Resilient Agriculture for Food and Nutrition Security

Frank Notes

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India is the largest populous country in the world surpassing China. Food security has been the national priority since independence to rapidly growing population. The food grain production increased by more than 6 times from 1951-52 to 2022-23 and out-paced the growth of population which went by about 4 times during this period. There has been also impressive growth in production of oilseed, sugarcane, cotton, jute and mesta, fruit and vegetable crops. Production of horticultural crops (fruits and vegetables) and food grain reached a record level of about 352 million MT and 329.7 million MT, respectively in 2022-23. The country has not only become self-reliant in food grains but also food exporter with adoption of better farm technologies.

Population will continue to rise and may reach to about 149 crore by 2030 from about 142 crore now. Making the huge population nutritionally secured with the change in food habits mounts a daunting challenge in view of stagnation in net cultivated area due to urbanization and industrialization. Fragmentation of land holdings; exploitation of natural resources, shrinking water resources, biodiversity; and farm profits; climate-change induced adverse impact; and emerging energy and environmental concerns are posing serious threats to agricultural sustainability, food and nutritional security.

To meet the sustainable development goals of 'zero hunger' by 2030, production of food grain and other crops should be accelerated to meet the demand of food, fibre, feed and fuel of the growing population with nutrition security. To realize a paradigm shift, there is a need to make Indian agriculture more productive, efficient and resource conserving.

Use of fertilizers is indispensable for agricultural development. For achieving full yield potential of crops, it is vital that soil and crop specific doses of N, P and K containing fertilizers, inclusive of secondary and micronutrients wherever deficient, are applied in balanced manner to individual field on the basis of soil test-based recommendations. Imbalance in use of fertilizers is an uneconomic waste of scarce resources. Long-term fertilizer experiments (LTFEs) carried out in India have amply demonstrated that use of fertilizers in balanced proportion can sustain soil productivity. Lack of P and K fertilizers resulted in sharp decline in crop response to N as evidenced by the grain yields of LTFEs. Integrated plant nutrient supply system (IPNSS) comprising of fertilizers, organic manner, bio-fertilizers and recycling of agricultural wastes need to be popularized among the farmers. In this context, suitable fertilizer policy intervention and bringing awareness among all stakeholders to ensure balanced use of fertilizers and adoption of IPNSS are necessary. Accelerated adoption 'towards organics' *i.e.* integrated management approach in intensive agricultural areas (food hubs) and 'certified organic farming' with combination of tradition, innovation and science in the de-facto organic areas. *i.e.* hills and rain fed/dryland regions can contribute towards safe food security and climate resilience, besides increased income of farm households.

The growing requirement of high quality crops, environmental concerns and thrust on improved nutrient use efficiency have driven the growth of specialty/innovative fertilizer products. Such fertilizers lead to additional benefits to growers by way of improving nutrient requirements of the crop. Among such products, 100% water soluble fertilizers have been witnessing good growth. Application of 100% water soluble fertilizers with drip irrigation has great potential in agriculture, particularly for horticultural crops. Drip fertigated greenhouse technology is the best example of climate resilient agriculture. This technology becomes more relevant and useful for the small and marginal farmers to realize better returns even during off-season. Some of the state governments giving subsidy on greenhouse technology can be utilized by the farmers for more productive uses and realizing better net returns.

Identification, creation, and adoption at field levels of suitable location-specific climate-smart agriculture technologies will go a long way in enhancing agriculture production, farmers' income, elevating poverty and ensuring food and nutrition security on sustainable basis.

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 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 to 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.

Malnutrition is a cause of concern in women and children due to poor purchasing power of poor peoples' inability to go in for nutrient-rich food like fruits, vegetables, pulses, meet, milk, etc. The problem can be addressed through bio-fortification of food with minerals, nutrient-rich mid-day meals and numerous other government's initiatives. Indian scientists are working seriously towards developing varieties enrich in zinc and iron. Production and use of millets for nutrition security should also be given more impetus.

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

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

Increasing food production and improving distribution and delivery methods require a comprehensive strategy because of the enormous strain that natural resource depletion and rapidly changing climate conditions place on agricultural systems. To bridge the income gap between agriculture and non-agriculture, we need to bring about a radical change in Indian agriculture through innovations and interventions. The necessity is to have a sustainable food systems in light of the climate change.

Scientific and technological innovations are essential for maintaining food and nutrition security on sustainable basis. 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 will go a long way in enhancing agriculture production, farmers' income, elevating poverty and ensuring food and nutrition security on sustainable basis.

To commemorate the XXII Biennial National Symposium on **Climate Smart Agronomy for Resilient Production Systems and Livelihood Security,** being organized by the Indian Society of Agronomy in collaboration with Indian Council of Agricultural Research, New Delhi during November 22-24, 2023 at ICAR-CCARI, Goa, this special issue highlights up-to-date methods and approaches for managing plant nutrients in a variety of crops. Numerous leading studies on integrated nutrient management techniques and balanced fertilization are included in this issue, which aim to increase nutrient use efficiency and restore soil fertility. It is hoped that this special issue will be helpful and relevant to all those involved in agriculture, including research scientists, policymakers, extension agencies, and of course, the farmers. ■