has shown an increase from 6.1 million ha in 2012 to 16.7 million ha in 2024. Share of drip system in micro-irrigated land was 46% in 2023-24 and remaining was sprinkler irrigation. Share of WSFs in total consumption of fertilisers in India is only 0.6%, which is much less when compared with other parts of the world. Therefore, there is an enormous potential to enhance consumption of WSFs in the country.

Liquid fertilisers have a good potential due to attractive net returns and minimum environmental footprints. Global market of such fertilisers is on rise. Production and import of such need-based fertilisers had been initiated in 2022-23 in the country. Consumption of such liquid fertilisers showed an increase from 422,156 liters in 2022-23 to 762,450 liters in 2024-25, showing a growth of nearly 81% in a span of only 3 years.

Continuous removal of micronutrients by crops without adequate replenishment has resulted in progressive depletion of soil micronutrient reserves. Soil properties also influence micronutrient availability. Consumption of micronutrients in 2024-25 was nearly 333.5 thousand tonnes, out of which share of zinc sulphate was 63.5%, followed by ferrous sulphate 14.2%, boron-based 11.4%, manganese sulphate 8.6% and copper sulphate 2.3%. Further,

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evidence increasingly demonstrates a direct relationship between soil micronutrient status and human & animal health outcomes. Strengthening the soil-plant-animal-human continuum through effective micronutrient management offers a cost-effective and sustainable pathways for achieving food and nutritional security in India.

There are boron, zinc, and secondary nutrients-based fortified fertilisers. Sale of boron-based calcium nitrate, NPK 09-24-24 fortified with Mg, S, Zn, & B, S-coated urea was nearly 67,077 MT in 2024-25, out of which S-coated urea was 17,565 MT in 2024-25. Further, SSP industry is concerned about production and sale of Zn, B, Zn + B and Mg + Zn + B-based single super phosphate. The sale of these fertilisers in 2025-2026 was 2914.3 thousand MT, revealing that 52.7% of the total SSP was fortified and lion's share was of Zn SSP and Zn + B SSP to the extent of 60.3% and 33.3%, respectively. Remaining share was of 4.9% for Mg + Zn + B SSP and 1.5% of B SSP. To give stimulus to use of Zn and B, Government of India has been providing additional subsidy of Rs. 500 and Rs. 300 on Zn and B, respectively for fortification of P&K fertilisers per tonne under nutrient based subsidy. Production and sale of customized fertilisers is on decline. However, they are vital for overall agricultural development. A conducive policy needs to be in place for giving boost to production of such area and crop specific fertilisers.

Soil organic carbon content in India is very low (<0.5%) and it is also one of the major reasons of poor physical, chemical and biological properties of soil and also nutrient use efficiency (NUE). There are two categories to improve such properties and NUE. One is bio-fertilisers and another is organic fertilisers. Bio-fertilisers are N-fixers, P-solubilisers, K-mobilisers, Zn-solubilisers, mycorrhiza, liquid- and carrier-based consortia, and P-solubilising fungal bio-fertilisers. Use of bio-fertilisers (carrier or liquid based) with pertinent knowledge may reduce dependence on mineral fertilisers while maintaining yields; improve NUE; restore soil biological health and organic matter; mitigate environmental pollution; and contribute to the long-term sustainability of Indian agriculture. Consumption of carrier-based and liquid-based bio-fertilisers in 2023-24 was 256,208 MT and 106,262 kilo Litre, respectively. The growth in

production and consumption of liquid-based compared to carrier based bio-fertilisers is more pronounced in view of better shelf-life.

City compost, vermicompost, organic manure, bio-enriched organic manure, PROM, fermented organic manure & liquid fermented organic manure come under category of organic fertilisers. Organic fertilisers improve soil health, boost water retention, support microorganisms, and provide a slow, steady release of nutrients. Fertiliser companies are concerned to improve physical & biological properties and organic carbon of the soil for sustainable agriculture and are in business of organic fertilisers also.

Bio-stimulants are another emerging category that enhances plant growth through physiological processes rather than direct nutrient supply. These products improve root development, nutrient uptake, tolerance to abiotic stresses such as drought and salinity, and overall crop quality. Their use is expected to become increasingly important under changing climatic conditions. There are large numbers of bio-stimulants in FCO 1985 under 11 categories.

Nano fertilisers represent a significant technological advancement. Nano urea and nano DAP have demonstrated the potential to improve N and P use efficiency while reducing the quantity of conventional fertilisers required. Their targeted nutrient delivery mechanism contributes to lower greenhouse gas emissions, reduced logistics costs, and improved nutrient utilisation. Specifications of nano N, nano NP without K, nano P, nano Zn and nano Cu are outlined in Schedule VII of FCO 1985. Companies are in business of making new-age fertilisers such as nano urea, nano DAP, nano Zn and nano Cu available to the farmers to improve their farm income.

Government of India has announced PM Programme Scheme for Restoration, Awareness Generation, Nourishment and Amelioration of Mother-Earth (PM-PRANAM) for promotion of alternate nutrients for sustainable agriculture.

Going forward, a balanced nutrient management strategy integrating conventional fertilisers with new-age fertilisers such as nano fertilisers, bio-fertilisers, bio-stimulants, customised fertilisers, fortified fertilisers, organic fertilisers, and precision agriculture technologies will be essential for improving NUE & soil health, and that is the key for sustainable agriculture. This is the high time that the State Governments should come forward to provide a level playing field to the fertiliser companies under PM-PRANAM Scheme to promote new-age fertilisers along with traditional fertilisers among the farmers for sustainable agriculture. ■