Frank Notes

Holistic Approach for Agricultural Development

Agriculture continues to be the backbone of Indian economy. Quite a large numbers of people depend directly or indirectly on agriculture for their livelihood. However, it continues to be the largest and high risk economy activity. India has geographical area of about 329 million hectares, divided into 20 agro-climate regions and has become the most populated country in the world. India has 18% of world population on 2.3% of the land geographical area and 4% of the fresh water resources. To feed 1.42 billion people, the country produced 329.7 million MT of food grains and 355.5 million MT of horticultural crops in 2022-23. The corresponding figures for 2023-24 are expected to be 309.3 million MT and 355.3 million MT, respectively. Except wheat and jute & mesta, production of oilseed, sugarcane and cotton is also expected to decline considerably in 2023-24 compared to 2022-23. The country is self-sufficient in production of food grains except for oilseeds and pulses. Estimated requirements for 2050 are 405 million MT of food grains, 39 million MT of oilseeds and 646 million MT of horticultural produce for nourishing about 1.69 billion people. The growth in agricultural production should be on sustainable basis as there have been ups and downs on year-on-year basis.

Government of India announces minimum support prices (MSPs) of 22 commodities. Government also procures wheat and rice at procurement prices for maintaining buffer stock to meet any kind of exigencies and requirement of public distribution system. Punjab, Madhya Pradesh, Uttar Pradesh and Haryana contribute more than 90% of wheat to central pool. Procurement of wheat in 2022-23 was down by 56.6% compared to 2021-22. More than 90% of rice is procured from 11 states. There was marginal dip of 1.2% in procurement of rice in 2022-23 compared to 2021-22. The dwindling stocks of rice and wheat in the central pool can be a cause of worry at any stage of time. Procurement of wheat is in progress. It is hoped that the procurement will be better in view of expectation of record production of wheat as per the 2nd advance estimates released by the Ministry of Agriculture & Farmers Welfare.

Productive land should be used for agriculture only rather than diverting for other purposes. Average yields of paddy and wheat in India in 2021 were 4214 kg ha^{-1} and 3467 kg ha^{-1} compared to 7144 kg ha^{-1} and 5811 kg ha^{-1} in China, respectively. The yields of food grains in India are also lower than many developing and developed countries. There are considerable inter-state and inter-region variations in average yields of the crops. Further, the yields are low at farmers' level compared to well managed conditions under scientific supervision. This shows that there exists a large untapped potential to enhance farm productivity in the country.

Indian agriculture sector has been facing enormous challenges of changing patterns of temperature and weather due to climatic change; deterioration of soil health; depleting natural and water resources; imbalance in use of fertilizers, fragmentation of land holdings; etc. In 2023, there was longest delay in onset of south-west monsoon. Further, August 2023 was considerably dry and rain was 36% below long period average. Many sub-divisions received deficient rains during the season including part of north-eastern states, eastern U.P., Gangetic West Bengal; Jharkhand; Bihar; South interior Karnataka and Kerala. South-west monsoon withdrew from the entire country on 19th October, 2023.

During the current year, Southern Peninsula and coastal areas were worst affected by severe heat waves and high temperatures in April, 2024. However, a relief in the form of normal south-west monsoon and good rains in current year of August as per the weather forecast due to La Nina effect will be quite helpful for agriculture sector.

Deterioration of soil health is happening due to lowering of organic matter content and imbalanced use of fertilizers. Balanced fertilization can easily be adopted by following soil test-based recommendations and the same needs more emphasis enabling farmers to accept this concept. Use efficiency of applied N, P_2O_5, K_2O, S and micronutrients is, 35-50%, less than 20%, 50-60%, 8-12% and 2-5%, respectively. The farmers need to make use of the scheme of

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distribution of soil health cards of Government of India for their benefits. The products such as *neem* coated urea, sulphur coated urea, Nano fertilizers, slow release N fertilizers and nitrification inhibitors have been reported to enhance nitrogen use efficiency. If a farmer makes use of fertilizers sensibly, the chances of leaching of nitrate nitrogen in the soil profile and ammonia volatilisation from the soil surface in the atmosphere will be minimum. The need of the hour is to promote balanced fertilization and integrated nutrient management (INM) among the farmers by stakeholders.

Water is the most important natural resource for civilization to survive. Agriculture is the major consumer of water. Over exploitation of ground water resource is leading to falling ground water table and creating hydrological droughts. In canal irrigated areas due to seepage losses and over use of water for irrigation, problems of salinity and alkalinity are the major issues. Scientific management of water is indispensable for agricultural growth, and sustainability of ecosystems. Proper synchronization of application of fertilizers before or after irrigation as per the situation improves nutrient as well as water use efficiency. Rain water harvesting with construction of bunds and check dams in rural areas should be taken on war footing. It has become necessarily in view of climate change. Every drop of water needs to be conserved in the soil. Recommended practices of water application in different crops should be practiced by the farmers. Use of micro-irrigation system is on rise in the country and it should be given more impetus. For fragmentation of land holdings, cooperative farming system approach would be helpful for the farmers to use advanced technologies for their benefits.

Proper nutrient management is also one of the major factors bringing success in precision agriculture. Modern tools and technologies such as remote sensing, artificial intelligence, drone technology, variable rate technology, crop modelling, site specific nutrient management, leaf colour chart and mobile applications are helping farmers make informed decisions about better nutrient management, reducing wastage and minimizing environment footprints. The tools also help in improving farm productivity and farmers' income.

Conservation agriculture (CA) is an area, in which nutrient management requires reorientation. Under CA, there are scientific evidence for lower nutrient requirements and high efficiencies. Refining fertilizer practices; promoting high nutrient use efficiency and crop variants; advancing sub-surface application; mechanization; exploring fertigation; and real-time nutrient management tools are crucial for improving CA's productivity and sustainability.

Climate-smart agriculture is a comprehensive approach intended to preserve sustainability, resilience, and mitigation in the agricultural production system. An integrated, evidence-based, and transformative approach to address the food and climate issues requires coordinated efforts at all levels, from research to policies, and across commercial, governmental, and civil society sectors. Identification, creation, and adoption at field levels of suitable location-specific climate-smart agriculture technologies, and promotion of integrated farming systems will go a long way in enhancing agriculture production, farmers' income, elevating poverty and ensuring food and nutritional security on sustainable basis.

In line with the purchasing power of the farmers and occupation of land, different models of nutrient management (specific to combinations of fertilizers, organic manures, bio-fertilizers, recycling of agricultural wastes, etc.) on optimizing cost of cultivation, which will translate to enhancing farm productivity and income of the farmers, need to be developed taking all factors into consideration.

A holistic approach for mitigating climate change; proper water management; promotion of balanced fertilization and integrated nutrient management; improvement in nutrient use efficiency; importance of crop diversification and integrated farming systems; use of modern tools; and adoption of precision and conservation agriculture has to be given more momentum for sustainable growth in agriculture. ■