



Long-term Strategic Framework for *Atmanirbharta* in Fertiliser

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India has made rapid strides in the agriculture sector over the past decade. As per the Economic Survey 2025-26, the growth rate over the past 5 years has been more than 4%. There has been bumper production of food grains, horticulture and oil seeds, which is an outcome of the adoption of technologies by farmers, supported by concerted government policies such as expansion in irrigated area, better water use efficiency, along with timely and adequate availability of fertilisers.

However, there are rising concerns related to excessive use of chemical fertilisers, which are resulting in declining soil health and plateauing of productivity of major crops. As per the agriculture scientists, the gradual decline in Nitrogen Use Efficiency (NUE) has resulted in a vicious cycle of farmers progressively increasing the fertiliser dosages with minimal incremental rise in productivity.

The government follows a welfare policy to protect farmers from the global inflationary trends by fixing the sale prices of urea and Di-Ammonium Phosphate (DAP) and providing nutrient-based subsidies for other products. This has led to a substantial surge in the fertiliser subsidy bill over the years. The budgetary burden tends to rise whenever there is a surge in global oil and gas prices or any global crisis like the ongoing situation in the Middle East.

To face the challenges emanating from the current ongoing Middle East crisis, our Prime Minister has issued a seven-point appeal, which includes judicious use of chemical fertilisers and adoption of natural farming. This crisis may hopefully end soon, with the country successfully mitigating the impact. The criticality of achieving *atmanirbharta* in the fertiliser availability for long-term sustainable agriculture in the country has been at the centre stage of policy discussion.

This vision is sought to be fulfilled through broad strategies of (i) developing non-fossil fuel-based alternative sources for the manufacturing of nitrogenous and other fertilisers, (ii) development and adoption of indigenous products that have efficacy similar to existing and popular chemical fertilisers, and (iii) reducing the demand by moving towards balanced use of fertilisers for sustainable, climate-resilient production, while improving soil health.

The annual requirement of urea has shown an increasing trend in recent years, reaching close to 39 million tons. India has done well in increasing the domestic production capacity while improving the capacity utilisation. The annual domestic production has risen and reached around 31 million tons, while the balance requirement is imported. However, even the domestic production is hugely dependent on imported gas, and therefore, the cost of production fluctuates

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Rural farmers spreading organic compost in the field

with the changes in prices of petroleum products. Similarly, the dependence of imports in the case of DAP is as high as 60%, while the domestic production is again dependent on imported raw materials.

Coal Gasification Mission

The government is prioritising the development of technologies that have shown promise to reduce this import dependence on finished products and raw materials. The coal gasification technology, which transforms coal into syngas, can be utilised as an alternative for the production of nitrogenous fertilisers. Recognising the availability of large coal reserves in the country, the Government has already launched a National Coal Gasification Mission with a target of 100 MT of coal gasification by 2030. The Union Cabinet has very recently approved a scheme for Promotion of Surface Coal/Lignite Gasification Projects with an outlay of Rs 37,500 crore. The technology will help the production of ammonia, an important ingredient for the production of critical chemical fertilisers, without the need for petroleum gas.

Green Ammonia

The other promising alternative is that of green ammonia. Being a rich source of nitrogen (around 82%), its production does not require fossil fuel-based raw materials and can be directly applied on farms

through appropriate mechanisation techniques. The technology is already being put into practice in other countries, and the private sector is now engaged with the Indian Council for Agriculture Research (ICAR) for conducting field trials to assess its efficacy on different soils and crops. Early results have been very encouraging. Development of a standardised package of practices supported by large-scale demonstrations and extension will encourage the private sector to invest in its manufacturing and quick adoption by farmers.

Nano-fertilisers

The third alternative is that of nanotechnology, which has been in use for the last five years. Indigenously developed, the products, nano urea and nano DAP, have already demonstrated their potential to partially replace conventional urea and DAP. Scientifically robust trials are ongoing under the ICAR framework to develop a standard package of practices, which will clearly specify crop-wise, appropriate time and dosage of nano fertilisers for the most optimal results, and scientifically establish the extent to which nano products can replace the conventional chemical fertilisers.

Natural Farming

The National Mission on Natural Farming is spearheading the chemical-free farming practices

in collaboration with States/ Union Territories. For many years, cow-based natural farming has been adopted by farmers with remarkably positive results on several crops. Now, ICAR has developed region and crop-specific potential mapping, where natural farming will be effective. Concerted efforts are on to scientifically validate the efficacy of this indigenous technology for wide-scale adoption that will ensure sustainable agriculture, improving soil health without compromising productivity. Multiple trials undertaken under the supervision of ICAR institutions have yielded very positive outcomes on many crops, and the same are now being disseminated through the Mission.

Soil Health

The soil health and fertility scheme of the Government of India has succeeded in providing more than 26 crore soil health cards to farmers across the country. What is now required is to convert the sensitisation into behavioural change towards a balanced use of chemical fertilisers and integrated nutrient management, based on deficiencies observed in the soil health analysis.

Crop Diversification

Experts have already flagged the concerns related to overproduction of water and fertiliser guzzling crops like paddy, sugarcane and wheat. The diversification towards oilseeds and pulses, which use relatively less fertilisers and water, is consistent with the overall mission of import substitution and self-sufficiency. The concerted strategy under the National Mission on Edible Oil-Oil Seeds and Oil Palm and the National

Pulse Mission will help in increasing area coverage, productivity and production. The government's policy of procuring all of the three pulses (urad, tur and masoor) offered by farmers at Minimum Support Price (MSP) will go a long way in assuring the farmers and encouraging them to shift towards pulses in a sustained manner.

Digital Public Infrastructure in Agriculture or the Agri Stack

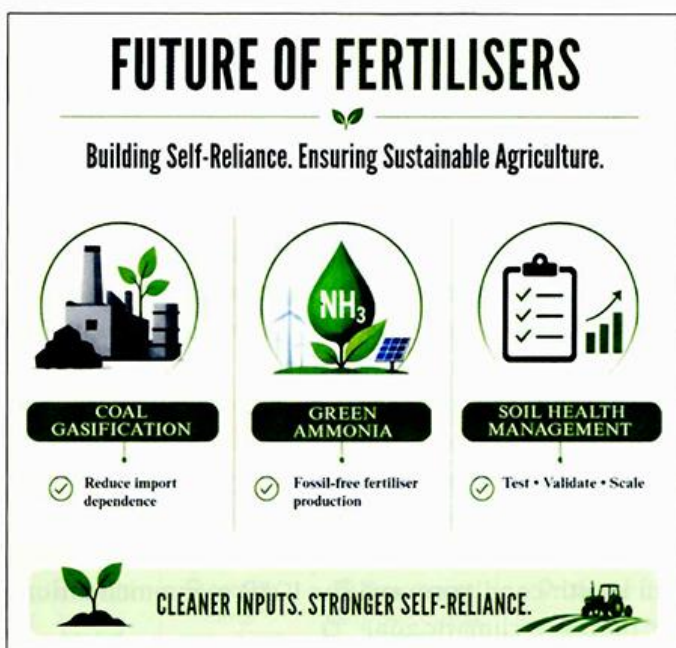
The Agri Stack being developed under the Digital Agriculture Mission has already created more than 9.5 crore farmer IDs, which have updated land ownership details of farmers at the back end. Further, more than 640 districts across 24 States/UTs have undertaken Digital Crop Survey of more than 30 crore plots to record crops sown immediately after the sowing in each season. These numbers are growing as the Government strives for saturation.

Agri Stack, with its farmer and crop sown registry, has the potential to transform the fertiliser management system of the country and facilitate movement towards more balanced use of chemical fertilisers, while preventing illegal diversion. Already, successful pilots have been conducted in several States where the farmer ID and crop sown registry forms the basis of advising the farmers about the crop-wise most appropriate fertiliser dosage and nudging them to adopt the scientific recommendations for better productivity and improved soil health.

The Way Forward

The long-term measures discussed above will ensure minimising the dependence of our fertiliser sector on imports, reducing the foreign exchange outflow and making it more resilient to future global shocks. Therefore, the way forward is as follows:

- While the policy makers make efforts to find alternative sources to meet the energy and fertiliser requirements of our nation, the concerted strategy for developing and adopting alternative technologies like coal gasification and green ammonia, which can produce chemical fertilisers without the necessity of fossil fuels, holds a lot of promise. Government is already treading the path of fast-tracking its efforts to test, validate and incentivise them, for early adoption.
- The early validation and development of a package of practices for utilising nano fertilisers as an alternative to partially replace conventional



fertilisers will enable building further confidence about their efficacy among the farming community. Instead of following the practice of forcefully tagging nano products (which they are often accused of), the fertiliser companies would promote voluntary sales, while educating the farmers on the crop-wise optimal dosage and appropriate time of its application in the crop life cycle, as recommended by ICAR.

- Pure natural farming with certification, marketing and branding linkages is being promoted through the ongoing mission. The strategy of promoting a hybrid model wherein the adoption of natural farming practices with reduced dosage of chemical fertilisers can also result in sustained productivity, while contributing to sustainable soil health. This model also has a broad acceptance, fulfilling the objectives of reducing the dependence on chemical fertilisers.
- The desired behavioural change for more judicious use of chemical fertilisers based on results of Soil Health Cards will be possible through a very aggressive outreach and extension services through the state agriculture departments and the *Krishi Vigyan Kendra* under the ICAR.

To assist in bringing this change, the resources under the Soil Health and Fertility scheme can be partly channelised to organise large-scale demonstrations in clusters of 2 to 5 hectares in each village where soil health cards have been distributed in the recent past. In these demonstrations, appropriate doses of chemical fertilisers and micro nutrients based on ICAR recommendations and identified soil deficiencies will be administered. Such experimental plots will demonstrate that higher productivity and better quality produce can be obtained by applying balanced nutrients/micro nutrients with reduced application of chemical fertilisers.

Farm schools can be organised at each of these demonstration sites to sensitise and disseminate the best practices among other farmers of that village. Sustained efforts of demonstration with farm schools are likely to bring in the desired behaviour change towards a balanced and integrated fertiliser application.

- The soil health testing can gradually become demand-based. A partial subsidy may be considered with an online platform to facilitate farmers forwarding the self-collected soil samples of their farm, through the postal courier services

to the nearest authorised lab. The detailed reports, along with crop-wise recommendations, can be communicated digitally with free online advisory services. This way, the ownership of the scheme and consequent adoption of recommended practices is likely to increase.

- The implementation of missions for self-sufficiency in pulses and edible oils will certainly lead to an increase in area and productivity, resulting in enhanced production. The States/UTs should ensure effective Minimum Support Price-based procurement mechanisms under the Price Support Scheme. This is necessary to build confidence among the farmers that they will get remunerative prices, so that they continue producing these crops.
- Reforms in fertiliser management systems have been an agenda of discussion for quite some time. As discussed in earlier paragraphs, the building of Agri Stack has provided a platform wherein farmer-wise data, land ownership, crop sown and location of each plot owned is available. These can be easily integrated with the soil health conditions and the agro-climatic zones. The platform can be integrated with the fertiliser management system. The existing no-denial policy of fertiliser distribution, where any person with Aadhaar can procure subsidised fertiliser unchecked, can be reviewed and amended. Subsidised fertiliser may be allowed to be given only to those farmers who hold agricultural land or nominate some authorised representatives like their relatives, sharecroppers or leaseholders.

The ICAR recommended doses can then be allowed to be sold to them on the first visit, and thereafter, any additional procurement for that piece of land should be followed by cautionary advice on the ill effects of overdose.

As the country reaches near saturation stage in the generation of farmer ID and Digital Crop Survey, after due deliberations with stakeholders, the policy for direct release of subsidy to farmers' accounts can be considered. But this will have to be designed after considering the concerns of all stakeholders and addressing practical implementation challenges of various States/UTs. Needless to say, the subsidy will be available only when the crop is grown and based on multiple variables like size of land holding, crop sown, soil health conditions and the ICAR recommendations for that agro climatic zone. □