“However efficient the organization which is built up for agricultural demonstration and extension, unless that organization is based on the solid foundations provided by research, it is merely a house built on sand”

(Royal Commission on Agriculture, 1925)

Introduction

Science and technology are the engines of agricultural growth and development. Agriculture continues to remain a major sector of the Indian economy. The contribution of agriculture to the Gross Value Added (GVA) is 16.5 per cent in 2019-20, continues to be the primary source of livelihood for 58 per cent of the population. Technological progress in agriculture is, therefore, crucial for the overall economic development of the country.¹

National Agricultural Research Systems (NARS) encompass a wide range of institutions and activities. The need for NARS and their strengthening in developing countries over the last three decades was stimulated by the need to increase food production by making science and technology available for transformation of traditional agriculture.

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¹ Economic-Survey-2019-20
The green revolution is primarily the result of NARS and the emergence of International Agricultural Research Centres (IARCs) as instruments of change. The 'miracle' seeds and packages of technology developed through IARCs catalysed NARS to adapt the technology and reap the full benefits. Thus, the first phase of the revolution in production came through 'seeds of change,' and fertilizer and irrigation interaction.\(^2\) We need NARS system to switch from Green Revolution to Rainbow Revolution and from Rainbow Revolution to Evergreen Revolution then Gene Revolution. India adopted the Agricultural Research Council (ARC) model. The Council, an autonomous research organization with 101 ICAR institutes and 71 agricultural universities spread across the country, is one of the largest national agricultural systems in the world.

Q.1 a) Why are National Agricultural Research Systems (NARS) necessary and How far the NARS system achieved its mandate?

b) Whether we have shifted from Input Intensive to Knowledge Intensive Agriculture?

Ans. The ICAR has been playing a pivotal role in promoting excellence in higher education in agriculture, while also engaging in innovative areas of science and technology development by its research, which is acknowledged nationally and internationally. In the recent years, ICAR has been playing an important and proactive role in the agricultural technology dissemination through its strong network of Krishi Vigyan Kendras and supporting farmers in all possible ways. Technology assessment is one of the main activities of KVKs to identify the location specificity of agricultural technologies developed by National Agricultural Research Systems (NARS) under various farming systems. ICAR is sturdily contributing towards the efforts and initiatives of government to double the farmers’ income by 2022 by its research on farming systems, policy inputs and coordination with state agencies.\(^3\)

Over the years, ICAR has enabled the country to increase the production of food grains by 5.6 times, horticultural crops by 10.5 times, fish by 16.8 times, milk by 10.4 times and eggs by 52.9 times since 1950-51 to 2017-18, thus making a visible impact on the national food and nutritional security.

b. To increase the production of food crops in India, the ICAR led the National Agricultural Research System (NARS) in developing location-specific new high yielding varieties/hybrids and their matching production and protection technologies of food and horticultural crops. The Indian Council of Agricultural Research is a time tested premier organization. The Council has always been ahead of its times, however as advance world is moving towards precision farming

\(^2\) [http://www.fao.org/3/w7501e/w7501e06.htm]
\(^3\) [https://icar.org.in/dare-icar-annual-reports]
using sensors and other scientific tools for exact practices and application of inputs. It saves costs, reduce environmental effect and yield more and better quality produce. Upgrading farming from low tech to high-tech (green house cultivation, poly houses, tissue culture, precision farming) will reduce average cost, raise farmers income and address some scale disabilities⁴. Some key initiatives launched by the Government to focus on agricultural research.

- Student READY (Rural Entrepreneurship Awareness Development Yojana) programme
- Mera Gaon Mera Gaurav (MGMG)
- Attracting and Retaining Youth in Agriculture (ARYA)
- National Level Cluster Frontline Demonstrations (CFLDs)
- PM Fasal Bima Yojana
- Green Revolution – Krishonnati Yojana- It is a Centrally Sponsored Umbrella Scheme that has been implemented since 2016-17. It comprises of 11 schemes / missions. To develop the agriculture and allied sector in a holistic and scientific manner to increase the income of farmers by enhancing production, productivity and better returns on produce
- National Mission On Sustainable Agriculture
- Rashtriya Krishi Vikas Yojana – Raftaar (RKVY-RAFTAAR)- To strengthen the farmers’ efforts through creation of required pre and postharvest agri-infrastructure that increases access to quality inputs, storage, market facilities etc. and enables farmers to make informed choices.
- Bringing Green Revolution to Eastern India (BGREI)
- Strengthening & Modernization Of Pest Management Approach in India (SMPMA)
- National Innovations On Climate Resilient Agriculture (NICRA)
- The Farmer’s Science Congress was inaugurated in University of Agricultural Sciences, Bengaluru for the first time in the 107 years of history of the Indian Science Congress, highlighting the importance of farmer’s innovations and their scientific validity.
- Farmers Innovation Fund and Innovation Centres will be set up to encourage innovations made by progressive farmers.

Q.2. ICAR is the premier organization of agriculture research in the country, therefore, for Strengthening of Research system we have to strengthen ICAR. How can we strengthen ICAR?

Ans. The criterion which determines the success of an organization is whether or not the structure enhances or retards the efficient performance of a function. The organization must relate to the functions, and should be compatible with the national resources and goals. Science

⁴ Transforming Agriculture for Challenges of 21st Century, NITI Aayog report
and technology is pivotal to the country’s effort to meet the challenges enumerated and to help our farm and fisher families to enhance the productivity, profitability, sustainability and equity. For this a three pronged approach should be adopted: Firstly, there is need to prioritize strategic research and technology development programmes, including cutting-edge technologies, geared to meet the technological problems retarding and decelerating agriculture-led growth and development. Secondly, Science and technologies should have a human face and cannot operate in a vacuum. Therefore, it is absolutely necessary to formulate clear cut goals, policies, strategies and programmes and build partnerships for harnessing the (unlimited) power of science and synergizing technological and social revolutions. Thirdly, the National Agricultural Research System, the technology assessment and transfer system, the knowledge system (skill development, re-tooling, indigenous knowledge, the humanware aspects, enabling mechanism (IPR, SPS) and services must be synergistically aligned, restructured and revitalized to dismantle the unholy alliance of hunger, poverty, unemployment, unsustainability and exclusion.

Expand the horizon of agriculture from food and nutrition security to source of raw materials for secondary and tertiary industrial sectors. Adopt modern production strategy-

- From ‘at any cost’ to ‘minimal cost’
- From ‘any how approach’ to ‘sustainable approach’
- From ‘supply-push’ to ‘demand-pull’ production system

The production system may be re-prioritised by adopting a market-led crop geometry and product matrix guided by nutrition yielding, job creating and income generating crop and sector diversification

- From major cereals (paddy & wheat) to nutri-cereals
- From only food grains (cereals + pulses) to fruits, vegetables and flowers
- From carbohydrates only to proteins (pulses)
- From only floral/vegetative proteins to floral + faunal/animal based proteins (eggs, milk, meat and fish)
- From field crops only to horticulture + dairy + livestock + fisheries, etc.
- From only farm activities to farm + on-and-off farm activities (primary + secondary agriculture). Promotion of Secondary Agriculture (as defined by the Committee), is critical to impart vertical elasticity to the land, which is otherwise horizontally inelastic.  

Q. 3 a) Describe briefly the Digital India Land Record Modernization Programme (DILRMP) and the progress made so far?

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5 *Doubling Farmers’ Income – Volume XIV Comprehensive Policy Recommendations*
b) Agriculture sector is not a lucrative profession; hence, it is fully dependent on Government funding. Therefore, How to promote investment in agricultural sector by the private players other than the farmer?

Ans. The Digital India Land Record Modernization Programme (DILRMP) has 3 major components - (a) Computerization of land record (b) Survey/re-survey (c) Computerization of Registration. The District has been taken as the unit of implementation, where all programme activities are to converge. It is hoped that all districts in the country would be covered by the end of the 12th Plan period except where cadastral surveys are being done for the first time. Out of 655959 villages in the States and UTs of India, computerization of Land Records completed is 591421 (90 per cent) and ongoing of Land Records computerization is 13105 (2 per cent) and yet to digitalized is 51433 (8 per cent).

b. There is an urgent need to promote investment in agricultural sector by the private players other than the farmer, especially in the post-harvest infrastructure and facilities besides the machinery, processing and value chain related products. The investment in agriculture sector should be made in partnership with private sector. There is need to expedite the proposal(s) of Public-Private-Partnership in agricultural research and education.

The Department Related Standing Committee on Agriculture, in its 2013-2014 report finds that so far the Public Private Partnership (PPP) in National Agricultural Research system has mainly been used as a vehicle to enhance technology validation and transfer/commercialization through MoUs/MoAs/NTA/Agreements/Licensing/ or Consultancy Contracts etc. They also find that in research there have been initiatives mainly in the areas of farm implements, machinery processing and value addition. They note that partnership with private sector has seen a new approach for growth in ICAR. It is based on the principles of joint IPR ownership and pre-decided licensing rights. The Ministry informed the Committee that about 385 technologies / know-how have been transferred / commercialized through more than 900 partnership developed with external agencies. In 203 sub-projects of various components of National Agricultural Innovation Project (World Bank supported) there are 212 private sector organizations including NGOs participating in 6 consortia. The Committee was also informed that a Cabinet Note on “In-Principal approval of the Public-Private-Partnership in Agricultural Research and Education” has already been initiated to provide the much needed stronger foundation to meet these requirements.

Q. 4 a) what are the key hurdles in getting targeted 4 per cent agricultural growth rate and how can we achieve it?

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7 Lok Sabha Unstarred Question No 412 answered on 04.02.2020
b) Has the time come, when we should think about shifting of agriculture subject from the state list to concurrent list?

Ans.- Agriculture sector is both gigantic in size and complex in nature, that cut across domains and all socio-economic backdrops and therefore it cannot be restrict to the size of a farm or in a narrow prism of a traditional farmers discipline. Agriculture Sector in India faces various type of challenges like small farm holdings, varied kind of climate, upland-lowland problems, natural disasters like several districts reeling under floods with several others experiencing drought at the same time. According to the DARE (Department of Agriculture Research and Education) the cultivated land areas in the country is 140 million hectare for last 6 decades and it has not increased, while the population of the country has increased to 121 crore people. According to the Department of Agriculture Research and Education to attain 4% agricultural growth, as targeted by the Planning Commission, at least one-third of this growth must come through technological innovations and the remaining two-thirds has to be achieved through additional use of agricultural inputs.

Director, National Centre for Agricultural Economics and Policy Research said: “The model which was prepared for 11th Plan to achieve 4 per cent growth was based on four or five assumptions. The first assumption was that public investment in agriculture in the form of infrastructure, irrigation, water conservation, and land etc. which at that time had dipped to 2.5 per cent, recommended to be increased to the 4 per cent. Then, the second aspect was that the R&D expenditure was around 0.5 per cent. It was a strong recommendation that the R&D expenditure must also increase from 0.5 per cent of agriculture GDP to one per cent. Then, there was the recommendation about agriculture credit for seed, hybrid and all these things. Within those five or six recommendations, we could achieve only in agriculture credit and seed. Over the years, agriculture, being a State subject, has been viewed as a road-block for implementation of reforms. In some sense it is true. For instance, the recently announced policy

The advantage of shifting agriculture subject from the State list to Concurrent list, then the Centre will give more attention to the problems farmers are facing in different parts of the country. It is the Union Government that decides on the grant-in-aid to the states; also the overriding financial powers of the Union will help the states to address the issues relating to agriculture. As agriculture has been debated in the trade talks (World Trade Organization and in many other multilateral forums) where the Union Government participates, it will be good and appropriate that the Union government gets the input from states when such meetings are held. This will help present the problems of the farmers objectively in the trade talks.
Every farmer in India also expects some relief for them in the Union Budget, by way of waiver of loans or an increase in the support price for their products. Over the years, agriculture has become more than a State subject.

Q.5. Which countries in the world have the highest percentage of agricultural exports to its production? And how did they achieve that? Illustrate with some examples.

Ans. United States of America (USA) is the highest exporter of agricultural products even though their production is less than some countries. Other top producers and exporters of food items includes Germany, Canada, United Kingdom, Brazil, India, China, France, Netherlands, Japan, Belgium, Italy, Russia, etc.

There are many factors that influence the level of food production in a country, including the climate, the types of naturally-occurring and the viability of the country's overall economy among other factors. Important factors are availability of cultivable land, workforce, technology applied in farming, etc. Most agricultural commodities require a lot of land area, and land area is something only the largest countries have in abundance. In fact, four of the world's dominant food-producing countries—China, India, the U.S., and Brazil—also rank in the top five countries in the world for total geographic land area.

India has remained consistently a net exporter of Agri-products, touching Rs 2.7 lakh crore exports and imports at Rs 1.37 lakh crore in 2018-19. However, its total agricultural export basket accounts for a little over 2.15 per cent of the world agricultural trade. The major export destinations are USA, Saudi Arabia, Iran, Nepal and Bangladesh. Among agricultural commodities, rice, spices, oil meals, sugar cotton and castor oil have been leading export commodities. Therefore, the Government has recently initiated a comprehensive “Agriculture Export Policy” aimed at doubling the agricultural exports and integrating Indian farmers and agricultural products with the global value chains. Government will invest Rs. 1,400 crore to set up specialized clusters in different states for different produce to push exports.

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Exports</td>
<td>35.2</td>
<td>33.7</td>
<td>39.5</td>
<td>39.4</td>
</tr>
<tr>
<td>Total Imports</td>
<td>25.4</td>
<td>26.9</td>
<td>30.2</td>
<td>24.6</td>
</tr>
<tr>
<td>Imports from the US</td>
<td>1.3</td>
<td>1.4</td>
<td>1.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

8 https://humboldt.global/top-agricultural-exporters/
10 https://www.export.gov/apex/article2?id=India-Agricultural-Sector
In the case of USA, technological developments in agriculture have been influential in driving changes in the farm sector. Innovations in animal and crop genetics, chemicals, equipment, and farm organization have enabled continuing output growth without adding much to inputs. As a result, even as the amount of land and labor used in farming declined, total farm output nearly tripled between 1948 and 2017\textsuperscript{11}. Many American companies dominate the food export market, which is, in part, resulting to an increasingly productive farming sector.

In the France last reform of the Common Agricultural Policy (CAP), a special effort was made for small and medium farmers to encourage more productivity and drive the involvement of youth. In France, the structural policy is aimed at modernizing family farms and limiting the development of large farms. Thus, land use and forestry and rural development instruments were created and several measures have been implemented: long-term, tacitly renewable leases, control of land allocation to regulate the size of farms, regulation of rent prices and strong, secure access to land. This land policy has allowed family farmers to invest in soil fertility, limiting investment in the land to concentrate on productive land management and the promotion of generational change. Politically, professional agricultural organizations are involved in decisions and the implementation of agricultural policies\textsuperscript{12}.

The Netherlands is a leading agricultural producer and the third largest agricultural exporter in the world, after the United States and France\textsuperscript{13}. The Netherlands is a small, densely populated country, with more than 1,300 inhabitants per square mile. It is bereft of almost every resource long thought to be necessary for large-scale agriculture. Yet it is the globe’s number two exporter of food as measured by value, second only to the United States, which has 270 times its landmass. The brain trust behind these astounding numbers is centered at Wageningen University & Research (WUR), widely regarded as the world’s top agricultural research institution. WUR is the nodal point of Food Valley, an expansive cluster of agricultural technology start-ups and experimental farms.

Q.6. (a) The Government is determined to double the farmers income by 2022, What are the steps undertaken by Government to increase the farmers' income and how the rural godown scheme (Rural Storage Infrastructure) will help in achieving this target?

\textsuperscript{12} http://www.fao.org/family-farming/countries/fra/en/
\textsuperscript{13} http://www.fao.org/3/y1669e/y1669e0c.htm
Ans. The Government constituted a committee under the Chairmanship of Sh. Ashok Dalwai to examine issues relating to “Doubling of Farmers Income” (DFI) in 2016. The Committee submitted its Report to the Government in September, 2018. To achieve above mentioned objective the Committee identified seven sources of income growth viz., improvement in crop productivity; improvement in livestock productivity; resource use efficiency or savings in the cost of production; increase in the cropping intensity; diversification towards high value crops; improvement in real prices received by farmers; and shift from farm to non-farm occupations. Due to the efforts made as part of schemes/ programmes of the Department of Agriculture and Farmers’ Welfare which also aligns with the strategy of doubling farmers’ income, there has been an appreciable improvement in efficiency bringing about a positive impact in the agriculture sector.

The Production of Food grains, horticultural crops and growth rate of Gross Value Added (GVA) of agriculture and allied sector (as per the figures released by Central Statistics Office) from 2016-17 to 2019-20 are detailed below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Food Grains (million tonnes)</th>
<th>Horticulture crops (million tonnes)</th>
<th>Growth rate of GVA of agriculture and allied sector (at 2011-12 prices)</th>
<th>Share of Gross Value Added (GVA) of Agriculture and allied sector to GVA of total economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-17</td>
<td>275.11</td>
<td>300.64</td>
<td>6.8</td>
<td>18.0</td>
</tr>
<tr>
<td>2017-18</td>
<td>285.01</td>
<td>311.70</td>
<td>5.9</td>
<td>18.0</td>
</tr>
<tr>
<td>2018-19</td>
<td>285.21</td>
<td>310.74</td>
<td>2.4@</td>
<td>17.1</td>
</tr>
<tr>
<td>2019-20</td>
<td>291.95*</td>
<td>313.35**</td>
<td>2.8#</td>
<td></td>
</tr>
</tbody>
</table>

* As per the Second Advance estimates of production of Foodgrains
** As per First Advance Estimate of production of Horticulture crops
@ As per the revised estimates of national income released by CSO on 31st January, 2020

The Government has taken various steps to promote the use of modern techniques and plans to increase the agriculture production and thereby doubling the farmers' income. Some of the interventions in this direction are: (i) Sub-Mission on Seed and Planting Material (SMSP) (ii) Per Drop More Crop (PDMC) (iii) Soil Health Card (SHC) Scheme (iv) Creation of a network of Krishi Vigyan Kendras (KVKS) by Indian Council of Agricultural Research (ICAR) to facilitate farmer’s access to knowledge and information generated by Agricultural Universities and ICAR Institutes of the country. (v) Initiatives under Agriculture Technology Management Agency (ATMA) Scheme like Extension Reforms, Mass Media Support to Agricultural Extension, Kisan Call Centres, Agri-Clinics and Agri-Business Centres, Exhibitions/ Fairs etc.(vi) Sub Mission on Agricultural Mechanization (SMAM) (vii) National Agriculture Market (e-NAM) scheme (viii) Awareness campaigns, advertisements etc are also

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14 Lok Sabha Unstarred Question No. 2339 answered on 03.12.2019
15 Answered to the Lok Sabha's Unstarred Question no.1973 on 03.03. 2020
16 Answered to the Lok Sabha's Unstarred Question No.1594 on 11.02.2020
17 Lok Sabha Unstarred Question No.3834 answered on 17.03.2020
organized in print and electronic media to raise awareness among the farmers about the various initiatives taken by the Govt. of India for their welfare.

As per the study report of Central Institute of Post Harvest Engineering and Technology (CIPHET) based on survey conducted during the year 2013-14, the annual harvest and post-harvest losses of major food grains ranges from 4.65 per cent to 5.99 per cent. To promote storage infrastructure and reduce wastage of food grains the Government proposed creation of warehouses through viability gap funding on a PPP mode at block level. In February 2020\textsuperscript{18}, the government also proposed warehouse building by Food Corporation of India (FCI) and Central Warehousing Corporation (CWC) on their land too. As a backward linkage, Smt. Sitharaman, Union Finance Minister proposed village storage scheme to be run by Self Help Groups (SHG). “Women, SHG’s shall regain their position as Dhaanya Lakshmi” said Smt. Nirmala Sitharaman.

To build a seamless national cold supply chain for perishables, inclusive of milk, meat, Smt. Sitharaman said, “Indian Railways will set up Kisan Rail-through PPP arrangements. There shall be refrigerated coaches in express and freight trains as well”. “To help improve value realization especially in North-East and tribal districts Krishi Udaan will be launched by the Ministry of Civil Aviation” added the Finance Minister.

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8. Lok Sabha Questions  

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\textsuperscript{18} Press Information Bureau