

Frank Notes

Transforming Indian Agriculture

India is the most populous country in the world with a geographical area of about 329.7 million ha. Population will continue to rise. The country has progressed well towards agricultural production, ensuring food and nutrition security to the teeming population. Production of food grain and horticulture crops in 2023-24 reached a level of 332.3 million MT and 353.2 million MT compared to 329.7 million MT and 355.5 million MT in 2022-23, respectively. Per cent growth in GVA of agriculture and allied sectors which was 4.7% in 2022-23 slipped to 1.4% in 2023-24. Therefore, contribution of the sector in GVA also declined from 18.2% to 17.7% during the period. Further, agriculture sector used to contribute about 50% in GVA in 1950s as other sectors of the Indian economy were not so spread. Evolution of fertilizer responsive high yielding varieties in late 1960s was the landmark in the history of Indian agriculture and the success of the same is the testimony of the facts as envisaged. However, challenges in the sector have been emerging and the country will have to keep pace of production in line with the need of the burgeoning population which may be around 167 crore by 2050.

There is no escape but to increase agriculture production by addressing the challenges being encountered in the sector. The challenges such as dwindling soil and water resources; deterioration of soil health; low fertilizer and water use efficiency; decline in crop response to fertilizer use and stagnation in farm productivity; adoption of same cropping system especially in Indo Gangetic plains; stagnant net cultivated area; adverse effect of climate change; etc. are cropping up. There is no doubt that Green Revolution has paid high dividends, but with the pros and cons. The second Green Revolution is the need of hour which can only be possible with systematic outcome-based approach to adopt the best sustainable farming practices to address the emerging challenges of agriculture.

Intervention in transforming Indian agriculture is of paramount importance through promotion of digital tools. The pace of spread of internet users in rural areas has been picking up and has even surpassed the urban areas. Even rural women are

making use of internet. There are good opportunities to tap such potential through encouragement of rural masses to utilize digital tools for farm operations in agriculture.

Application of remote sensing, sensors, GPS/GIS, cloud computing, artificial intelligence, machine learning, deep learning, block-chain, robotics, data analytics, smart phones, drones, etc. in agriculture may be a step towards transforming Indian agriculture to bring second Green revolution in the country. Use of digital technologies is critical for precision agriculture..

Companies in the private, cooperative and PSU sectors have been engaged in providing agri-based information on efficient use of fertilizers and water, crop surveillance, advance technologies, market prices, weather information, etc. with the help of digital tools. Quite a good number of agri-based mobile apps have been developed and farmers are getting information in real-time. Large numbers of agri-tech start-ups are based in India and various venture capital funds, and angel investors have long supported the sector. Satellite-based crop monitoring and drone technology are also being promoted.

Among the NPK use, contribution of N is about 67%. Both over-use or under-use of N in agriculture is detrimental to either crops or environment or both. Therefore, N management strategy needs to be given more emphasis. Efforts are continuing towards checking status of N in leaves through digital applications for precision N management. Availability of high quality satellite data has been considerably enhancing the fields of N estimate by remote sensing. Amalgamation of crop simulation modelling and remote sensing can be of great help in enhancing site-specific N management. Radiative transfer model, based on spectral reflectance data may be inverted to determine canopy chlorophyll content from spectral simulation model, can be utilized to estimate N requirement of a crop.

Digital tools such as DSSIFER, Nutrient-Expert, and KISAAN 2 in conjunction with Soil Health Card (SHC) Portal and Kisan Sarathi provide tailored,

India has the opportunity in transforming agriculture through mobilisation of digital tools towards climate resilience, sustenance of soil health, and ensuring food and nutrition security to the burgeoning population on sustainable basis.

site-specific fertilizer recommendation, leveraging ICT to enhance farming efficiency for sustainable agriculture. www.soilhealth.dac.gov.in have the facilities for registration of soil samples, recording test results of soil samples, and generation of SHC containing fertilizer recommendation. A soil test crop response mobile app provides fertilizer recommendations for a specific yield target for Maharashtra farmers in different crops.

Digital agriculture has the potential to transform rainfed farming by offering ways and means to overcome the challenges of climate change, soil degradation and water scarcity.

Realizing the vital scope, Government of India announced a Digital Agriculture Mission which aims to create digital ecosystems for farmers, improve efficiency of government programme, and support evidence-based policy making. The mission includes digital public infrastructure (DPI) to integrate with state and central digital infrastructure to provide services to farmers such as information on soil health, livestock and fisheries; AgriStack for a farmer-centric DPI to provide farmers with a digital identity (farmer ID); and Krishi Decision Support System for combining remote sensing data on weather, soils and crops to create soil profile maps. Further, Jio Agri (Jio Krishi) platform was introduced in early 2020 to digitalize the agriculture ecosystem. To provide farmers with real-time data and the necessary advice, NITI Aayog has teamed up with International Business Machines to create a crop production forecast model supported by AI. It aids in enhancing crop output, soil quality, agricultural input control and early disease outbreak warning. Government is also giving financial support to agri-tech firms.

Fertilizer industry is a major contributor to the growth and development of Indian agriculture. Major fertilizer players have adopted digitization for enhancing efficiency in production; evaluation and dissemination of advanced technologies and agronomic practices among the farmers. Industry in real-sense has been engaged in transforming of

agriculture and will continue to do. Towards transforming agriculture, fertilizer industry has been giving due attention on R&D and developing and promoting new products such as *neem* coated urea, sulphur coated urea, Nano urea, Nano DAP, Nano zinc and Nano copper, specialty fertilizer products etc. Industry is also promoting use of drones for application of fertilizers and agro-chemicals. Various advanced farm technologies are also taken to farmers' doorstep to improve their farm productivity and sustain soil health on sustainable basis.

As the awareness grows, India has the opportunity to take a lead in transforming agriculture through mobilization of digital tools, setting a global example in sustainable farming that balances productivity with ecological preservation, climate resilience, and ultimately fostering food and nutrition security for the future generations

Soil is an essence containing living organisms and non-living components. For a growth of at least 4% in agriculture on annual basis, productivity of soil has to be sustained. Use of digital tools with soil health card portal has been helping in recommending nutrient doses more precisely, enabling to sustain soil health. Further, adoption of integrated nutrient management comprising fertilizers, bio-fertilizers, organic manures, recycling of agricultural wastes by the farmers needs impetus.

To commemorate the **Global Soil Conference on Caring Soils beyond Food Security: Climate Change Mitigation & Ecosystem Services**, being organised by Indian Council of Agricultural Research, International Union of Soil Science and National Academy of Agricultural Sciences at NASC Complex, New Delhi during November 19-22, 2024, this special issue has been brought out on Digital Agriculture. The issue covers the leading articles on Digital sensing of crop N content on site-specific N management, Digital technologies for optimal plant nutrient management; Digital agriculture in rainfed farming; Embarked to a digital green revolution; Leveraging generative AI for site-specific fertilizer recommendations; ICLeaf-leaf scanning technology; Fasal: Revolutionizing agriculture through AI and IoT, etc. It is hoped that this special issue will be helpful to those connected to agriculture including research scientists, policy makers, extension agencies and of course the farmers. ■