Indian Journal of Fertilisers **18** (4) : 302-303, April, 2022

Precision Agriculture for Sustainable Food Security

Frank Notes

Dr. S. Nand

Indian agriculture is at cross roads to meet the challenges of environmentally sustainable and economically feasible food system. The huge and ever-increasing population has driven the demand for more food, fiber, energy, and water which is associated with use of natural resources in a more sustainable way. At the same time, plateauing crop yields, lowering farm profits, shrinking land and water resources, emerging environmental concerns, and climate change are posing a serious threat to agricultural sustainability and national food security.

It is a known fact that further growth in agriculture will come from improvement in crop productivity as there is practically no scope of bringing more area under plough. The intensive agriculture which primarily relied on increased use of inputs and exploitation of natural resources has started showing signs of fatigue. The focus now has to be shifted from intensive agriculture to precision agriculture.

Precision agriculture, used synonymously as satellite farming, prescription farming and sometimes also as site-specific crop management (SSCM), refers to a farming management concept based on observing, measuring and responding to inter- and intra- field variability in crops. The goal of precision agriculture is to define a decision support system (DSS) to whole farm management with optimizing returns on inputs while conserving the resources.

The concept of precision agriculture emerged in the early 1990s and was focused on the study and management of spatial variability, what is referred to as precision farming. It has advanced over years with the use of technology like remote sensing, Global Positioning System (GPS) and Geographical Information System (GIS). These technologies help to pin point the need for agri-inputs like fertilizers, crop protection chemicals and water. Further precision agriculture with features of predictive modeling, use of digital farm data, sensors, etc. provide inputs for measures to be taken in crop management. Specifically, the technology allows for creation of maps of spatial variability of variables like crop yields, soil organic matter content, moisture levels, nitrogen levels, pH, EC, Mg and K.

Variable rate application (VRA) technologies apply precise amounts of water, fertilizer, pesticide, herbicide, etc. during the crop growing season. Using VRA alongside geo-spatial mapping, farmers can apply inputs to hyper-localized regions of their farms. An ideal example of precision agriculture practices is a focused fertilizer or agro-chemical application with artificial intelligence (AI) aided analysis, targeting only areas that need attention instead of blanket application. For example, site-specific application of irrigation in wheat of Punjab and Haryana; pesticide sprays in cotton; and fertilizer applications in oil palm plantations in South India, and coffee and tea gardens of Eastern India can reduce the production costs and also minimize the environmental loading of chemicals.

The precision agriculture principles have gained momentum in India during the last 15 years propelled by the technological advancements. The adoption of mobile devices, access to high-speed internet, low cost and reliable satellite communications and farm equipment are the technologies which have facilitated the shift towards precision agriculture. E-extension services can improve farm productivity via decision-support services on mobile apps or other digital platforms. Using information from a variety of sources – weather data, GIS special mapping, soil sensor data, satellite/drone pictures, etc. e-extension platforms can provide real-time recommendations to farmers.

Many companies have developed agriculture apps that provide valuable guidance like land preparation, crop sowing, crop planning,

With increased government support, growing agri-tech providers, and burgeoning starts-up ecosystem, a strong transformation in Indian agriculture is under way.

fertilizer management, seed treatment, pest and disease management, weed management and irrigation. Besides streamlining farm production, digital agriculture technologies can make agricultural markets more efficient. Mobile phones, online ICTs, e-commerce platforms and digital payment systems can reduce transaction costs throughout the value chain.

In spite of these developments, the adoption of precision farming is yet to pick up speed in our country due to number of barriers including unique pattern of land holdings, poor infrastructure, and socio-economic conditions. The small size of landholdings (more than 85% being <2 ha size) in Indian agriculture limits the economic gains from currently available precision farming technology. But, rapid socio-economic changes such as economic growth, urbanization, and energy consumption are creating new opportunities for the application of precision farming in India. With increased government support, growing agri-tech providers, and burgeoning starts-up ecosystem, a strong transformation in Indian agriculture is under way.

Government of India is keen on promoting the use of artificial intelligence (AI) and Big Data in rural farming. The government is collating volumes of data on farmers through the registration process for national level schemes. A wealth of digital information is available from Government Schemes/Missions, such as Crop Insurance, Soil Health Card, and Kisan Credit Card (KCC) on the status of farmers and their crops. Pradhan Mantri Fasal Bima Yojana (PMFBY) is wholly using the remote sensing imageries, AI, and modeling tools to reduce the time for claim settlements. Agriculture industry is turning to AI for mitigating the effects of locust swarms, climate change, droughts and floods on agriculture.

Three successful public private partnerships for digital farming are: (i) AI-sowing app by Microsoft (with ICRISAT); (ii) Price forecasting model by Karnataka Government & Microsoft; and iii) Infosys precision crop management. Further in the Union Budget for the financial year 2022-23, Government of India has announced several initiatives including dedicated fund for agri-tech start-ups. The government is set to launch public private partnerships (PPP) model to incentivize agri-tech players and other stakeholders in the agriculture value chain. These measures signify the commitment of the Government of India to facilitate prosperity through digital farming in India.

Government should also encourage research and development of digital agriculture, and engage in private-public R&D partnerships to foster smallholder–oriented digital agriculture projects in the country. The objective is to deliver digital and high-tech services to farmers, which would enable them to cut costs, find new markets, and gain competitiveness in the global markets. Schemes under corporate social responsibility (CSR) in India have also helped in adoption of latest farm technologies and need to be expanded.

With increasing use of innovations varying from drones to satellite images and sensor technology, huge amount of data are available. This digital information goes beyond the mere presence or availability of data but creates actionable intelligence. Artificial intelligence, and data analytics help in arriving at actionable recommendations. It uses high-tech tools and satellite images to manage crop health and harvesting. To farmers, digital agriculture provides the opportunity to increase their farm's production, save on costs and eliminate the risks.

This special issue on precision agriculture is an initiative of FAI to present the developments in this emerging field and underlines the increasing need for paradigm shift in Indian agriculture. The issue includes 9 papers covering important aspects of precision agriculture. We hope that all those concerned with agriculture will find the contents of this special issue relevant and useful.■