

Revitalizing India's farm science institutions

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Agriculture is one sector of economy where the returns from investments in science are easily recounted. Amongst others, building a large infrastructure by way of agricultural research and education institutions under the aegis of the Indian Council of Agricultural Research and the State-owned Agricultural Universities starting early sixties was a key factor in bringing about agricultural transformation in seventies and eighties, whose impact extended far beyond farmers' fields. Agriculture became the engine of wider growth benefitting other sectors of economy and the society at large. Past achievements and greatly expanded research and education infrastructure over the successive five-year plans notwithstanding, there are clear evidences that Indian agriculture is tending to stagnate, productivity growth rates have slowed and this is a cause of serious worry for the country's planners. Agricultural GDP growth rate which was more than 3% per annum during the period 1980–81 to 1995–96 declined to less than 2% during the tenth plan period, 2002–03 to 2006–07, as against targeted growth of 4% per annum. Even conservative estimates of domestic demand show that growth in annual demand in respect of most agricultural commodities is now outstripping growth in domestic supply, necessitating recurrent dependence on the need to import foodgrains, pulses, etc. to meet the basic food needs of the still growing population. Slow growth in agricultural GDP can be a serious impediment to the country's overall economic growth, which is poised now to move to double-digit growth.

These concerns¹ were amply reflected in the recent National Development Council meeting under the chairmanship of Prime Minister of India, Manmohan Singh, which deliberated exclusively on the gamut of issues afflicting Indian agriculture. Among the highlights of these deliberations was that India's technology generation and dissemination system had fatigued and needed to undergo a transformation to be able to respond to the new challenges that the system now faces.

The changing challenges

The challenges facing India's agricultural research and education system are now not the same as what we faced in the sixties and seventies. The singlemost pressing challenge that the country faced in the sixties was to increase the production of foodgrains in the shortest time to reduce and eliminate dependence on imports for want of adequate foreign exchange resources and for reasons of self-esteem. India's agricultural research and education system responded to this challenge by adopting a strategy, which focused on increasing the area and productivity of selected foodgrain crops, particularly rice and wheat, in regions which had assured irrigation or where irrigation facilities could be created relatively easily. Developing and promoting the spread of improved high-potential yield germ plasm of crops, matching input and management needs (nutrients, crop protection, soil management, etc.) formed the key elements of the R&D strategy. With passage of time and with expanding R&D infrastructure, the efforts were extended to a larger array of field and horticultural crops as also on a range of livestock species, fisheries, etc. While the past strategies and efforts have contributed significantly to achieving the objectives of increased production of selected crops and livestock products, there is increasing evidence that our past strategies are proving increasingly inadequate in responding to the challenges we now face and which go much beyond those we imagined in the sixties. The nature and magnitude of the challenges we face now call for a serious rethinking on the ways that will enable the system to respond more effectively. While the basic task of increasing agricultural production and productivity to meet the needs of the growing population and increasing living standards continue, the new challenges demand that:

- Productivity growth must now extend to greater variety of crops, farming sectors (horticulture, livestock, fisheries, forestry) and ecologies/regions. It is particularly important to focus on

areas which were bypassed during the green revolution period and where the livelihoods of the vast majority of poor, particularly women are directly or indirectly linked to farming.

- Agricultural practices and technologies that we generate and promote do not adversely impact our natural resources base. Our past strategies aimed at gains in the short run have led to serious and widespread problem of resources degradation in both irrigated and rainfed ecologies, with grave consequences for sustained productivity and overall ecology. Declining soil quality, deteriorating water resources, loss in biodiversity have all become a serious limitation in achieving enhanced productivity.
- In view of increasing trade liberalization and emerging WTO regimes, it is important that agricultural production systems become more efficient and competitive.
- A serious consideration is given to understand and think of ways to respond to issues of climate change, which are already impacting agriculture in a variety of ways.

It is apparent that the demands on agricultural research are becoming more complex. While the need and concerns of enhancing productivity to meet the needs of the increasing population continue, there are additional concerns which relate to poverty alleviation, equity and sustainability issues. There is increasing pressure for agricultural research not only to result in increased yields, but also to ensure that the benefits of research accrue to the largest recipient groups and that the quality of natural resources base is maintained and improved. These concerns pose a major challenge.

The new challenges call for new strategies and approaches to address the problems. The new research for development strategies will differ from that in past in many ways.

- Most importantly new strategies must enable solve location-specific problems facing the farming communities, i.e. they must take into account local

resource endowments as also prevailing socio-economic conditions. Addressing the Consultative Group on International Agricultural Research Meeting in Delhi in 1994, the former Prime Minister P. V. Narasimha Rao² implored, 'I would like you to think of the whole world and at the same time think of the need to find differentiated and properly considered solution for each variety of situations, rather than tarring everything with one kind of brush. That is not going to work in agriculture. Every plot of land is like a human being, it has to be tended like a child and that is how we, the farmers, think about our land'.

An important feature of the new strategies will be the need to build a farming systems perspective in defining our research for development agenda. In the past, many of the technologies that scientists developed and promoted were not readily acceptable because they did not 'fit' the prevailing system. We now need organizational models which will permit participation of users of research in defining and executing research agenda. These models should also enable a smooth way of extension of new technologies amongst potential users. Thus the need now is to shift from individual crop-based focus to a region-based research focus, which takes into account the resource endowments, the socio-economic conditions as reflected in current levels of agriculture and technology use.

Eco-regional approach to research for development

A critical leveraging point to enable India's agricultural research system to face the new and larger challenges is to shift from the largely commodity-focused strategy toward a focus on eco-region and land-use systems. The term eco-region refers to an area which is relatively homogenous with respect to biophysical and socio-economic environment, as reflected in the current farming situation and which would allow results of research to be applied to a large area. An eco-regional approach has several potential benefits over the commodity-focused research that we have emphasized thus far. Most importantly, it enables concerns of enhanced productivity and natural resource degradation problems to be

addressed in an integrated manner. Further, the approach helps to better understand and address interactions amongst different components of land-use and agriculture, viz. crop and livestock husbandry, forestry, fisheries, etc. and the way they impact integrity of the natural resources. The eco-regional framework is conducive to cooperative linkages between farming and scientific community on the one hand, and between the scientific and development agencies on the other. Importantly, the approach enables defining research for development strategies in a problem-solving mode, i.e. enables identification and prioritization of the most pressing problem of a region, e.g. constrains to cropping, livestock production, soil management, forestry, wildlife, etc. and the needed R&D agenda. Eco-regional framework also provides a platform for organizations responsible for the development of different sectors, e.g. forestry, animal husbandry, water resources, etc., to work cooperatively.

Operationalizing eco-regional approach to research for development

Defining the boundaries of an eco-region is important for planning research for development agenda. Three sets of criteria which have been used to define a region include agro-ecological criteria, socio-economic criteria and administrative criteria. Agro-ecological criteria define a target area that is relatively homogenous in its agricultural and resource management pattern. Thus the area should be relatively homogenous with respect to climate (temperature, rainfall, etc.), soil (type, topography, depth, etc.), natural resource endowments (availability of water resource, proportion of area covered by forests, diversity of species, etc.) and land use. Land-use criteria reflect how people respond to climate, soil and natural resource endowments within existing institutional and socio-economic environments. Thus current land use, in some ways, reflects an integration of biophysical and socio-economic parameters. The term land use includes such variables as crops and cropping patterns, livestock production, forestry activities, management practices, etc. Socio-economic parameters greatly influence the technological needs and are therefore important in defining a region for res-

earch for development planning. Important elements are income level, market access, farm size, urbanization, etc. These factors influence both the potential and opportunities for technological intervention to enhance agriculture and livelihoods. The third, i.e. administrative criteria become important in a country of our size, divided into states and districts, because administrative division forms the framework for implementing public policies. Respecting these boundaries will therefore appear important in linking R&D. In the past, efforts have been made to identify and demarcate agro-ecological zones based on landform, soils, bioclimatic conditions and length of growing period adopting well standardized methodologies. At the national level the country was divided³ into 20 agro-ecological regions and later into 60 sub-regions. Before this, in the early eighties, recognizing the necessity of need-based research for development, the Indian Council of Agricultural Research (ICAR) identified 120 agricultural zones for putting in place an infrastructure to strengthen regional research and extension capability by way of laboratory-buildings, scientific manpower, equipment and other facilities through the National Agricultural Research Project (NARP). Unfortunately the process of research planning and execution has continued to be top-down for want of a new vision and the system inertia. Operationalizing eco-regional approach to R&D will call for building a shared vision amongst the key stakeholders and a strategy which will enable step-wise shift to new ways of planning and executing research for the development agenda, constantly learning and evolving in relation to the horizon of emerging problems.

In his address to the National Development Council, the Prime Minister Manmohan Singh observed¹: 'What we have been missing in agriculture so far is a common thread that ties all our interventions into a common whole and focuses on tangible outcomes. We need to move away from mechanical implementation of fragmented schemes towards an integrated approach, which is based on a mix of interventions consistent with local requirements'. It is in this regard that the eco-regional strategy deserves a closer analysis as a way to meet the new challenges.

Agriculture being a state subject, the main onus to operationalize the approach

will lie with the State Agricultural Universities conjunctively with the State Departments of Agriculture and other stakeholders. Yet the Central institutions, ICAR and the Ministry of Agriculture will be required to play a critical role in operationalizing the approach both at the national and state levels. Natural resource endowments, land and water resources, climatic features, and biodiversity do not follow administrative boundaries and cut across the states and districts. Central institutions will be required to play a lead role in conceptualizing an operational framework, which is flexible and open to evolution. Thus while they will play a critical role in facilitating a shift from crop-based focus to an eco-region and a system-based focus in the states, they will need to do the same at the national level. More importantly, the Central institutions will have an enabling role in evolution of new approaches through interactive and iterative processes, while themselves undergoing a change to meet the challenges.

Implications for agricultural research systems

A shift to eco-regional mode of planning and implementation of agricultural research has major implications for the organization and management of research institutions. Most importantly, the approach calls for and provides a basis for system-based thinking and in conceptualizing, planning and execution of research agenda linking near-term and futuristic goals. An important implication of the change relates to the need for redefinition of the system itself. Traditionally, the system has been conceived as being constituted of two main components – the state agricultural universities and the research institutes directly overlooked by the ICAR. The changing nature of the challenges calls for the concept of the system to include new players, which will contribute to enhanced knowledge base on both ends of the spectrum –

knowledge which will contribute to bear upon solutions of problems in the short run and building a pool of basic knowledge necessary to understand and find solutions to increasingly complex system-based problems. Building and strengthening partnerships with farming communities, NGOs, local entrepreneurs and private sector players on the one hand and institutions engaged in more basic and complex system researches nationally and globally on the other, will increasingly become a necessity. While India's agricultural research system will need to embrace new partners, the roles played by the traditional partners will need to undergo a fundamental change. In the green revolution period, the Central institutions provided major R&D leads, while the State Agricultural Universities translated these leads into action programmes, contributing to transformation in the fields. Operationalization of eco-regional approaches will demand that the scientific community in the State Agricultural Universities take an upfront role in defining the research agenda, best approaches to arrive at solutions and developing a seamless interface with development agencies. They must also increasingly guide policy at local level in consonance with larger goals. If this be so, the Central institutions will need to redefine their roles which will have to be more supportive in nature. While their research agenda will clearly need to build strong linkages with those of scientists of the State Agricultural Universities, there will be need to increasingly build a perspective of problems which cut across the state boundaries, have national and global dimensions and contribute to building knowledge base for solving increasingly complex problems. The changing role of key stakeholders, need for systems-based approaches and new pattern of linkages, need for building a short and longer-term perspective, all will call for new and more innovative ways of prioritizing, planning and funding research programmes. Central institutions will also need to address policy

perspective to bear on national issues by building a strong interface with the development wings of the Ministry.

An implication, which is critical to the success of a new approach, is the need to build-up scientific capacity to analyse, understand and find solutions to system-based sustainability problems. It is also clear that more varied expertise which resides outside the traditional agricultural research system, will be required. Similarly, scientists within an organization and from among different organizations will need to work in a problem-solving mode and this will call for significant institutional changes, i.e. the ways of working, which will permit and facilitate a change.

It is apparent that a shift from crop-based focus to an eco-regional approach to research for development has wide-ranging implications for the way India's agricultural research system is structured and functions. Transforming the system to meet the new challenges calls for a new vision which is widely shared by the key stakeholders and processes put in place to guide and leverage a step-wise change, learning and correcting as we seek new directions and scale new heights.

1. Singh, Manmohan, PM's opening remarks at the 53rd meeting of the National Development Council, 29 May 2007.
2. Rao P. V. Narasimha, Inaugural remarks, The Consultative Group on International Agricultural Research, Mid-term meeting, MTM 94, 23–27 May 1994, New Delhi.
3. Sehgal, J., Mandal, D. K. and Mandal, C., Agroecological regions of India. Tech Bull. NBSS Publ. 24, Oxford and IBH, New Delhi and NBSS and LUP, Nagpur, 1992, p. 130.

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