Frank Notes

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Contribution of ICAR – All India Coordinated Research Projects in Natural Resource Management

Post-independent India has made remarkable progress on agricultural front which is evident from 5.4 times increase in production of food-grains, 10.1 times in horticultural produce, 15.2 times in fish, 9.7 times in milk and 48.1 times in eggs since 1950-51. March of a nation from the 'ship to mouth' situation to over flowing granaries has been an impressive journey. A remarkable growth in agricultural research and development played pivotal role in increase in agriculture production and productivity. With 101 institutes of Indian Council of Agricultural Research (ICAR) and 71 agricultural universities spread across the country, India has one of the largest national agricultural research systems in the world.

Formulation of coordinated research schemes/projects played a significant role in the field of agricultural research and development. A report submitted by Dr. A.B. Stewart (1947) of the Maeaulay Soil Research Institute, Aberdeen, Scotland sowed the seeds of coordinated and multidisciplinary agronomic research in the country. As a follow up of this report, a scheme called "Simple Fertilizer Trials on Cultivators' Fields" was started during 1952-53. Subsequently in 1956, with the addition of "Model Agronomic Experiments", the scheme was rechristened as "All India Coordinated Agronomic Experiments Scheme". The first ICAR-All India Coordinated Research Project (AICRP) was established in 1957 at IARI, New Delhi on Maize. The novel feature of this project was that it brought Central Research Institutes, Agricultural Universities and State Departments of Agriculture together as a team to resolve the problems of maize at the national level.

The success of AICRP on Maize led to the extension of this approach to cover all the major crops including horticulture and other related areas. AICRPs have been essentially conceived as an instrument to mobilize available scientific resources for accelerating the agricultural production through inter-institutional interactions. Currently, out of 60 All India Coordinated Research Projects in place, 34 deal with crops, 10 with natural resource management, 6 with agricultural engineering and the rest deal with animal sciences and fisheries.

Sustainable management of natural resources is a priority area for achieving food, nutritional, environmental and livelihood security. ICAR has established a number of coordinated projects for developing-location specific, eco-friendly conservation and management technologies to achieve higher input use efficiency and profitability without deteriorating natural resource base. AICRPs in the realm of Natural Resource Management include i) Micro- and Secondary Nutrients and Pollutant Elements in Soils and Plants, ii) Soil Test Crop Response, iii) Long-Term Fertilizer Experiments, iv) Salt-Affected Soils & Use of Saline Water in Agriculture, v) Irrigation Water Management Research, vi) Dryland Agriculture, vii) Agrometeorology, viii) Integrated Farming System Research, ix) Weed Control and, x) Agroforestry. In addition, there are five more projects which include i) Network on Biodiversity-Biofertilizers, ii) Network on Organic Farming, iii) National Innovations in Climate Resilient Agriculture, iv) Consortium Research Programme on Conservation Agriculture, and v) Consortium Research Programme on Water.

AICRPs have contributed immensely during last half-a- century in making the country food secure/surplus and are working tirelessly to realize the goal of nutritional security. Twenty-five per cent increase in country's cropping intensity since independence; development of environmentally-benign nutrient management strategies (integrated nutrient management and balanced fertilization), increase in nutrient and water use efficiencies through adoption of efficient tillage and planting methods, site-specific nutrient management, fertigation, crop rotations, etc., are some of the achievements of these projects. Forty-five science-based climate-friendly Integrated Farming System models developed and 63 existing farming systems refined through the farmers' participation offer a scope to the farmers to increase their income besides meeting their household level nutritional requirement.

Fifty-years of long-term fertilizer experiments have established that the balanced and integrated

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application of nutrients sustains productivity of cropping systems, improves soil quality/health, and mitigates the impact of climate through increased carbon sequestration. Application of 10-15 tonnes farm yard manure/ha/year is more effective than lime in sustaining the productivity of moderately acid Alfisols. Establishment of usefulness of biofertilizers/ bio-inoculants as components of Integrated Nutrient Management packages, development of liquid biofertilizer formulations with longer shelf-life; identification of potassium and zinc solubilizing bacteria for mineralization of these nutrients from native soil reserves, perfection of vermi/bio-enriched composting technology and getting quality compost in about 45 days has become possible only through coordinated projects.

AICRP on Soil Test Crop Response developed GPS and GIS based soil fertility maps of 173 districts of the country. Integrated plant nutrition system (IPNS) technology, in which the fertilizer nutrient doses are adjusted not only to that contributed from soil and fertilizers, but also from various organic sources, is a futuristic approach for making fertilizer recommendations. Project has also provided the technical backstopping for Soil Health Card Scheme of the Government of India.

As indicated by analysis of more than 2.0 lakh soil samples collected across the country using global positioning system, 36.5, 23.2, 12.8, 7.1 and 4.2% of samples are deficient in zinc, boron, iron, manganese and copper, respectively. Inclusion of zinc in balanced fertilization of rice–based systems and boron in oilseeds and horticulture crops is already a part of package of practices. Screening of micro-nutrient efficient cultivars and their subsequent use helped the resource-poor farmers in realising sustainable yields. Development and release of the zinc-dense rice cultivars by NRRI, Cuttack is a typical success of national and international coordination under harvest-plus programme of CGIAR.

Development of the wholesome site-specific nutrient management schedules for rice, wheat and lately maize crops has been the most-extensive coordinated effort where input from even CGIAR Institutes like IRRI and CIMMYT has been significant. Maximization of N use efficiency through application of N on real time basis with gadgets like LCC, SPAD meter, green seeker, etc., is a significant step forward. Revision of the optimum fertilizer doses for higher crop yields is being done continuously for different crops. Fertigation, a system of applying fertilizer through pressurized irrigation (drip or sprinkler), enhances the efficiency of both water and nutrients. Commercial crops like cotton and sugarcane have been identified for fertigation and schedules have been developed. Coordinated efforts are also underway to develop the production technologies for conservation agriculture and organic farming.

Research findings from these coordinated projects have contributed in formulation of various policies such as setting up of the Task Force on Balanced Fertilizer Use in 2005; National Food Security Mission in 2007; Policy for Fortified/Coated Fertilizers in 2008; Policy Guidelines for Customised Fertilizers in 2008; Nutrient Based Subsidy Scheme in 2010 and Soil Health Card Scheme in 2015. National Mission for Sustainable Agriculture (NMSA) made operational from 2014-15, aims at making agriculture more productive, sustainable, and remunerative and climate-resilient by promoting location-specific integrated/composite farming systems; soil and moisture conservation measures; comprehensive soil health management; and efficient water management practices. Soil Health Management (SHM), one of the most important interventions under NMSA, aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilizers including secondary and micro nutrients in conjunction with organic manures and bio-fertilizers for improving soil health and its productivity.

Despite the commendable research work carried out under coordinated projects, these well proven technologies have not percolated down to the farmers' fields. As a result, it has not been possible to realise potential yields. Transfer of technology is equally important. Coordinated and concerted efforts are needed by all the stakeholders to implement the proven technologies on the farmers' fields. The state governments and even input providers can play a proactive role in knowledge dissemination.

This special issue on ICAR Coordinated Projects is an initiative of FAI to highlight the major contribution made by these projects in enhancing the productivity of cropping/ farming systems; improving the input use efficiency; and sustaining soil, water and environmental quality. The issue includes eight lead papers presenting research achievements of major projects in the field of crop science and natural resource management. We hope that all those concerned with agriculture including scientists, policy makers and extension workers will find the content of the special issue relevant and useful.