

## Agricultural research, education and extension of small farm holders for sustainable livelihood and nutritional security in India

Feeding a growing and more affluent global population in the coming decades will be a major global concern in the twenty-first century. The Food and Agriculture Organization (FAO) of the United Nations estimates that food production will have to increase 70% globally to feed an additional 2.3 billion people by 2050. Besides the burden of food security, the world is now plagued with the additional responsibility of nutritional security, particularly in developing countries where a majority of its population suffers from malnutrition. Today it is realized that food security does not ensure nutritional security linearly. About 795 million people, or every ninth person, are undernourished, with the majority living in rural areas, and India is no exception. In India, 35.5% children under the age of 5 still suffer from stunting, 19.3% from wasting and 32.1% are underweight (NFHS-5, 2019–2021). According to the Global Hunger Index (2022), India ranked 107 out of 121 countries, reflecting the dismal picture of the malnutrition scenario in the country. However, Supplementary Nutrition Programme under Anganwadi Services and POSHAN Abhiyaan have been merged under ‘Saksham Anganwadi and POSHAN 2.0’ to address the challenges of malnutrition in children, adolescent girls, pregnant women and lactating mothers. Still, India is home to an estimated 927,606 severely acutely malnourished children from six months to six years (Bose, R., *Outlook*, 2022). All these facts force the policymakers to examine the existing food and nutrition security policy and highlight the missing links in the current policies.

In this backdrop, the new agricultural policy has thrust upon the role of agricultural research, education and extension systems in ensuring sustainable livelihoods and nutritional security. Although the contribution of agriculture to national GDP has come down to 18.3% (MoSPI, 2022), it acts as the prime pulse of Indian society and economy. Agriculture is still the most important economic sector, with a high socio-economic importance for small and marginal farming categories for creating employment, income generation, nutrition, and overall rural development. While the population is likely to increase to more than 1.6 billion before near-stabilization by 2030, the food demand is expected to rise up to ~400 million tonnes (MT) by the year 2050 (FAO, 2013). Now the dual challenge before the agriculture sector is to feed its growing population and eradicate the country’s

malnutrition scenario with limited and diminishing resources. According to Agricultural Census 2015–16, 68% of farm holdings operate on less than 1 hectare of land area and 85% of farm households undertake farming on less than 2 hectares (Chand, R., NABARD Research and Policy Series No. 6, 2022). The future of sustainable agriculture growth and food security in India depends on the performance of these small and marginal farmers. Hence, there is a need to reorient research, education and extension approaches to be sensitive to small holder farming systems and nutritional outcomes as well.

Sustainable Development Goal SDG 2 aims to end hunger and ensure access to sufficient, safe and nutritious food by all people all year round. Achieving zero hunger by 2030 will require new and existing applications of science, technology and innovation across the food system, addressing all dimensions of food security. Agriculture sector has to play a big role in achieving this target of food and nutrition security of the country. The ICAR should develop new, nutritious, bio-fortified varieties, introduce nutritious crops and varieties, diversify crops, empower women, promote value-added nutri-products, and carefully design price and subsidy policies that encourage the production and consumption of nutrient-rich crops. Diversification of agricultural livelihoods through allied sectors such as animal husbandry, apiary, mushroom cultivation, processing and value addition, forestry and fisheries can enhance livelihood opportunities and nutritional security for small-holder farmers. Hence, the national research and extension system should develop new nutrition-sensitive technologies and technology delivery models, keeping the smallholder farming system of the country in mind. The National Agriculture Research, Education and Extension System of ICAR realized these challenges and has taken many initiatives in this direction. The renewed focus on addressing the issue of malnutrition in India through agricultural intervention in the form of the Millet Mission is praiseworthy. However, poor seed availability and low adoption of these nutri-crops and varieties on a large scale in small farming systems are major concerns. Here comes the role of extension.

Recent studies have found that the challenge of malnutrition is broader and multidimensional. Individuals may intake enough calories for daily subsistence and still suffer from

'hidden hunger'. Besides technology development, the transfer of those technologies, ensuring their adoption by end users, and bringing behavioural changes such as following the recommended food habits, diet diversification, etc., to the user level must be adhered to achieve the final target of food and nutrition security. Hence, cross-sectoral planning between the agricultural research and extension system is the need of the hour for getting the maximum impact of agricultural policies. Besides the focus on the production of nutritious health foods, stress needs to be placed on increasing the consumption of whole grains, fruits and vegetables and processing to alleviate micronutrient deficiencies through the country's vast extension networks.

The current agricultural extension systems in India are mainly based on 'Field Extension System' and 'Frontline Extension System'. While the field extension system is concerned with large-scale agricultural technology dissemination to the large number of Indian farmers by development departments and agencies, the frontline extension system of the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) focuses on the adaptation and demonstration of the technologies and capacity building of the related stakeholders. The broad typology of the agricultural extension systems in the country has mainly Field Extension Systems and Frontline Extension Systems. Whereas the field extension system is concerned with large-scale agricultural technology dissemination to a large number of Indian farmers by the development departments and agencies, the frontline extension system of the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) focuses on the adaptation and demonstration of the technologies and capacity building of the related stakeholders. The ICAR's frontline extension initiatives, such as Farmer FIRST Programme (FFP), Attracting and Retaining Youth in Agriculture (ARYA), Mera Gaon Mera Gaurav (My Village My Pride), Nutri-sensitive Agricultural Resources and Innovations (NARI), Knowledge Systems and Homestead Agriculture Management in Tribal Areas (KSHAMTA), Value Addition and Technology Incubation Centre in Agriculture (VATICA), all have to play an important role in promoting nutri-sensitive farming systems amongst small-holders. They must be introduced to the newly released nutri-crops and varieties. Their capacity needs to be built, and they should be given a demonstration of the value-added nutrition products, including marketing through FPO. The frontline extension network of Krishi Vigyan Kendras (KVKs) can help refine the different farming technologies and practices at the field level by conducting demonstrations at farmers' fields, organizing capacity building on food processing and adding value to the produce. FPOs and SHGs should impart technical literacy on nutrition at the district level of the country. The linkage between KVK and ATMA is also essential for effectively delivering extension services

on nutrition-sensitive agriculture to small-holder farmers. ICT-based extension platforms like Kisan Sarathi, web-based portals (e.g. AGRISNET, DACNET, AGMARKNET), kiosks (e.g. VKC, e Choupal), mobile applications (Pusa Krishi app, mKrishi, mKisan), video-based (Pusa Samachar), etc. have to be used to promote information dissemination more effectively. Additionally, the field extension and frontline extension systems must play a huge role in mobilizing and linking small-holder farmers to large, organized supply chains, e.g. Reliance Fresh, Food World, Safal, for marketing through FPOs. Market information and food safety issues must also be disseminated among farmers for price stabilization, income generation, and employment opportunities. Also, dietary diversification, bio-fortification, and food fortification have to be promoted to bring the focus on nutritious crops. The shifting of consumption patterns toward non-cereals in society provides a good opportunity for small farmers to diversify their cropping patterns to improve both income and nutrition. In this context, appropriate extension activities like community education programmes for ensuring food security, food safety and individual nutrition security have to be promoted to establish linkages across agriculture, food and nutrition in achieving food and nutrition security for all.

In this context, cooperation and partnerships among the National Agricultural Research, Education and Extension Systems of ICAR are becoming critical. The research programmes under the umbrella of ICAR are designed and undertaken to harness the power of science and technology to ensure food, nutritional and livelihood security for the vast population of our country. In the past, ICAR played an enabling role in ushering green revolution and subsequent developments in agriculture. It will continue to do so for the country.

Agricultural extension has long been recognized as vital in improving agrarian development. It builds the knowledge base and the capabilities of farmers to adopt improved farming technologies and innovations developed in public and private research systems. Agricultural extension system in the country played an instrumental role in meeting agrarian challenges for ages and contributed successfully, bringing desirable changes in human behaviour leading to Green Revolution. A robust and efficient extension system capable of meeting the evolving needs of farmers in the context of changing agricultural scenarios is the need of the hour to enhance farmers' income and ensure the sustainable growth of agricultural sector. Investment in reviving the extension system would infuse dynamism into the stagnating graph of agricultural development in India.

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