AGRICULTURAL RESEARCH, DEVELOPMENT AND EXTENSION (ARD&E) IN INDIA: THE KEY TO FOOD SECURITY

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Abstract

Climate change, coupled with increasing population, is posing a threat to global food security and now a matter of great concern for UN and other international bodies. To boost up production in a sustainable way agricultural research plays an important role. India's present good performance in agriculture is the result of scientific researches in the past. But there is ample scope for improvement in terms of yield, variety, quality, method etc. which require application of advanced technology. Research sector has some structural impediments which need to be taken care of. Development of agriculture will be possible only by proper blending of commerce with scientific knowledge which will enable India to become self-reliant.

INTRODUCTION

Food security in a country like India, which is large, economically backward and densely populated, always remains a major issue. Food security is not possible without adequate agricultural production within the country. More production, is possible only through scientific research and innovation.

In the past, India, a famine-starved country as British had left it, dependent on foreign-aid and import for food for next two decades, was able to come out of that condition with judicious application of science and technology in different sectors of agriculture and achieved self-sufficiency in food production. It ranks second in terms of global farm output and net exporter in agriculture since 1992. But after 1990 no major path-breaking scientific steps have been taken in agriculture and it is just following "business-as-usual".

Meantime agriculture production is showing a declining trend. Yields of most crops have reached their plateau. Climate change has started to take its toll on agricultural productivity. Incidence of pest and diseases, a consequence of global warming, has increased resulting in more harvest loss. Possibility of further expansion of arable land is restricted for loss of biodiversity and other environmental issues. Existing farming practice is not capable of tackling these challenges.

Unless India rises to the occasion in time and initiates necessary measures to revitalise its agriculture research sector, it may find it difficult to feed its vast population projected as 1.5 billion by 2050.

AGRICULTURAL R D& E-GLOBAL SCENARIO

The first conscious attempt to solve the world's food problem through technological innovation was made in 1960 when the Norwegian-American agronomist Norman Borlaug developed a dwarf variety of wheat in his laboratory at Mexico which when planted at high density in the field and cultivated with application of chemical fertilizer, controlled irrigation and farm machinery resulted in manifold increase in crop-yield. India, led by scientist MS Swaminathan, was one first countries (next to Mexico)

to embrace the technology and demonstrate its success. The process later was applied to other cereal crops and adopted by many other countries. It was known as green revolution. In spite of stern criticism developed in later period against green revolution it is no denying a fact that without green revolution world would not be able to feed even fifty percent of its current population.

During eighties and nineties, led by digital technology, investment in agriculture was on decline. Food price shock in 2007-08 made world authority to revisit agriculture sector and put necessary impetus in its research but in a direction that will remove the short-comings of green revolution.

Green revolution concentrated on increased production, not farmer's income. It involved costly inputs and could be made economically viable only with heavy subsidy by respective governments on seed, fertiliser, energy (diesel and electricity) etc. Increased yield often led to lower price and the profit could not match the related cost. Moreover, its benefit could be reaped by a section of rich farmers only while large population of small and marginal farmers were left out. Also the process exploited natural resources like soil and water heavily resulting ecological imbalance.

Current agricultural research aims to develop methods which will be economically viable, socially acceptable and environmentally sustainable. It focuses on the following aspects:

1. From earlier top-down, supply-driven approach it has taken a bottom-up, demand-driven and most importantly farmer-centric approach. Research topic is selected in consultation with them, recognizing their needs with regional variation.
2. Green revolution technology required large land holding whereas majority of farmers in world hold land between 1-3 ha. Hence research now gives more attention to the need of small and marginal farmers.
3. Conventional research concentrated on crop development, mainly wheat and rice. Now with changed dietary habits the emphasis is on products like fruits, vegetables, dairy and poultry products with more nutrient value and higher price. Simultaneously research to enrich existing crops with more nutrients and to find alternatives of cereal crops such as millet, sorghums cassava is also in the process. This broadens the scope of farmers' income.
4. Women form a large part of agricultural labour particularly hired labour. Their roles are now acknowledged to improve their income. For instance, horticulture is a sector which employs more women. Hence development of horticulture will ensure their betterment.
5. Tremendous progress in biotechnology and molecular biology since nineties, especially in current millennium has opened a new horizon in agriculture. Scientists have developed new plant-species with qualities like climate-resilience, pest-resistance, more-nutrient, higher-yield etc and/or animal breed with higher productivity. This new arena of research in agriculture is often termed as gene revolution.
6. Taking due cognizance of environmental aspects, new farming techniques are developed which help to preserve natural resources. Conservation agriculture and, organic farming is now being promoted as environment-friendly but their large scale application in an economically beneficial way is yet to be developed.

AGRICULTURAL R, D&

E- INDIAN SCENARIO

Indian Council of Agricultural Research (ICAR) is the apex body in India for co-ordinating research and education in agriculture at national level. Its various divisions are committed to different branches of agriculture, viz., crop, animal, fisheries, horticulture agriculture engineering etc. ICAR has 111 research institutes spread across the country and devoted to specific area, 6 national bureaux to conduct research in basic sciences, 64 agricultural universities to impart educations and conduct research at State level, 4 Central universities, number of Krishi Vigyan Kendras to conduct field level experiments and extension services. As per ADB Report 2014, India has one of the world's largest agricultural research systems and most qualified research staffs.

Yet Indian agriculture is suffering from some chronic problems which offer ample scope for its researchers.

1. Productivity of all major crops is low and yield gaps are high when compared to world average or its neighbouring countries like China or Vietnam.
2. Cultivation is more water intensive resulting in depletion of ground water to an alarming level.
3. Although use of fertiliser or pesticides are not excessive, improper use of fertiliser with mono-crop culture has reduced soil's nutrition value while use of low quality pesticides increases risk of toxicity in plants in addition to huge output losses due to pests and weeds.
4. Surplus production is predominantly crop-centric and India has to pay heavy import bill in respect of vegetable oil or pulses. Potentials of other products such as fruits, vegetables, dairy, animal husbandry having relatively

higher contribution in Agri-GDP have not been exploited in full. Potential of aromatic plants, medicinal plants remain untapped.

Some structural defects persist in the sector which hinders its growth.

Fund constraints: World Bank recommends spending on agricultural research as 1 per cent of agricultural GDP. Most developed countries spend much higher amount, up-to 3 per cent. India spends only .4 per cent on research or 0.54 per cent including extension, which is even lower than many other South-Asian developing countries. Moreover, a large part of that goes to meet salary and other administrative cost, little left for basic or applied research. China to meet its problem of insufficient resource has grouped its research institutes in two categories- commercial and non-commercial. While the latter category is engaged in core research and gets more public fund, revenue of the former largely depends on commercial source. As per WTO agreement subsidies on agriculture to be removed in phases, released fund could be deployed in research, as UNEP suggests.

Technology Gap: India is lagging far behind in modern technology, particularly in the area of biotechnology, which is becoming a major threat in the present day context. In green revolution, technology was developed by public institutions and open to all. In contrast, the sector is now highly corporatized and new technologies are well protected under patent rights, not accessible freely. Also, licence fee for accession is quite high. A fact that world's seed industry is becoming exceedingly monopoly of few multinational corporate giants is becoming a global concern. Recent legal dispute between seed manufacturing company Monsanto and its Indian licensee Nuziveedu over fixation and payment of licence fee may be an eye-opener. To combat this, China in the last decade has invested heavily in seed development sector.

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Recent acquisition of world's largest seed manufacturer Syngenta by State owned Chem-China is another step in this direction. India's seed industry is heavily dependent on foreign technology. It is urgently required to develop indigenous technology in collaboration with foreign institutions. Some initiative has already been taken in rice sector which needs to be pursued.

Low private investment : In developed countries agricultural research, particularly product development, is largely sponsored by private organizations while research on basic technology is carried out at Government institution. In India private investment though increasing, is still quite low. While private investment is considered more efficient and productive than public expenditure, there is also the possibility that selection of research topic by private sector will be done more with commercial interest rather than for public good. It is necessary to design proper policy with incentive to attract private investment in the right direction. India's ambiguous patent regime is one reason that is deterring private investment. Private firms are reluctant to invest unless their commercial interest is protected. In India, agricultural tools and chemicals come under Indian Patent law of 1970, amended in 2005, while Protection of Plant Variety and Farmers' Right Act, 2001 provides patent right to the plant breeders which also protects farmers from exploitation of breeders and saves their rights on inherited knowledge. However, its many clauses and definitions are not clear and interpretations widely differ. Most agricultural patents taken in the past are by foreign companies, as the survey noted.

Weak Extension Linkage: 'Extension service' means dissemination of research knowledge from experiment station to farmers' field with necessary training for their adaptation. That requires deep rural penetration with trained extension staff. The services in India are provided by Agriculture Technology Management Agency (ATMA), KVK, SAU under ICAR. Performance of these could not be up-to the expectation due to lack of manpower and specialized staff. Research scholars are often more oriented towards academic career rather than field-level activities. Digital platforms provide one-way information on weather or market. Services provided by some large agro-based companies have only limited coverage. Linking newly developed agri-start-ups with research centres may be helpful.

People opposition against GM technology: Genetically Modified species raises severe opposition from several corners like NGOs, social activists, environmentalists on issues like health hazard or ecological imbalances. Although these claims cannot be ruled out totally, unfortunately most of the allegations are made from mythical belief or wild guess without any scientific proof, as pointed out by the experts. Also the movement is highly polarised between EU and USA indicating the possibility of commercial interest. India so far has approved only one GM crop i.e. Bt cotton and a good many numbers awaiting under Supreme Court injunction. Benefits and possibility of biotechnology in general, or genetic engineering in particular, is well beyond question. Apart from higher yield it could also reduce the requirement of water, fertilizer, pesticide etc thus reducing the input cost. Negative impact, if any, as cited by its opponents, is not the flaw of technology but its inefficient or premature use by its producers on profit motive. What is needed is to

build up the necessary infrastructure for reliable testing before commercial release of GM species and complete database.

CONCLUSION

As per ADB report one-unit investment in ARD&E generates ten units of return. Indian ARD&E system needs reforms to become more responsive and deliver the expected result. The country's present initiative towards agriculture sector reform has focussed on market only (in line with WTO recommendation) with oblique reference to infrastructure. Research and development couldn't find its place in reform agenda. Research takes time to bear.

its fruit, even ten years, and any delay may be disastrous. Proper blending of science with commerce will enable the country to become self-reliant and improve farmer's income. MA

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