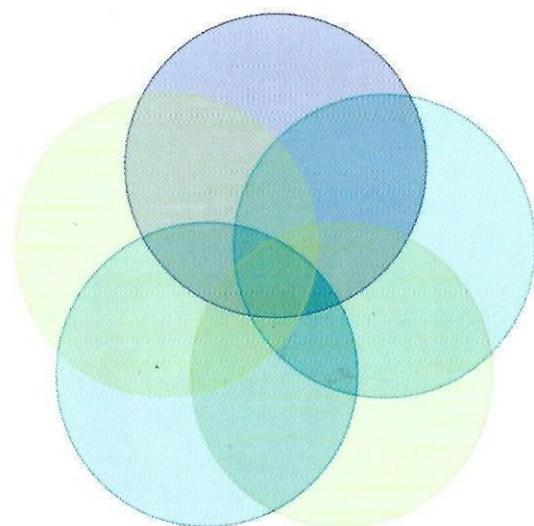


Human Resource Development Plan for National Agricultural Research System in Bangladesh

2009-2025



**Project Implementation Unit
National Agricultural Technology Project
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215**

Human Resource Development Plan for National Agricultural Research System in Bangladesh

2009-2025

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Preface

For its utmost importance and contribution the agricultural sector is considered to be the lifeline of the economy of Bangladesh. In spite of success in production in various commodities the sector is facing a number of challenges to produce enough food for its people. The complex problem of productivity in vulnerable natural resource requires advanced scientific skill and right institutional setting. Through an appropriate manpower planning, I believe, the National Agricultural Research System (NARS) of the country could further be strengthened and accelerated. Still many unexploited areas are there for which skilled and efficient manpower is badly needed. Although we have made substantial progress in some researchable areas, we need skilled manpower to explore new researchable areas against the backdrop of climate change, globalization, increased food demand and dietary changes. There are other constraints like distribution of resources requiring for scientific and technological research and lack of clear perception of the very special nature of R & D institutions and the management. The limitation of resources, shortage of skilled manpower in many areas, inadequate research facilities and skill development program and brain drain and etc. have always been the major hurdles in the way of research and development in the ARIs in Bangladesh.

This Human Resource Development (HRD) Plan 2009-2025, prepared in line with the objectives of the national priority of research, aims at developing the desired level of scientific manpower through training and higher study programs at home and abroad. This will improve the personal and organizational skills to meet the future demands of the NARS. All the NARS institutes namely, BARI, BRRI, BFRI, BLRI, BJRI, BTRI, BFRI (Forest), SRDI and BARC, the Apex Body of the System, will equally be benefited through the Plan. The Plan has been prepared through collection of institutional information such as weakness, strength, mandate and present manpower status and future needs by using a uniform format developed with the participation of NARS scientists. It contains a number of issues related to Human Resources Management (HRM), skill gaps of scientific staffs, need for enhancement of institutional efficiency and the effective use of human resources to achieve the national goal for future agriculture.

The plan also includes management structure, research achievement, on-going research activities, projection of future research options in multidisciplinary fields of agriculture, livestock and fisheries, skill gap of scientific staffs, training needs assessment and institute-wise opportunity for higher study. The HRD Plan also contains information about the sources and budgetary requirements for executing the Plan.

Seemingly, the HRD Plan has also directives to fulfill the skill gaps for conducting frontier research like biotechnology, genetic engineering, molecular biology etc. which will help attaining nation's food and nutrition security through increasing agricultural production. The Plan has provided some specific guidelines to inspire the scientists to give more attention in advanced research. In addition, NARS institutes will also be benefited by using this Plan through efficient utilization of scientific staffs in the respective field.

This HRD Plan, as I observed, analyzed the different issues on skill development ranging from the level of understanding the research and development situation to specific challenges. I would like to express my sincere thanks to the team for the excellent job they delivered.

The HRD Plan presents many aspects for the development of NARS institutes. I hope that the Plan would be the guidelines for the policy makers, research managers, scientists, donors and other stakeholders who are engaged in research as well as overall agricultural development.



(Dr. Wais Kabir)

Executive Chairman

BARC

Foreword

Bangladesh is a resource-poor country and her economy mainly depends on agriculture. The agricultural development depends on its sustainable technology generation in all sub sectors by the adoption of scientific knowledge in view of food and nutrition security and their uses by the end users. Bangladesh has been facing challenges in agriculture such as shrinking of quality agricultural land, fragment land holdings, degrading of natural resources, poor genetic quality of livestock, poultry and other economic animals, disease infestation, competition of crops, livestock and fisheries for land, water, climate change, disaster, etc. with increasing population. Though scenario is very critical and complex, off course, problems must be address to attain the dream set by the nation.

To overcome challenges and to achieve the national goal, highly skilled and competent scientific manpower is essential for generating and transferring technologies at farmers' level. As such efforts must be made to raise the skilled scientific personnel who can strive to produce the additional amount of food and other essential agricultural products requires for an increasing population.

The successful application of science and technology in the field of agricultural research is very important for agricultural growth. The country needs high innovative frontier research such as genetic engineering, plant, fish and animal physiology, molecular biology, molecular bio-information, molecular marker assisted technologies, tissue culture, biotechnology for crop, fishery, livestock and forestry, DNA profiles, fish and animal vaccine development, biotechnology policy and regularity efforts relating to bio-safety, information technology, etc. Therefore, the NARS scientists need to be equipped with knowledge and skill in the areas/disciplines mentioned to enable them to generate modern technologies that could make break through major change to reach the productivity target by the year 2025 in all agricultural production systems of Bangladesh.

Skill development of scientific and professional personnel is an important instrument for harnessing benefit from technological opportunities. There should be a clear policy framework and strategic plan for implementation of human resource development (HRD) program, particularly in addressing research gaps of frontier research areas and national priority needs.

PIU-BARC has given strong emphasis on the manpower development through higher degree and non degree training both home and abroad for increase of higher agricultural productivity and farm income at the farmers' level.

In preparation of NARS HRD plan several meetings, workshops were arranged by the PIU-BARC for proper finalization of the plan, thus I express my thanks and gratitude to all heads and concerned scientists of NARS institutes, BARC and their concerned divisions/units relevant scientists for their kind cooperation. Dr. Wais Kabir, the executive chairman, BARC has been directly and constantly giving us encouragement and valuable suggestions and advice in preparation of HRD plan. His personal interest is even remembered by the PIU-BARC. I also express my heartiest thank fullness to Dr. Sk. Ghulam Hussain, Member Director (P&E), Dr. SM Khalilur Rahman, Director (M&T) and colleagues of BARC for their support, cooperation and encouragement in preparation of HRD plan. Last not least I express my thanks to Dr. M A Siddique, Training and Communication Expert, PIU-BARC for his pain stocking exercise in preparation of NARS HRD plan.

I believe the HRD plan made by painstaking exercise is the valuable document. Its implementation will be created a strong NARS to elevate Bangladesh agriculture as well as science.



(Dr. Md. Abul Kashem)

Director
PIU-BARC

Director's Note

Bangladesh is one of the most densely populated countries in the world. The country has to grow adequate food for its growing population in the interface of consistent cultivable land shrinkage. Human capital is the engine for technologies advancement keeping this in view project Implementation Unit (PIU), Bangladesh Agricultural Research Council (BARC), National Agricultural Technology Project (NATP), Phase-I has prepared a Human Resource Development Plan for the National Agricultural Research System (NARS) of Bangladesh. The HRD Plan 2009-2025 is a resource guide book for planners in development of the NARS scientists.

The HRD Plan 2009-2025 is a projected model for future development of NARS scientists in phases. The HRD plan will be helpful for each research institutes to better understand the future need for development of agriculture. This will encourage planners or decision makers to formulate future human resource development plan for the NARS institutes.

National Human Resource Development Plan is an important reference tool. I hope that this will enable us to identify the training and development priorities to address the world's changing situations.

There exists both challenges and opportunities in the changing world. We must develop our human resources to make our workforce more equipped, skilled, dynamic and competent. I am confident enough that the HRD, Plan 2009-2025 will play a significant role in strategic development of the NARS scientists and other fields of research as well.



(Dr. S M Khalilur Rahman)

Director (Manpower & Training), BARC

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Acronyms and Abbreviations

ACIAR	-	Australian Centre for International Agricultural Research
ACR	-	Annual Confidential Report
AER	-	Annual Evaluation Report
AEZ	-	Agro Ecological Zone
AIC	-	Agriculture Information Center
AIP	-	Attractive Incentive Package
APAARI	-	Asia Pacific Association of Agricultural Research Institutions
ARIs	-	Agriculture Research Institutes
ARMP	-	Agriculture Research Management Project
BARC	-	Bangladesh Agricultural Research Council
BARI	-	Bangladesh Agriculture Research Institute
BFRI	-	Bangladesh Fisheries Research Institute
BFRI	-	Bangladesh Forest Research Institute
BINA	-	Bangladesh Institute of Nuclear Agriculture
BJRI	-	Bangladesh Jute Research Institute
BLRI	-	Bangladesh Livestock Research Institute
BRI	-	Bangladesh Rice Research Institute
BSRI	-	Bangladesh Sugarcane Research Institute
BTRI	-	Bangladesh Tea Research Institute
CARP	-	Common Address Redundancy Protocol
CASC	-	Central Allocation and Selection Committee
CIRDAP	-	Centre on Integrated Rural Development for Asia and the Pacific
CORRA	-	Council for Partnerships on Rice Research Association
CRPB	-	Central Recruitment and Promotion Board
CSO	-	Chief Scientific Officer
DAE	-	Department of Agriculture Extension
DC	-	Developed Country
DG	-	Director General
DLS	-	Department of Livestock Services
DNA	-	Deoxyribonucleic Acid
DoF	-	Department of Fisheries
DPP	-	Development Project Proposal
EC	-	Executive Chairman
ERIE	-	Enhancement of Research Institutional Efficiency
Ext.	-	Existing
GDP	-	Gross Domestic Product
GIS	-	Geographical Information System
GoB	-	Government of Bangladesh
HRD	-	Human Resource Development
HRMS	-	Human Resource Management System
HRP	-	Human Resource Planning

ICAR	- Indian Council of Agricultural Research
ICT	- Information and Communication Technology
IFAD	- International Fund for Agricultural Development
IPR	- Intellectual Property Rights
LSC	- Local Selection Committee.
MARDI	- Malaysian Agricultural Research and Development Institute
MB	- Management Board
MD	- Member Director
MIS	- Management Information System
MoA	- Ministry of Agriculture
MoC	- Ministry of Commerce
MoE	- Ministry of Education
MoEF	- Ministry of Environment and Forest
MoFL	- Ministry of Fisheries and Livestock
NARC	- National Association of Regional Councils
NARS	- National Agricultural Research System
NATP	- National Agricultural Technology Project
PA	- Personal Appraisal
PARC	- Pakistan Agricultural Research Council
PCARRD	- Philippine Council for Agriculture, Forestry and Natural Resources and Development
PhD	- Doctor of Philosophy
PIU	- Project Implementation Unit
Prov.	- Provision
PSO	- Principal Scientific Officer
R&D	- Research and Development
SAARC	- South Asian Association of Regional Cooperation
SAC	- Scottish Agriculture College
SPGR	- Sponsored Public Goods Research
SRDI	- Soil Resource Development Institute
SSO	- Senior Scientific Officer
SO	- Scientific Officer
ST	- Short-term Training
SWT	- Seminar, Workshop, Training
SW	- Seminar/ Workshop
TORs	- Terms of References.
TRIPS	- Trade-Related aspects of Intellectual Property Rights
TTMU	- Technology Transfer and Monitoring Unit
TWC	- Third World Countries
USAID	- United States Agency for International Development
Vac.	- Vacant
WB	- World Bank

Human Resource Development Plan for National Agricultural Research System 2009-2025

1.0 Introduction

Human resources are the vital force of national development. A nation is developed in accordance with the development of its human resources. Bangladesh is a resource-poor country and her economy mainly depends on agriculture. Thus agricultural manpower development is essential and more emphasis needs to be given to the research scientists. Besides, the country is the most densely populated one and there is a little scope to expand the land horizontally. Therefore attempts should be made to increase agricultural production vertically without destroying natural resources. For that matter, it is essential to develop research scientists in such a way that they can face the future research challenges in all sectors of agriculture. The NARS human resource development plan is, therefore, undertaken with the aim of upgrading the knowledge, skill, competency and attitude of the research scientists.

The Government of Bangladesh (GOB) has been implementing the National Agricultural Technology Project (NATP) with receiving a financial assistance from the World Bank through IDA credit, 4836-BD and International Fund for Agricultural Development (IFAD). NATP: Phase-1 is the first 5-year plan of a long term (15-years) program to support Govt.'s strategy to increase national agricultural productivity and farm income. NATP is a comprehensive project with focus on revitalizing the agricultural technology system (including agricultural research, extension and development of supply chains) and increasing agricultural productivity in Bangladesh.

1.1 Agricultural research support

This component aims to enhance the efficiency and effectiveness of the national agricultural research system. The component would have national coverage related to (i) competitive grants program (CGP), (ii) sponsored public goods research (SPGR) and (iii) enhancement of institutional research efficiency (EIRE) of the national agricultural research system (NARS).

In the enhancement of institutional research efficiency (EIRE) of the NARS, skilled human resource is the main focus of the scientific organization. Scientists are the key factors for producing effective output and success in research sector. Skill development of scientific and professional personnel is an important instrument for harnessing benefit from technological opportunities. There should be a clear policy framework and strategic plan for implementation of Human Resource Development (HRD) program, particularly in addressing research gaps of high technological areas and national priority needs. The HRD plan should carefully consider and

ensure the maximum benefit from the well trained and skilled manpower resource. There should also need to create a proper working environment along with opportunities for appropriate research facilities conducive for scientists to produce meaningful technology generation for contributing national economy. The incentive and reward system should be reformed in a way that promotes creativity and excellence by providing better opportunity and sustains scientists' moral at high and discourages them to leave scientific profession (NATP, 2007).

1.2 Status of agriculture

Farming is the main source of income for the people who are living in rural areas. The economy of Bangladesh is primarily dependent on agriculture. About 70 percent of the total population live in rural areas and are directly or indirectly engaged in a wide range of agricultural activities. The agricultural sector, including crops, livestock, fisheries and forest sub-sector contributes a major share to the GDP, which is now about 20.83 percent during the year 2007-08 and employs about 48.10 percent of the working force (BD Economic Review-2009).

In Bangladesh agricultural education, research and extension are separated from each other and controlled by two Ministries. On the other hand National Agricultural Research System (NARS) in Bangladesh consists of 10 national research institutes under the umbrella of Bangladesh Agricultural Research Council (BARC). Out of 10 research institutes six belong to Ministry of Agriculture (MoA), two belong to Ministry of Fisheries and Livestock (MoFL), one in the Ministry of Environment and Forest (MoEF) and one in the Ministry of Commerce (MoC). The agricultural universities are under the Ministry of Education (MoE).

To achieve national goal, scientific manpower development is essential for generating new technologies and transferring the technologies for increasing national productivity as well as national development. As such all efforts must be made to make a team of highly skilled scientific persons, who can strive to produce the additional amount of food and other essential agricultural products required for an increasing population.

Quality scientific staff is the heart and soul of research. All Agricultural Research Institutes are currently constrained by limited number of quality staff, which hinders self-sustained growth in technological innovation. About 300 skilled scientists have left the research system due to mainly poor human resource management policy and inadequate incentive structure. With current low remuneration package and absence of an incentive scheme, the institutes could neither attract nor retain good quality scientists. Furthermore, opportunities for training and retaining of scientific staff, particularly in new areas of science like biotechnology and information technology are limited (Actionable Policy Brief and Resource Implications, 2004, p. 67).

1.3 Human resource development planning for NARS

To improve national manpower quality in the NARS; there is requirement of proper human resource development planning and its implementation. Human resource planning is a process by which an organization ensures the right number and kinds of people, at the right place, at right time, capable of effectively and efficiently completing those tasks that will help the organization achieve its objectives. The process includes an inventory of the scientists and skills available within the institute. The inventory would include scientist name, education, age, training, experience, prior employment, current position, skills, performance ratings, salary level, languages spoken, etc. Preparation of human resource inventory with detailed information as stated above and job description for each employee, volume of jobs, relevancy of jobs and job description, qualifications and experience of person performing the jobs. Based on these information plans determine appropriate number of human resource will be recruited for the institute.

1.3.1 Challenges of agriculture in Bangladesh

Immediate challenges of agriculture in Bangladesh are to be faced by the scientists are as follow:

1. Shrinking good quality agricultural land is getting out of agriculture production by around 1% per year.
2. Decreasing farm size by land fragmentation resulting in increasing smallholder agriculture.
3. Increasing demand of diversified food items for increasing population demands more food associated with performance of high value food items.
4. Deteriorating natural resources (land, water, biodiversity, air, etc.)- demanding frontier research to develop technologies for enhancing input use efficiency and cost effectiveness.
5. Low profitability of crop production, particularly food grain creating disincentive to producers.
6. Yield gap and stagnating yields, yield potential are yet to be exploited.
7. Development of forestry for potential timber production as well as proving thrust on agro forestry.
8. Climate change requires clear understanding of production constraints by individual commodity and identification of problems, thus special thrust on technology development switch to changing environment for increased food production (BARC: A portal to NARS, 2008, p. 1).
9. Low genetic quality of livestock, poultry and other economic valued animals, develop their feeding technologies with disease prevention and control measurers.

10. Techniques and technologies are not sufficient for maximizing productions and utilization of all living aquatic resources (fisheries & others) and transfer of technologies to the end users.

1.4 NARS scientific manpower development for facing challenges of agriculture

To overcome the above mentioned challenges and to achieve the national goal, highly skilled core and competent scientific manpower is essential for generating and transferring technologies for national development. As such all efforts must be made to raise a battalion of highly skilled scientific personnel who can strive to produce the additional amount of food and other essential agricultural products required for an increasing population.

The successful application of science and technology in the field of agricultural research is very important for agricultural growth. The country needs high innovative technological research such as genetic engineering, plant, fish and animal physiology, molecular biology, molecular bio-information, molecular marker assisted technologies, tissue culture, biotechnology for crop, fishery, livestock and forestry systems, DNA profile, fish and animal vaccine development, biotechnology policy and regular efforts relating to bio-safety, information technology, etc. in the agricultural systems. Therefore, the NARS scientists need to be equipped with knowledge and skill in the areas/disciplines mentioned to enable to generate modern technologies that could break through major change to reach the productivity target by the year 2025 in all agricultural production systems of Bangladesh.

Due to resource constraints it is not possible for Bangladesh to provide higher studies leading to PhD degree for all research scientists working in the NARS institutes. Therefore, the development of scientists to the relevant fields is necessary, so that future high priority research can properly be done that could increase the productivity model to feed future generation. So NARS HRD plan is necessary on the basis of identified priority areas and skill gaps in various frontier researches (Siddique, NARS HRD plan up to 2020, prepared 2001).

1.4.1 Vision

The vision of NARS HRD Plan 2009-2025 is to develop effective and efficient, skilled and knowledge based manpower for sustainable development in the sector of agriculture by adopting frontier technologies, which would be the requirement for increasing standard of living and well being of the people of Bangladesh.

1.4.2 Mission

The mission of the NARS HRD Plan 2009-2025 is to strengthen the research of the institutes and setting future frontier priority research in collaboration with universities, private sectors and other

stakeholders for generating appropriate technologies and information, which could be adopted by end users for sustainability in the agricultural sector.

1.4.3 Purpose of HRD plan

Planning involves setting goals and objectives for an organization

- Planning involves setting goals and objectives for an organization
- Ensuring the right number and proper kinds of people to complete a set of objectives more efficiently and effectively
- Generating cost effective and highly technologies on the national priority basis
- Maximizing benefit from a well highly qualified and skilled manpower
- Developing quality researchers for taking up research program of international standard
- Development of mechanism for skill gap identification and enrichment for the institute.

1.5 Strategy of HRD plan

Manpower planning may be analyzed on the basis of the following points

- Building on major achievements in crops, fisheries, livestock and forestry
- Current manpower strengths and weaknesses in respect of R&D
- Future national research and development needs
- Level of manpower requirements on the basis of R&D needs
- Identification of training needs on the basis of R&D.

2.0 Methodology

BARC developed scientist's personal data sheet for preparation of NARS HRD plan and Divisional information format in association with the concerned NARS scientists. BARC requested all the Heads of NARS institutes for providing scientific manpower information through the developed personal data sheet and divisional format. Accordingly all the Heads of NARS submitted scientific manpower information as per supplied format (Annex i & ii).

BARC compiled collected scientific manpower information from different NARS institutes including on going MIS and some information from Consultancy Report on HRD for NARS 2000-2020 of M. H. Zaman (2000), Siddique (2001), NARS HRD plan up to 2020 and report prepared on HRD for NARS 2009-2015 by Shajahan (2006), and. In addition, information from the National Agricultural Research System in Bangladesh, a report of Z. Karim (1999), a portal to NARS of BARC, Actionable Policy Brief and Resource Implication. On the basis of available scientific manpower information from NARS and in consultation of recommendations of different seminars, conferences, recent development of sciences around the world related to agriculture and

discussion with the concerned NARS scientists as well as other related personnel, the NARS HRD plan for 2009-2025 was prepared.

The collected information included the following (i) management structure of the NARS institutes; (ii) objectives; (iii) major research achievements; (iv) present research activities and future priority research in each of the NARS institutes were placed. In case of present scientific manpower, the information were placed in a MS Excel program in the computer, along with compilations of available data and also some analyses of data through MS Excel for obtaining PhD status, retirement status, and ongoing degree status of NARS scientists. The analyzed data were also used for graph preparation in Excel.

The report on HRD Plan 2009-2025 contained the following chapters:

- 1.0 introduction which provides information about NARS, its management structure, objective, major achievements, present research activities and future priority research in each of the institutes starting from BARC,
- 2.0 methodology provides the information of data collection, compilation, analysis,
- 3.0 deals with the existing scientific manpower of the NARS, needs of manpower development, scientific manpower development planning during 2009-2015, 2016-2020, 2021-2025 and its summary analysis,
- 4.0 present implementation of manpower plan, placement of trainees at home and abroad, budgetary requirements,
- 5.0 describes monitoring and evolution and
- 6.0 conclusion and recommendations.

3.0 Status of existing scientific manpower of the NARS institutes/council

3.1 Bangladesh Agricultural Research Council

Bangladesh Agricultural Research Council (BARC) was established in the year 1973 under the Ministry of Agriculture. Since its inception in 1973, vide ordinance No. 32. Amendment made vide Act No. 28 of 1988 and 1996 has provided clearly defined and broad authority for the quality improvement of agricultural research manpower in the country. The authority is specified in four categories. They are to-

- i. Prepare a master plan for NARS manpower development, select candidates and award fellowships and scholarships within country and abroad.
- ii. Advise Government on representation of Bangladesh in international conferences or seminars concerned with agricultural research.
- iii. Arrange national and international short courses of training, study visit, seminar, workshop, conference concerning agriculture as is deemed necessary.

- iv. Sponsor and finance the travel expenses of research scientists to visit appropriate institutes, universities or laboratories abroad where outstanding work in their respective fields is conducted.

The BARC is the Apex Body of the NARS. The Council serves as a national coordinating organization for planning, coordination, monitoring and evaluation, setting priorities of research, integrating and helping for implementation of research on crops, livestock, fisheries and forestry. BARC also identifies problem areas for agricultural research and prepares national agricultural plan within the framework of national policies. BARC collaborates with all the national agricultural extension departments such as Department of Agricultural Extension (DAE), Department of Livestock Services (DLS), Department of Fisheries (DOF), Agricultural Universities, other Universities and various NGOs in order to disseminate agricultural technologies to the end users.

BARC is responsible for planning, developing and upgrading the manpower of the following 10 agricultural research institutes under the NARS such as:

- (a) Bangladesh Agricultural Research Institute (BARI),
- (b) Bangladesh Rice Research Institute (BRRI),
- (c) Bangladesh Jute Research Institute (BJRI),
- (d) Bangladesh Sugarcane Research Institute (BSRI),
- (e) Bangladesh Institute of Nuclear Agriculture (BINA),
- (f) Bangladesh Forest Research Institute (BFRI),
- (g) Bangladesh Fisheries Research Institute (BFRI),
- (h) Bangladesh Livestock Research Institute (BLRI),
- (i) Bangladesh Tea Research Institute (BTRI) and
- (j) Soil Resource Development Institute (SRDI).

3.1.1 Vision for the NARS

- Exploit scientific principles, especially recent advances in frontier sciences, in order to generate technologies that will enable to increase agricultural production through efficient (more output from the less input) and sustainable (without degrading the natural resources) production system.
- Exploit advances in management of sciences to improve both the effectiveness and efficiency of research resources use (A portal to NARS, 2008, p-14).

BARC has been developing NARS manpower since 1975 and also identifies problem areas of agricultural research and prepare national research plan and advising the Govt. for research and

development. The Council has been collaborating with the national and international research centers to ensure rapid introduction of potential technologies for adoption. The international institutes/centers/organizations are as follows:

3.1.2 Consultative group of international agricultural research (CGIAR) centers

International Rice Research Institute (IRRI), International Maize and Wheat Improvement Center (CIMMYT), International Crop Research Institute for the Semi Arid Tropics (ICRISAT), International Potato Center (CIP), International Center for Agricultural Research in the Dry Areas (ICARDA), International Institute of Tropical Agriculture (IITA), International Livestock Research Institute (ILRI) Asian Vegetable Research and Development Center (AVRDC), World Fish Center (WFC), World Agro forestry Center (WAC), etc.

3.1.3 International organizations

The following international institutes like ICAR, PARC, CARP, NARC, MARDI, ACIAR, PCARRD, APAARI, CORRA, CABI, AGRIS, CAPSA, SAC, SAARC, CIRDAP, etc. are in association with BARC.

HRD is a continuous process through which improves the research manpower capabilities of the NARS. The manpower development programs taken by BARC are as follows:

1. Higher studies leading to PhD/ MS at home and abroad.
2. Non-degree short term training at home and abroad.
3. Seminar, workshop, conference and study tour at home and abroad.
4. Post doctoral fellowship in abroad.
5. In country diploma training for non-diploma holders.
6. Non-degree technician training at home and abroad.

Table 3.1.1 Management structure of BARC

Top Executive		Scientific Staff				Total
Executive Chairman	Member Director	Director / Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	
1	7	7+9=16	24	9	5	62 (PhD =23; 37%)

Head Quarters: Farmgate, Dhaka, Bangladesh

Division: 7

- | | |
|---------------------------------|---|
| 1. Planning and Evaluation | 2. Crops |
| 3. Natural Resources Management | 4. Agricultural Economics and Rural Sociology |
| 5. Fisheries | 6. Livestock |
| 7. Administration and Finance | |

Unit: 7

- | | |
|------------------------------------|-------------------------------------|
| 1. Manpower and Training | 2. Technology Transfer & Monitoring |
| 3. Nutrition | 4. Computer & GIS |
| 5. Agricultural Information Center | 6. Finance |
| 7. Support Service | |

3.1.4 Objective of BARC

- i. Research coordination and planning
- ii. Priority setting for future research
- iii. Monitoring and evaluation of research activities/ programs/ projects
- iv. Manpower development of NARS
- v. Human Resource Development (HRD) Plan for the NARS
- vi. HRD Plan implementation and organization of national and international training, seminar/workshop
- vii. Training on monitoring and evaluation
- viii. Facilitating of technology transfer through training, seminar/workshop
- ix. Developing of national and international linkages
- x. Advising Govt. time to time for agricultural R & D

The BARC is now governed by a 27-members governing body (GB) chaired by the Minister of Agriculture and co-chaired by the Minister for Fisheries and Livestock and Minister for Forest and Environment. The GB is also represented by the members of parliament; farmers; bureaucrats of the respective ministry; eminent agricultural scientists; agricultural universities; department of agricultural extension, non government organizations, etc represent the GB.

The major manpower development activities have already been achieved by BARC during the years 1976 to 2001 as shown in Tables 3.1.2.1 to 3.1.2.2.

Table 3.1.2.1 Major manpower development achievements of BARC under various projects from 1976-1997

Field of Training	Foreign				Local			
	PhD	MS	S.T.	S.W.T.	PhD	MS	S.T.	S.W.
Agronomy	10	9	16	28	12	9	1293 (16)	160 (2)
Plant Breeding	10	1	20	33	8	9	35 (1)	250 (1)
Entomology	10	4	10	16	3	7	245 (9)	80 (2)
Plant Pathology	2	0	8	0	3	6	52 (3)	0
Horticulture	10	1	20	24	5	6	656 (10)	0
AERS	11	6	22	18	6	4	380 (21)	68 (2)
Farming System Research	9	0	30	35	5	2	271 (11)	335 (7)
Soils	4	4	42	27	6	7	523 (17)	322 (6)
Agric. Engineering	3	2	14	16	0	3	150 (7)	0
Irrigation	8	3	23	21	1	2	289 (16)	287 (5)
Library & Document	1	0	4	3	0	0	0	22 (1)
Training & Comm.	0	1	12	7	0	0	170 (7)	70 (1)
Planning & Res. Mgt.	0	2	36	41	0	0	1360 (36)	549 (10)
Livestock	9	3	10	18	4	8	299 (90)	220 (3)
Fisheries	5	3	9	12	7	5	130 (7)	296 (4)
Forestry	9	1	7	10	3	0	0	45 (1)
Jute Technology	0	0	0	4	0	0	0	100 (1)
Computer	0	0	7	7	0	0	91 (8)	0
Agric. Extension	1	2	4	28	5	2	757 (19)	0
Nutrition	1	1	5	6	0	0	90 (3)	0
Others	0	0	11	41	0	3	40 (2)	0
Total	103	43	310	395	68	73	6831 (212)	2804 (46)

() Parenthesis indicates number of courses, PhD= Doctor of Philosophy, MS= Master of Science, S.T.=Short-term Training, S.W.T.= Seminar/ Workshop/ Study tour, S.W.= Seminar/Workshop

Table 3.1.2.2 Institute-wise manpower development under various projects of BARC, 1976-1997

Organization	Foreign				Local			
	PhD	MS	S.T.	S.W.T.	PhD	MS	S.T.	S.W.
BARI	43	30	122	127	24	25	3305 (98)	675 (12)
BIRRI	6	4	16	15	5	4	305 (11)	36 (2)
BJRI	1	0	8	6	5	6	123 (24)	350 (2)
BINA	5	0	15	12	3	1	35 (1)	0
BSRI	4	0	11	5	3	7	0	0
BFRI (Forest)	5	1	8	6	2	0	0	0
BTRI	0	0	1	0	0	0	0	0
BFRI (Fisheries)	4	3	7	7	3	5	160 (90)	15 (1)
BLRI	8	3	12	8	1	0	384 (11)	0
SRDI	0	0	2	2	1	0	0	0
BARC	15	2	46	87	6	0	491 (20)	1713 (208)
BAU	10	0	30	45	10	11	421 (16)	15 (1)
DAE	0	0	3	019	1	3	308 (7)	0
Others	2	0	34	65	4	11	335 (15)	0
Total	103	43	315	404	68	73	5867 (212)	2804 (46)

Table 3.1.3 Institute-wise manpower development under IDA Credit-2815BD, 1997-2001

Organization	Foreign					Local			
	PhD	Post Doc.	MS	S.T.	S.W.T.	PhD	MS	S.T.	S.W.
BARI	8	0	0	59	49	30	0	0	0
BIRRI	20	0	12	54	18	10	0	0	0
BJRI	3	0	0	41	4	0	0	0	0
BINA	0	0	0	0	0	0	0	0	0
BSRI	5	3	0	10	16	4	10	0	0
BFRI (Forest)	2	3 Dip.	2	10	31	0	0	0	0
BTRI	0	0	0	0	0	0	0	0	0
BFRI (Fisheries)	10	0	2	17	7	5	0	0	0
BLRI	8	4	1	24	21	3	0	0	0
SRDI	0	0	0	0	0	0	0	0	0
BARC	3	10	0	85	176	3	0	1034 (30)	2998 (30)
Total	59	20	17	300	322	55	10	1034 (30)	2998 (30)

() Parenthesis indicates number of courses

Table 3.1.4 Discipline wise scientific manpower provision, exiting and vacant post of BARC as on June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)/ Director			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Crops	2	2	0	4	2	2	0	0	0	0	0	0	6	4	2	2	1
TTMU	1	0	1	1	1	0	2	2	0	0	0	0	4	3	1	1	1	1
Agril. Engineering	1	0	1	2	1	1	0	0	0	0	0	0	3	1	2	1	1	0
Soil	1	0	1	2	1	1	0	0	0	0	0	0	3	1	2	1	0	0
Forestry	1	0	1	2	1	1	0	0	0	0	0	0	3	1	2	0	1	0
Planning and Evaluation	1	0	1	2	2	0	0	0	0	0	0	0	3	2	1	1	1	1
Agril. Econ. and Rural Sociology	1	1	0	2	1	1	0	0	0	0	0	0	3	2	1	1	1	0
Fisheries	1	0	1	2	1	1	0	0	0	0	0	0	3	1	2	0	1	0
Nutrition	1	1	0	1	0	1	1	1	0	0	0	0	3	2	1	1	0	0
Live Stock	1	0	1	2	1	1	0	0	0	0	0	0	3	1	2	0	1	0
Training	1	1	0	1	1	0	1	0	1	0	0	0	3	2	1	1	1	0
Computer	1	1	0	1	0	1	2	2	0	2	0	2	6	3	3	1	2	0
AIC	1	1	0	2	1	1	3	2	1	3	2	1	9	6	3	1	2	0
Sub Total	14	7	7	24	13	11	9	7	2	5	2	3	52	29	23	11	13	3
Administration	1	1	0	0	0	0	3	0	3	4	3	1	8	4	4	2	2	1
Finance	1	1	0	0	0	0	2	2	0	1	1	0	4	4	0	1	2	1
Sub Total	2	2	0	0	0	0	5	2	3	5	4	1	12	8	4	3	4	2
Total	16	9	7	24	13	11	14	9	5	10	6	4	64	37	27	14	17	5

NB: Prov.= Provision, Ext.= Existing, Vac.= Vacant

Table 3.1.5 Discipline wise present scientific manpower and PhD positions at BARC as on June, 2009

Type of posts Discipline	Director/ Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
	Crops	2	2	2	2	0	0	0	0	4	4	2	0	1	0	1
TTMU	0	0	1	1	2	2	0	0	3	3	1	0	1	0	1	0
Agril. Engineering	0	0	1	1	0	0	0	0	1	1	1	0	1	0	0	0
Soil	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0
Forestry	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0
Planning & Evaluation	0	0	2	2	0	0	0	0	2	2	1	0	1	0	1	0
Agril. Econ. & RS	1	1	1	1	0	0	0	0	2	2	1	0	1	0	0	0
Fisheries	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0
Nutrition	1	1	0	0	1	1	0	0	2	2	1	0	0	0	0	0
Live Stock	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0
Training	1	1	1	0	0	0	0	0	2	1	1	0	0	1	0	0
Computer, ICT, MIS	1	0	0	0	2	0	0	0	3	0	0	1	0	2	0	0
AIC	1	0	1	0	2	0	2	0	6	0	0	1	0	2	0	0
Sub Total	7	5	13	11	7	3	2	0	29	19	9	2	8	5	3	0
Administration	1	0	0	0	0	0	3	0	4	0	0	2	0	2	0	1
Finance	1	0	0	0	2	0	1	0	4	0	0	1	0	2	0	1
Sub Total	2	0	0	0	2	0	4	0	8	0	0	3	0	4	0	2
Total	9	5	13	11	11	3	6	0	37	19	9	5	8	9	3	2

BARC coordinates research activities, planning and fixing future priority research, monitoring and evaluation of existing research/ project/ programs, facilitating technology development and dissemination and played an extremely important role in developing NARS manpower. Also identified problem areas of agricultural research and prepare national research plan in association with NARS scientists and advise the government for research and development. The Council supports NARS institutes for introduction of probable technologies suitable for the country for rapid adoption which are being developed in the international research centers and elsewhere.

3.1.5 Enhancement of institutional efficiency

At present the manpower provision of BARC is about 62 including one Executive Chairman and 7 Member Directors. There are about 52 scientific posts including Director/CSO to SO or equivalent. Out of 52 posts 23 posts are vacant (Table 3.1.4). In the table it is observed that out of 14 posts of Director/CSO 7 posts are vacant, where as in case of PSO 11 posts are vacant out of 24 posts, in case of SSO 2 posts are vacant out of 9 posts and in case of SO out of 5 posts 3 posts are vacant. Therefore, at present 7 Director/CSO, 13 PSO, 7 SSO and 2 SO are working in different disciplines of BARC.

The scientists of BARC should have excellent management skill and high class technological knowledge with international exposure in all sectors of agricultural research especially high tech agriculture. Most of BARC's scientists came from NARS institutes holding with PhD degree. They need post doctoral fellowships and special high tech training in various fields of agriculture including participation of international study tours /seminars /workshops, etc. to upgrade and update the world knowledge system of information and technology of their respective field of expertise.

3.1.6 Identification of skill gaps on the basis of research management of NARS

At present there are 29 (55%) scientists working in various divisions/disciplines out of 52 provisions, where scientific vacant posts are 23 (44%). Among the 52 scientific provisions 19 are PhD holders (37%) (Table3.1.5). Analysis of present manpower of BARC, reveals that there exist skill gaps in the field of research management, research planning, monitoring and evaluation, research priority setting, bio-security, bio-safety, procurement, financial management, ex-ante analysis, IPR, WTO, TRIPS, MIS, ICT, GIS including genetic engineering, climate change, plant physiology, molecular biology and biotechnology in case of crops, fisheries, livestock and forestry.

3.1.7 Training needs analyses on the basis of skill gaps

For strong coordination and strengthening NARS and for proper management of research activities, research planning, monitoring, evaluation, research priority setting, etc. BARC needs short term training in the fields of research management, planning, monitoring, evaluation, natural resource management, project preparation, institutional management, library science, irrigation and water management, bio-safety, HRD, IPR, WTO, TRIPS, MIS, ICT, GIS, ex-ante analysis including climate change, etc. BARC also needs post doctoral programs in the field of plant physiology, molecular biology, biotechnology in crops, fisheries, livestock and forestry. Thus the above trainings provisions would be necessary for BARC as mentioned discipline wise (Table 3.1.5) to enhance the research capabilities of the NARS.

Table 3.1.6 Manpower development plan of BARC for the period of 2009-2025

Year Discipline	2009-2015				2016-2020				2021-2025				Total			
	PhD	Post D.	Short T.	Sty/S/W	PhD	Post D.	Short T.	Sty/S/W	PhD	Post D.	Short T.	Sty/S/W	PhD	Post D.	Short T.	Sty/S/W
Crops	0	1	2	1	1	1	2	1	0	1	2	1	1	3	6	3
TTMU	0	1	1	1	0	0	1	1	0	0	1	1	0	1	3	3
Agri. Engineering	0	0	1	1	0	1	1	1	0	0	1	1	0	1	3	3
Soil	0	0	0	1	0	0	1	1	0	0	1	1	0	0	2	3
Forestry	0	0	1	1	0	0	0	1	0	0	1	1	0	0	2	3
Planning & Evaluation	0	1	1	1	0	1	1	1	0	0	1	1	0	2	3	3
Agri. Econ. & RS	0	0	0	1	0	1	0	1	0	0	1	1	0	1	1	3
Fisheries	0	1	1	1	0	0	1	1	1	1	1	1	1	2	3	3
Nutrition	0	0	0	1	0	0	1	1	0	0	1	1	0	0	2	3
Live Stock	0	1	1	1	0	0	1	1	0	1	1	1	0	2	3	3
Training	0	0	1	1	0	0	1	1	0	0	1	1	0	0	3	3
Computer, ICT, MIS	0	0	2	1	1	0	1	1	0	0	2	1	1	0	5	3
AIC	0	0	1	1	0	0	2	1	1	0	1	1	1	0	4	3
Sub Total	0	5	15	13	2	4	13	13	2	3	15	13	4	12	40	39
Administration	0	0	1	1	0	0	1	1	0	0	1	1	0	0	3	3
Finance	0	0	2	1	0	0	1	1	0	0	2	1	0	0	5	3
Sub Total	0	0	3	2	0	0	2	2	0	0	3	2	0	0	8	6
Total	0	5	15	15	2	4	15	15	2	3	18	15	4	12	48	45

3.1.8 Local training programs

BARC has been arranging several local short-term trainings, seminars, workshops, meetings, field days, etc. in various field of agriculture for NARS scientists, administrators, officers, managers, and field supports personnel. The short training so far arranged are as follows:

1. Foundation training for NARS junior scientists for a period of four months
2. Research methodology training for NARS junior scientists for about 2 weeks
3. Administrative and financial management course for NARS PSO/CSO level scientists for about 2 week
4. Procurement training course for NARS concern personnel for about 1 week
5. Financial management course for NARS concern personnel for about 1 week
6. Monitoring and evaluation course for NARS concern scientists for about 1 week
7. Personnel management course for NARS officers / office staff for about 1 week
8. Research management for NARS scientists and research supporting personnel
9. ICT/MIS course for NARS concern personnel.

Local seminar, workshop, field days, etc. in various fields of agriculture included preparation of institutional master plan, strategic plan, HRD plan for NARS.

3.2 Bangladesh Agricultural Research Institute

The Bangladesh Agricultural Research Institute (BARI) is the largest multi crops research institute in the country. It was established at Joydebpur, Gazipur in the year 1976 under the Ministry of Agriculture (MOA). It carries out research on all the (108) crops except rice, jute, sugarcane, cotton and tea. The institute has developed so many high yielding varieties of cereal, pulse, oilseed, tuber, horticultural and specie crops. It has developed not only a number of varieties but also developed a number of improved management technologies, pest control methods, post harvest technologies, improved machines and devices, standardization of fertilizer and irrigation methods, etc. on the basis of different agro-ecological zones of the country. The institute has released about 305 high yielding varieties of different crops and developed about 615 improved technologies which are being used by the end users. The institute has also undertaken sociological research in related to production, processing, marketing and consumption.

At present wheat is the second important cereal crop in Bangladesh and it covers about 100% with high yielding varieties as released by the Wheat Research Center of BARI.

BARI has made a major break through in oilseed by developing *Brassica napus* varieties for tropical climate of Bangladesh. The yield potential is as much as 2 t/ha, which is the doubled yield than that of local mustard varieties. BARI has also developed several high yielding varieties of different pulse crops as well as their improved production technology.

Considerable success has been gained in potato research. Several high yielding varieties of potato developed by BARI are being widely cultivated by the growers, which acted as booster production of potato. Major success has also been achieved in research on growing potatoes from the true potato seed (TPS), which is considered as cost effective production technology.

The Horticultural Research Center has developed several leafy vegetables, which mature in shorter time and farmers can harvest several times from a single plant. Technologies developed for vegetables production at home-based involving rural women for earning extra money. It has also developed varieties of different fruits that grown round the year.

Besides the variety development, the institute made success in development of production and management technologies, post harvest processing methods, and developed tillage operation for crop production and post harvest process machineries.

Table 3.2.1 Management structure of BARI

Director General	Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	6	24	87	236	351	705 (PhD 135; 18%)

Headquarter: Joydebpur, Gazipur

The institute has 14 divisions and seven (7) research centers. They are as follow:

- | | |
|--------------------------------|-------------------------------------|
| 1. Plant Breeding | 2. Soil Science |
| 3. Agronomy | 4. Entomology |
| 5. Plant Pathology | 6. On-Farm Research |
| 7. Post Harvest Technology | 8. Agricultural Engineering |
| 9. Agricultural Economics | 10. Irrigation and Water Management |
| 11. Bio-Chemistry | 12. Seed |
| 13. Vertebrate Pest Management | 14. Farm Management |

Seven (7) Research Center:

- | | |
|-----------------|----------------------------|
| 1. Wheat | 2. Oil Seeds |
| 3. Pulse | 4. Tuber and root crops |
| 5. Horticulture | 6. Plant Genetic Resources |
| 7. Spice | |

BARI has six Regional stations, 24 Sub-stations, 9 Farming system sites and 70 Multi location trial sites

3.2.1 Objectives of BARI

- i. Development of different mandated crops varieties
- ii. Generating improved management technologies for various crops in different agro-ecological zones
- iii. Crop insect pest management
- iv. Post-harvest technologies for field crops, fruits and vegetables
- v. Development of various farm machineries and technologies for water management
- vi. Study of soil health for different crops and its management including irrigation technology
- vii. Social, economics and marketing aspects of various crops, fruits and vegetables
- viii. Technology transfer through training, seminar, workshop, demonstration, field days, etc.

3.2.2 Research on major crops at BARI

- Cereals : Wheat, Maize, Barley, Millets
- Oil Seeds : Mustard, Peanut, Sesame, Linseed, Sunflower, Safflower, Soybean, Niger, etc.
- Pulses : Lentil, Chickpea, Mungbean, Blackgram, Grass pea, etc.
- Tuber and Root: Potato, Sweet potato, Aroids, Yams
- Horticulture : Vegetables, Fruits, Flowers, etc.
- Spices : Onion, Garlic, Turmeric, Coriander, and other Spices

3.2.3 Major research achievements of BARI

<u>Crops</u>	<u>Variety released</u>	<u>Crops</u>	<u>Variety released</u>
1. Wheat	24	1. Onion	5
2. Maize	19	2. Garlic	2
3. Barley	6	3. Turmeric	3
4. Millets	4	4. Coriander	1
Total cereals	53	5. Chili	1
1. Potato	39	6. Black pepper	1
2. S potato	9	7. Methi	2
3. TPS	2	8. Betel Leaf	2
4. Aroids	4	Total spices	17
Total tuber crops	54	1. Mango	4
1. Mustard	15	2. Guava	3
2. Peanut	8	3. Litchi	4
3. Sesame	3	4. Sapota	2
4. Soybean	5	5. Taikor	1
5. Sunflower	2	6. Banana	4
6. Others	3	7. Papaya	1
Total oilseed crops	36	8. Pummelo	4

<u>Crops</u>	<u>Variety released</u>	<u>Crops</u>	<u>Variety released</u>
1. Chickpea	8	9. Lemon	3
2. Lentil	6	10. Wax Jambo	1
3. Mungbean	6	11. Orange	1
4. Blackgram	3	12. Coconut	2
5. Grasspea	2	13. Longon	1
6. Felon	2	14. Ber	2
Total pulses	27	15. Pear	1
1. Brinjal	8	16. Golden apple	1
2. Cabbage	2	17. Passion fruit	1
3. Cauliflower	2	18. Satkara	1
4. Lady's finger	1	19. Malta	1
5. Bottle gourd	2	20. Kamranga	1
6. Sweet gourd	2	21. Amra	1
7. Garden pea	3	22. Strawberry	1
8. Indian spinach	2	23. Latkon	1
9. Kangkong	1	24. Kathal	1
10. Chinese cabbage	2	Total fruits	43
11. Chinakopi	1	1. Gladiolus	3
12. Red amaranth	1	2. Orchid	1
13. Amaranth Radish	4	3. Chrysanthemum	2
14. Ribbed gourd	1	4. Gerbera	2
15. Radish	4	5. Anthurium	1
16. Tomato	18	Total flower	9
17. Bean	6		
18. Water melon	1		
19. Ash gourd	1		
20. Bitter gourd	1		
21. Pointed gourd	1		
22. Yard long bean	1		
23. Lettuce	1		
Total Vegetables	66	Total Variety Technology	305

Non commodity technology generated

#	Research Fields	No. of technologies
1.	Crop Management	245
2.	Insect Pest Management	64
3.	Farm Machinery	28
4.	Irrigation and Water Management	34
5.	Post-harvest Technology	18
6.	Farming Systems and Socio-Economics	83
	Total	472

Grand Total Variety Technology + Management Technology = 305 + 472 = 777

Newly established Agricultural Statistics and Information Communication unit has developed analytical tools for various field experiments and local area network (LAN).

3.2.4 Present research activities of BARI

The following research works are currently being carried out:

3.2.4.1 Plant breeding: Plant Breeding Division has developed varieties of mandate crops, collection of germplasm, conservation, characterization of different crops varieties. Conducted research for development of heat, drought, salt and excess moisture tolerant varieties. It has also been working on oil content, protein quality, carotene content of different oil crops.

3.2.4.2 Agronomy: It has been working on cultural management of different crops in various agro-ecological zones, fertilizer related activities and crop modeling, seed and seed health of prioritize of crops and integrated crop production approach in hill and coastal regions, multiple cropping, plant stress physiology, integrated crop and soil fertility management, piloting for technology transfer.

3.2.4.3 Soil Science: Its work included physical management aspects for soil conservation, chemical fertilization for soil health, micro nutrient related activities in specific crops and bio-fertilizer applications in legumes crops and soil management, organic matter management, etc.

3.2.4.4 Plant Pathology: Pathological work on pulse, oilseed, tuber, cereal and horticultural crops, etc. mainly directed toward developing environmental friendly plant disease management, resistant varieties through conventional and advanced molecular techniques, generating bio-control, integrated plant disease management, controlling soil borne pathogen by solarization, identification of varietal immunity against diseases (races of causal organization) through molecular marker techniques (MMT) and integrated disease management.

3.2.4.5 Entomology: Identification of insect of crops, ecological studies, selection of beneficiaries' insects, integrated pest management (IPM), crop pest management by various methods, residue analyses for different pesticides, etc. are some major research activities of this division.

3.2.4.6 Irrigation and Water Management: Water management and water efficiency studies of various crops including hill and coastal regions including waste water irrigation, solar pump irrigation, etc.

3.2.4.7 Farm Machinery: Activities include development of machineries for tillage and post harvest process and crop production including weeding, seeding, harvesting, threshing, winnowing, etc.

3.2.4.8 Post-harvest: Assessment of post-harvest losses is done in crops, vegetables, fruits, etc., post-harvest process in crops, vegetables, fruits and their quality control, improvement of handling processing and preservation of grain crops.

3.2.4.9 Agricultural Economics: Economic analyses of various crops are done to find out economic performance in respect of production, marketing, homestead vegetables including export potentiality, value chain, demand and supply chain analysis and socio-economic studies of various commodities and their social aspects, development of dynamic web site, RS techniques, GIS data base by the Statistics and ICT unit.

3.2.4.10 Cereals: The research includes development of varieties with high yield potentiality of wheat, maize, barley, millets, etc. in rice based cropping system, heat tolerant variety of wheat for late planting after *T. aman* rice, salinity areas, moisture stress and excess moisture areas, seed technology and breeders seed production, hybrid and open pollinated maize seed production.

3.2.4.11 Pulse and oilseed: High yield potential varieties suitable for location specific situation, short duration with high extraction of quality oil on mustard, water logged tolerant in sesame, seed dormancy in peanut, soybean, hybrid seed production in sunflower, varieties improvement of Niger, development of rust resistant varieties of lentil, botrytis gray mold (BGM) resistant/tolerant in chickpea, YMV resistant for late planting in black gram, low toxin in grass pea and seed production and transfer of technology for lentil, mungbean, and black gram through pilot project, etc. are the research areas of these areas.

3.2.4.12 Vegetables: Prioritization of vegetables varieties, development of off season vegetables, summer vegetables development such as tomato, leafy vegetables, cabbage, lady's finger, etc., hybrid variety of watermelon, muskmelon, egg plant, etc., tissue culture for potato, banana, production of true potato seed (TPS) and improvement of local potato seed, stress variety, organic, hydroponics variety development, multiplication of quality varieties.

3.2.4.13 Fruits: Studies are done on development of jackfruit, pineapple, etc. varieties for on and off-season and year round cultivation of pineapple, micro and macro propagation of jackfruit, mango and banana, etc., varietal improvement of grapes, and minor fruits like carambola, pummelo and multiplication of quality varieties, etc.

3.2.4.14 Socio-economic and farming system: Impact studies are conducted on crop commodity sector including marketing and export opportunity, adaptive trial on matured technologies in different crop commodity and non commodity items, homestead gardening of fruits and

vegetables production, integrated farming system, technology adoption, and economic stability of low cost labor intensive machinery.

3.2.4.15 Other research: Other research include gene bank management system (GMS) application for genetic resources management and GIS for information generation and its practical implication in agro-ecological regions, promotion and development of high value non traditional fruits, vegetables, spices, yams, orchids, jackfruit, pineapple, etc., application of bio-fertilizer for increasing nodulation and yield of leguminous crops.

In addition to the current research the following research should be directed in future

- i. Germplasm collection, conservation and characterization
- ii. Variety development through conventional breeding, biotechnological means
- iii. Conservation (plant/tissue/pollen/DNA), germplasm enhancement and pre-breeding (hybridization/ embryo rescue/ovule culture)
- iv. Implication of gene transformation techniques for variety development against biotic stress (salinity, water logging, etc.) and a biotic stress (disease insects and pests, post harvest quality, etc.)
- v. Development of hybrid variety in maize, sorghum, sunflower, tomato, brinjal, radish, cucurbits, watermelon, flowers etc.
- vi. Plant growth analysis in relation to physiological changes, environmental stress physiology (saline, drought, water logging, nutrient management, etc.)
- vii. Management technologies for different fields crops combating climate change and yield gap minimization
- viii. Technology development for adoption of climate change, crop modeling, hill farming
- ix. Forage agronomy, crop diversity, seed physiology, improving nutrient and water use efficiency
- x. Management of saline, acid, hill and *char* land, mineralization of nutrient, bio-fertilizer, soil test
- xi. Epidemiological study of major pathogens, molecular biological research, environmental friendly bio-control plant disease management
- xii. Biological control based IPM technology generation, insect pest resistant crop variety, storage pest management, pesticide residue analysis, ICM
- xiii. Improvement of export oriented commodities like mango, jackfruit, pineapple, banana, baby corn, sweet corn, flowers, etc.
- xiv. Biotechnological research on horticultural crops, heat, drought and salinity tolerant variety development

- xv. Quality seed and sampling production for mass distribution and technology development for hilly and coastal areas
- xvi. Hybrid variety of vegetables and fruits, seedless fruits and vegetables like watermelon, kakrul, grapes, etc.
- xvii. Linking production, market opportunities, policies, integrated management of natural resources
- xviii. Development of technological and socio-economic factors influencing cropping pattern changes
- xix. Renewable energy utilization, biogas plants, saline, drought, hilly, coastal areas required machineries development
- xx. Post harvest technology and agricultural engineering works to be done side by side for saving post harvest losses
- xxi. Strengthening the socio-economical research in the field of export oriented crops, vegetables, fruits and flowers
- xxii. Development dynamic website, GIS data base, RS technique, wide area net work, etc.
- xxiii. Identification and development methodology of on-farm research at farmers' fields without hampering their farming activities and social save guard
- xxiv. Development methods for supporting research inputs to the research programs very effectively
- xxv. Strengthening the management tools for evaluating the environmental and social safe guard issues
- xxvi. Development of methods for collecting daily weather information records

Table 3.2.1 Discipline wise scientific manpower provision, existing and vacant posts at BARI as on June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
Scientists:																		
Agronomy	1	1	0	11	15	0	21	44	0	24	88	0	148	148	0	5	15	21
Agricultural Economics	1	1	0	3	4	0	7	13	0	11	6	5	31	26	5	8	4	17
Entomology	1	1	0	2	3	0	10	18	0	17	18	0	42	42	0	4	4	13
Pathology	2	2	0	7	9	0	17	21	0	22	37	3	72	69	3	8	11	16
Plant Breeding	3	3	0	19	8	11	25	20	0	35	49	2	93	80	13	7	5	13
Horticulture	5	5	0	19	13	6	43	67	0	42	39	3	133	124	9	10	23	39
Soil Science	1	1	0	7	13	0	16	21	0	24	22	7	65	58	7	11	10	12
Agricultural Engineering	1	1	0	2	3	0	11	7	4	13	6	7	28	17	11	3	5	3
Postharvest Technology	0	0	0	1	1	0	5	2	3	6	4	2	11	6	5	0	1	1
Statistics	0	0	0	0	1	0	4	1	3	6	1	5	12	4	8	2	1	2
Open scientists	9	9	0	16	0	0	78	12	0	151	47	0	63	63	0	12	13	10
Sub-Total	24	24	0	87	70	17	237	226	10	351	317	34	698	637	61	70	92	147
Management/discipline																		
Administration	0	0	0	0	0	0	0	0	0	0	0	0	12	10	2	2	0	1
Finance	0	0	0	0	0	0	0	0	0	0	0	0	11	10	1	2	0	0
Procurement	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	1	0	0
Sub-Total	0	0	0	0	0	0	0	0	0	0	0	0	26	22	4	5	0	1
Total	24	24	0	87	70	17	237	226	10	351	317	34	724	659	65	75	92	148

Table 3.2.2 Discipline wise scientific manpower and PhD positions at BARI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Agronomy (production agronomy, seed technology, plant stress physiology, crop modeling, weed management, hill farming, multiple cropping, farming system, dry land farming, forage, seed physiology, etc.)	1	1	15	7	44	18	88	0	148	26	2	3	4	11	8	13
Agricultural Economic (rural sociology & marketing, value change, supply chain, production analysis, linking production & marketing, development software, statistics, ICT, MIS, etc.)	3	1	4	3	13	7	6	0	26	12	3	5	2	2	7	10
Entomology (biotechnology, identification gene, biological control, pesticide residue analysis, toxicology, IPM, insect physiology)	3	1	3	1	18	4	18	0	42	7	2	2	2	2	7	6
Pathology (mycology, virology, bacteriology, nematology, molecular plant pathology of crops)	2	2	9	11	21	7	37	1	69	21	3	5	5	6	6	10
Plant Breeding (plant molecular genetics, plant tissue culture, genetic engineering and bio-technology).	3	3	8	5	20	8	49	0	80	16	3	4	3	2	6	7
Horticulture (breeding, biotechnology, physiology, tissue culture, nursery physiology, vegetable production, fruit production, floriculture, homestead vegetable s prod. etc.)	5	3	13	5	67	16	39	1	124	25	4	6	10	13	14	25
Soil Science (soil physics, soil conservation & management, soil microbiology, micro- nutrient evaluation, soil and plant analysis, soil nutrients/ fertility assessment, crop modeling using GIS and GPS etc.)	2	1	13	9	21	7	22	0	58	17	4	7	4	6	5	7
Agricultural Engineering (soil and water resource engineering, farm machinery system, food process engineering, agricultural waste management, renewable energy utilization, etc.)	1	1	3	0	7	1	6	0	17	3	1	2	3	2	1	2
Post Harvest Technology (food microbiology, food safety and quality, food product process development, etc.)	0	0	0	0	2	1	4	0	6	1	0	0	0	1	0	1
Agricultural Statistics (bioinformatics, remote sensing, geo-informatics, etc.)	0	0	2		1		1		4	0	1	1	0	1	0	2
Open Scientists in various fields of agriculture	4	4	0		12		47		63	4	2	10	2	11	2	8
Total	24	17	70	41	226	69	317	2	637	129	25	45	35	57	56	91

3.2.5 Need for enhancement of institutional efficiency

The head quarters of BARI at Joydebpur, Gazipur with 14 Divisions/ Disciplines, 6 Regional stations, 24 Sub-stations, 9 farming system sites and 70 multi location trial sites located in different regions and agro-ecological zones of Bangladesh.

At present there are scientific manpower provisions of 705 at BARI including Director General 1 and Director 6. In case of Chief Scientific Officer (CSO) to Scientific Officer (SO) there are provisions of 698 scientific personnel and present scientists in position of 637 (90%), where 61(9%) posts are vacant (Table 3.2.1). From Table 3.2.1 it is observed that the all 24 posts of CSO are filled up, whereas in the case of PSO out of 87 posts 17 posts are vacant, as SSO 10 posts are vacant out of 237 provisions and in the case of SO 34 posts are vacant out of 351 provisions. Therefore, at present available scientists are 24 CSO, 70 PSO, 226 SSO and 317 SO working in different disciplines of BARI i.e. human resource gap is minimum. The available scientists should have enough scientific background to enable them to take up research individually and provide need based technologies for sustainable development to PhD, thus institutional efficiency will be accelerated.

3.2.6 Identification of skill gaps on the basis of priority research

The existing scientific manpower of BARI is 637 at BARI out of 698 scientific provisions in their various divisions/disciplines; where as about 61 scientific positions are vacant. Among the 637 scientists 132 scientists are PhD holders in different disciplines (18%), which is below of minimum standard of 35% (Table 3.2.1). The analyses of PhD holders disciplines wise are as Agronomy (17%), Agricultural Economics (38%), Entomology (16%), Plant Pathology (30%), Plant Breeding (20%), Horticulture (20%), Soil Science (28%), Agricultural Engineering (17%).

For proper enhancement of institutional efficiency there would be enhancement of PhD level at least 40% through the scientists' skill development from at present 18%. For upliftment of PhD level at 40%, the manpower development plan as well as manpower development project should be prepared in a way that the PhD level of scientists gradually increased by the year 2015 at 30%, 2020 at 35% and 2025 at 40% level.

At BARI on the basis of scientists' personal data analyses in their respective disciplines and for the address of future research priority areas, the following discipline-wise skill gaps have been identified: Frontier research to develop hybrid varieties on wheat, oilseeds, pulses, maize, sorghum, and variety development of cheena, kaon, bajra, etc. with development of low cost cultural methods, soil & pest management, post harvest processes, market analysis, storing, etc. Development of hybrid and high yielding varieties of horticultural crops such as all types of vegetables, annual and perennial fruit crops,

orchard management, pest and disease control, vegetables seed production, post harvest processing of vegetables and fruits, flowers and ornament plants, etc. In the case of tuber crops like potato, development of variety of table potatoes for Bangladesh ecosystem to overcome cytoplasmic degeneration, and sweet potato varieties rich in A vitamins with resistance to pests and diseases. Strengthening of Spices and Condiments Research for development of high yielding varieties with modern cultural methods including pests and disease control.

3.2.7 Training needs analyses on the basis of skill gaps

The scientists need higher technological knowledge and skill through manpower development in the identified skill gaps, so that future priority research can be addressed properly and might increase the productivity model to feed future generation. As per frontier research priority setting of BARI and skill gaps analyses the scientific man power development should be thrust in the field of genetic engineering, plant physiology, molecular biology as diagnostic tools for disease determination, bio-technology, seed technology, crop modeling, weed management, hill farming, dry land farming, IPM, toxicology, insect ecology, virology, bacteriology, plant disease diagnosis, horticulture breeding, tissue culture, fruits and vegetables, floriculture, post harvest technologies, soil physics, soil microbiology, soil and plant analysis, soil and water resource engineering, farm machinery system, food process engineering, agricultural waste management, renewable energy utilization, production economic, rural sociology and marketing, value chain, marketing and policy, food safety and quality, bioinformatics, remote sensing, geo-informatics, DNA profile, molecular marker, ICT, MIS, GIS, climate change, etc. in various disciplines.

BARI needs discipline-wise skill manpower development because of retirement of skilled manpower from the concern disciplines. Numbers of PhD and other relevant trainings as mentioned above in their respective disciplines is placed in Table 3.2.3.

Table 3.2.3 BARI scientific manpower development plan and enhancement of PhD level from 18% to 40% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD level 30%)				2016-2020 (PhD level 35%)				2021-2025 (PhD level 40%)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Agromony (production agronomy, seed technology, plant stress physiology, crop modeling, weed management, hill farming, multiple cropping, farming system, dry land farming, forage, seed physiology, etc.)	19	3	36	12	12	2	26	6	16	2	24	7	47	7	86	25
Agricultural Economic (rural sociology & marketing, value change, supply chain, production analysis, linking production & marketing, development software, statistics, ICT, MIS, etc.)	4	1	10	4	2	1	6	3	8	1	6	2	14	3	22	9
Entomology (biotechnology, identification gene, biological control, pesticide residue analysis, toxicology, IPM, insect physiology)	4	0	7	2	7	1	8	2	10	1	6	2	21	2	21	6
Pathology (mycology, virology, bacteriology, nematology, molecular plant pathology of crops)	4	1	11	4	7	1	12	5	10	1	14	4	21	3	37	13
Plant Breeding (plant molecular genetics, plant tissue culture, genetic engineering and biotechnology).	14	2	41	15	9	1	25	10	12	2	20	6	35	5	86	31
Horticulture (breeding, biotechnology, physiology, tissue culture, nursery physiology, vegetable production, fruit production, floriculture, homestead vegetables prod. etc.)	16	2	36	13	18	2	25	5	21	2	15	4	55	6	76	22

Year Discipline	2009-2015 (PhD level 30%)				2016-2020 (PhD level 35%)				2021-2025 (PhD level 40%)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Soil Science (soil physics, soil conservation & management, soil microbiology, micro-nutrient evaluation, soil and plant analysis, soil nutrients/ fertility assessment, crop modeling using GIS and GPS etc.)	5	1	9	4	8	1	10	4	8	1	12	3	21	3	31	11
Agricultural Engineering (soil and water resource engineering, farm machinery system, food process engineering, agricultural waste management, renewable energy utilization, etc.)	4	0	6	2	5	1	2	1	4	0	5	1	13	1	13	4
Post Harvest Technology (food microbiology, food safety and quality, food product process development, etc.)	2	0	2	1	1	0	3	1	1	1	4	1	4	1	9	3
Agricultural Statistics (bioinformatics, remote sensing, geo-informatics, etc.)	2	0	2	1	1	0	2	1	1	0	2	1	4	0	6	3
Open Scientists in various fields of agriculture	8	0	10	4	7	1	8	2	10	1	10	4	25	2	28	10
Total:	82	10	170	62	77	11	127	40	101	12	118	35	260	33	415	137

3.3 Bangladesh Rice Research Institute

Rice has made a tremendous impact in Bangladesh occupying nearly 80% of cropped area of which about 75% is occupied by high yielding varieties developed by the Bangladesh Rice Research Institute (BRRI). BRRI was established at Joydebpur, Gazipur in 1970 under the Ministry Agriculture. Rice is grown in three seasons such as *Aus*, *Aman* and *Boro*. A few varieties are not only high yielder but are also tolerant to salinity and other unfavorable situations like drought and cold. The developed varieties are suitable for varying eco-systems and have a wider range of disease and insect resistance.

Management technologies for rice crops, soil, fertilizer and pests and rice based cropping systems for various agro-ecological zones in Bangladesh have been developed.

Research on water management has standardized supplementary irrigation in *T. Aman* rice. Methods for preservation and use of rainwater for *T. Aman* rice and irrigation canal management to reduce water loss have been developed.

Identification of 175 rice insects, 99 species parasites and 88 species of predators has been made and their control measures have been recommended. Sampling methods for determination of economic threshold levels of some of the major pests have been developed. There are ten techniques based on IPM have been developed. Also plant pathologists have identified 31 diseases caused by viruses, mycoplasma, bacteria, fungi and nematodes that affect rice production.

Participatory research in farmer fields under farming system has made significant achievement and has improved cropping systems to increase farmers' income. The institute has developed rice cum fish farming system in deep-water areas. It also has developed rice-wheat, rice-pulse and oilseed cropping systems.

BRRI has developed prototype for seed drill, harvesters, threshers, driers, winner, tillage equipment, low lift pump, etc. To reduce post harvest losses improved processing and storage techniques have been developed. BRRI has developed 2 hybrid rice varieties for cultivation in the farmers' field.

Table 3.3.1 Management structure of BRRI

Director General	Directors	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	2	22	41	93	77	236 (PhD = 70; 29%)

Head Quarters:	Joydebpur:	Divisions
1. Plant Breeding		2. Genetics Resources and Seed
3. Bio-technology		4. Grain Quality and Nutrition
5. Plant Physiology		6. Soil Science
7. Agronomy		8. Irrigation and Water Management
9. Plant Pathology		10. Entomology
11. Rice Farming System		12. Farm Machinery & Post Harvest
13. Workshop Machinery and Maintenance		14. Adaptive Research
15. Training		16. Agricultural Economic
17. Agricultural Statistics		18. Farm Management
19. Regional Stations at various locations		

3.3.1 BRRI Mandate

BRRI has the mandate to:

1. Conduct research on all aspects of rice to develop superior quality rice varieties and associated management technology for increased production at reduced lost.
2. Conserve bio-diversity and natural resources for the present and future generation.
3. Enhance rice production for alleviation of poverty and hunger and eventually achieve food security.

3.3.2 Objectives of BRRI

BRRI's objective is mainly to generate rice production technologies for attaining rice food security. Specific, the objectives are: (i) Development of superior HYV rice varieties and associated production technologies, (ii) conservation of bio diversity natural resources eg. soil, water and environment, (iii) capacity building for research and (iv) development and enhance rice production for poverty alleviation.

3.3.3 Major research achievements of BRRI

- i. Released 51 high yielding varieties (HYV) of rice including 2 hybrids for growing in three seasons
- ii. Collection and maintenance of more than 8000 germplasms
- iii. Developed management techniques for crop, soil, nutrient, sulphur/zinc and irrigation
- iv. Identified 175 species of rice insect pests and 31 diseases caused by virus, mycoplasma, bacteria and nematodes
- v. Developed rice-wheat, rice pulse/oilseed, rice fish cropping systems
- vi. Developed prototypes of seed drill, harvester, thresher, drier, winnower, tillage equipment, low lift pump, low cost pumps, lawn mower, etc.

3.3.4 Present research activities of BRRI

The research activities include –

- i. Development of submergence tolerant aman variety through introgression of sub-1 gene
- ii. Further hybrid variety development
- iii. Rice varieties characterizations, finger printing etc.
- iv. Bio-technological research for development of disease free varieties
- v. Production and delivery of breeder seeds of current varieties
- vi. Collection, conservation, evaluation and use of germplasm
- vii. Rice marketing and price policy formulation
- viii. Integrated nutrient management technology development
- ix. Development of suitable rice farming system
- x. Arrangement of training for field level extension officers for technology transfer
- xi. Rice crop improvement for the coastal areas
- xii. Management of coastal saline soil for rice cultivation
- xiii. Rural institutions and economic consequences for rice production
- xiv. Overcoming harvest and post harvest management constraints
- xv. Maintenance of quality seeds of different varieties of rice
- xvi. Germplasm collection and maintenance

3.3.5 Future research priority areas of BRRI

In addition to present research work the following research will be taken up by BRRI

- i. Development of hybrid varieties for commercial cultivation
- ii. Development of more drought, flood, salt, cold tolerant rice. Disease resistant varieties through bio-technology and genetic engineering.
- iii. Collection, conservation, classification and finger printing of all germ-plasm of rice
- iv. Rice harvest and post harvest technology development to avoid the post harvest losses
- v. Develop new methods of uses of rice husk as a polishing materials, abrasive, fuel, etc.
- vi. Arsenic tolerant rice and arsenic management in food chain.
- vii. Bio fortification of high zinc, iron and vitamins in rice
- viii. Development of non premium quality of rice
- ix. Development of new technologies for modern rice cultivation
- x. Development of new plant type (super high yielding rice)
- xi. Development of farming system research in various locations and technology
- xii. Development of low cost technology
- xiii. Transfer of developed technologies to the end users
- xiv. Arrangement of national and international training, workshop, conference, etc. on rice.

Table 3.3.2 Discipline wise scientific manpower provision, exiting and vacant post at BIRRI in June, 2009

Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Plant Breeding	4	3	1	5	4	1	9	7	2	10	7	3	28	21	7	3	1
Genetic Resources and Seed	1	1	0	1	1	0	2	2	0	6	6	0	10	10	0	1	0	2
Biotechnology	1	1	0	1	1	0	3	3	0	3	1	2	8	6	2	1	0	1
Agronomy	1	1	0	3	2	1	10	8	2	5	4	1	19	15	4	2	3	2
Soil Science	2	2	0	3	2	1	7	5	2	6	5	1	18	14	4	4	1	1
Plant Physiology	1	0	1	2	2	0	4	3	1	3	2	1	10	7	3	2	1	2
Irrigation and Water Management	1	1	0	1	1	0	9	9	0	4	3	1	15	14	1	5	2	1
Entomology	1	1	0	3	3	0	5	5	0	4	2	2	13	11	2	3	1	3
Plant Pathology	2	2	0	4	4	0	7	6	1	6	5	1	19	17	2	3	2	2
Grain Quality and Nutrition	1	0	1	2	1	1	4	3	1	1	0	1	8	4	4	1	0	1
Rice Farming Systems	1	1	0	4	3	1	10	8	2	7	5	2	22	17	5	2	3	1
Adaptive Research	1	1	0	3	3	0	4	4	0	7	5	2	15	13	2	1	2	2
Farm Machinery and Post Harvest Technology	1	1	0	2	2	0	5	5	0	6	4	2	14	12	2	2	3	2
Farm Management	1	1	0	2	2	0	2	1	1	3	2	1	8	6	2	1	2	1
Workshop Machinery and maintenance	0	0	0	1	1	0	2	2	0	1	1	0	4	4	0	2	1	0
Agril. Economics	1	1	0	2	2	0	5	4	1	4	2	2	12	9	3	2	1	1
Agril. Statistics	1	0	1	1	1	0	3	1	2	1	0	1	6	2	4	0	1	1
Training	1	1	0	1	1	0	2	2	0	0	0	0	4	4	0	1	1	0
Total	22	18	4	41	36	5	93	78	15	77	54	23	233	186	47	36	25	26

Table 3.3.3 Discipline wise scientific manpower and PhD positions at BIRRI in June, 2009

Discipline	Type of posts		Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
													PhD	MS	PhD	MS	PhD	MS
Plant Breeding (plant molecular biology)	3	3	4	3	7	2	7	0	21	8	2	1	1	0	2	1		
Genetic Resources and Seed	1	1	1	1	2	0	6	0	10	2	1	0	0	0	1	1		
Biotechnology	1	1	1	1	3	1	1	0	6	3	1	0	0	0	1	0		
Agronomy (production, environmental, cropping system, waste management)	1	1	2	2	8	5	4	0	15	8	2	0	2	1	2	0		
Soil Science (soil fertility chemistry, soil and plant analysis)	2	2	2	2	5	0	5	0	14	4	3	1	0	1	0	1		
Plant Physiology (environmental, plant stress)	0	0	2	2	3	0	2	0	7	2	1	1	1	0	2	0		
Irrigation and Water Management	1	1	1	1	9	4	3	0	14	6	4	1	1	1	1	0		
Entomology (IPM on rice crops, insect biodiversity)	1	1	3	1	5	0	2	0	11	2	2	1	0	1	2	1		
Plant Pathology (bacterial, fungal, viral)	2	2	4	4	6	1	5	0	17	7	2	0	2	0	1	1		
Grain Quality and Nutrition	0	0	1	0	3	1	0	0	4	1	0	1	0	0	1	0		
Rice Farming Systems	1	0	3	1	8	5	5	0	17	6	2	0	2	1	0	0		
Adaptive Research	1	1	3	3	4	1	5	0	13	5	1	0	2	1	2	0		
Farm Machinery and Post Harvest Technology	1	1	2	2	5	1	4	0	12	4	1	1	2	1	1	1		
Farm Management	1	1	2	2	1	0	2	0	6	3	2	0	1	0	0	0		
Workshop Machinery and Maintenance	0	0	1	0	2	2	1	0	4	2	0	0	1	0	2	0		
Agril. Economics	1	1	2	2	4	0	2	0	9	3	3	1	0	1	1	0		
Agril. Statistics	0	0	1	0	1	0	0	0	2	0	0	0	0	1	1	0		
Training	1	1	1	1	2	1	0	0	4	3	1	0	1	0	0	0		
Total	18	17	36	28	78	24	54	0	186	69	28	8	16	9	20	6		

3.3.6 Enhancement of institutional efficiency

The head quarters of BRRI is situated at Joydebpur, Gazipur with 18 divisions, 10 regional stations located in different regions and agro-ecological zones of Bangladesh.

BRRI is mandated for conduction of research on all aspects of rice, which include development of modern varieties of rice with high potential for different ecosystems and develops component technologies for improving productivity of rice based cropping systems. BRRI also develops cultural management, disease and insect management technologies, rice value change, production and post harvest technologies, quality control, maintenance, etc.

At present the institute has scientific manpower provisions of 236 including Director General 1 and Director 2. In case of chief scientific officer (CSO) to scientific officer (SO) the institute has 233 scientific provisions and present scientific in position of 186 and 47 posts are remain vacant (Table 3.3.2). In the Table it is observed that out of 22 provisions 4 posts are vacant in the case of CSO, whereas in case of PSO out of 41 provisions 5 posts are vacant, as SSO 15 posts are vacant out of 93 provisions and in the case of SO 23 posts are vacant out of 77 provisions. Therefore, at present the filled up scientific positions are 18 CSO, 36 PSO, 78 SSO and 54 SO working in different disciplines of BRRI. For proper enhancement of institutional efficiency the scientists should develop high yielding cost effective varieties with modern production technologies including post harvest processing. To achieve the institute's goal, scientific manpower development is essential to enable them to develop and execute research plan.

3.3.7 Identification of skill gaps on the basis of priority research

At present BRRI has scientific manpower in positions of 186 (80%) out of 233 scientific manpower provisions in their various divisions, whereas 47 (20%) scientific positions are vacant. Out of 233 scientific provisions 69 scientists are PhD holders in different divisions i.e. (29%), which is not at the satisfactory level (Table 3.3.2). Division wise analyses of PhD holders indicate that in Plant Breeding, 38%, Genetic Resources, 20%, Biotechnology, 50%, Agronomy, 46%, Soil Science, 28%, Plant Physiology, 28%, Irrigation and Water Management, 42%, Entomology, 18%, Plant Pathology, 41%, Grain Quality, 25%, Rice Farming System, 35%, Adaptive Research, 38%, Farm Machinery and Post-harvest Technology, 33%, Agricultural Economics, 33%. For enhancing of institutional efficiency the PhD holders of BRRI should be increased to at least 50% gradually by the year 2025 in respective divisions. To fulfill 50% PhD level scientific manpower of BRRI, there should be a training plan showing gradual increase of the scientific manpower with PhD degree holder and 40% in 2015, 45% in 2020 and 50% in 2025.

On the other hand there are research gaps as identified by BRRRI as follows:

- i) Biotech – Genetic engineering
 - a) Developing rice varieties for unfavorable ecologies such as drought, flood, saline and cold resistance varieties of rice and vitamin and lysine rich rice
 - b) Collection, conservation, classification and finger printing of all rice germplasm
- ii) Variety maintenance/ production of breeders seeds
- iii) Collection, conservation, evolution and use of germplasm
- iv) Integrated nutrient management
- v) Integrated pests management
- vi) Development of sustainable farming systems
- vii) Management of coastal saline soil
- viii) Technology transfer
- ix) Rice marketing and price policy
- x) Overcoming harvest and post harvest management constraints

3.3.8 Training needs analyses on the basis of skill gaps

On the basis of scientists' personal data analyses in their respective disciplines for addressing future research priority areas, discipline wise following skill gaps have been identified:

- i. Plant molecular genetics, plant tissue culture, genetic engineering, biotechnology, etc.
- ii. Seed technology, plant stress physiology, crop modeling, weed management, multiple cropping, dry land farming, etc.
- iii. Biological control, pesticide residue analysis, toxicology, insect physiology, etc.
- iv. Mycology, virology, bacteriology, molecular plant pathology, etc.
- v. Soil physics, soil microbiology, soil micro-nutrient, soil nutrients/ fertility assessment, crop modeling using GIS and GPS, etc.
- vi. Biochemistry for rice value change, production and post harvest technologies, quality control, maintenance
- vii. Soil and water resource engineering, farm machinery system, food process engineering, agricultural waste management, renewable energy utilization, etc.
- viii. Rural sociology and marketing, value change, linking production and marketing, development software
- ix. Bioinformatics, remote sensing, geo-informatics.
- x. BRRRI needs discipline wise skilled manpower development because of retirement of skilled manpower from the concern disciplines. Number of PhD and other relevant trainings as mentioned above in their respective disciplines are presented in Table 3.3.4.

Table 3.3.4 BRRRI scientific manpower development plan and enhancement of PhD level from 29% to 50% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 40% level)				2016-2020 (PhD at 45% level)				2021-2025 (PhD at 50% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Plant Breeding	6	2	6	4	3	2	5	3	3	2	4	2	12	6	15	7
Genetic Resource and Seed	3	0	2	1	1	0	3	2	1	0	2	2	5	0	7	5
Biotechnology	2	1	2	1	1	1	3	2	2	1	3	2	5	3	8	5
Agronomy	3	1	4	1	3	1	3	1	2	1	2	1	8	3	9	5
Soil Science	4	1	4	2	4	0	3	2	1	0	2	2	9	1	9	6
Plant Physiology	3	1	2	1	1	0	2	1	2	1	2	1	6	2	6	3
Irrigation and Water Management	5	0	3	1	1	0	3	2	2	0	2	2	8	0	8	5
Entomology	4	0	3	1	2	0	2	1	3	0	2	1	9	0	7	3
Plant Pathology	3	1	4	2	3	0	3	2	2	1	3	1	8	2	10	5
Grain Quality and Nutrition	1	0	1	1	1	0	2	1	2	0	2	1	4	0	5	3
Rice Farming Systems	3	0	4	2	4	0	2	1	2	0	3	2	9	0	9	5
Adaptive Research	2	0	2	1	3	0	2	1	2	0	2	1	7	0	6	3
Farm Machinery and Post Harvest Technology	2	1	2	1	2	0	3	2	2	0	2	1	6	1	7	4
Farm Management	2	0	2	1	1	0	2	1	1	0	2	1	4	0	6	3
Workshop Machinery and Maintenance	0	0	1	1	1	0	1	0	2	0	1	0	3	0	3	1
Agril. Economics	4	1	2	1	2	0	2	1	2	0	2	1	8	1	6	3
Agril. Statistics	2	0	1	0	1	0	0	0	1	0	1	0	4	0	2	0
Training	0	0	1	1	0	0	1	0	0	0	1	0	0	0	3	1
Total:	49	9	46	23	34	4	42	23	32	6	38	21	115	19	126	67

3.4 Bangladesh Jute Research Institute

Bangladesh Jute Research Institute (BJRI) was established after the independence of Bangladesh and to this effect ‘The Jute Research Institute Act-XIII of 1974’ was promulgated in the parliament. Establishment of this institute has to be taken for the following mandates.

3.4.1 Mandates

1. To promote agricultural, technical and economic research on Jute and Allied Fibres(JFA) and their manufactures and dissemination thereof.
2. To organize production, testing and supply of improved pedigree of jute seeds, multiplication, procurement and their distribution to recognized organizations, related growers and such other agencies as may be approved by the board.
3. To organize training of officers and progressive farmers in modern improved technology of jute, kenaf and mesta crops and also to train technical hands for utilization.

In relation to these objectives, BJRI has able to meet up the following actions-

1. The institute has developed 38 varieties of JAF of which 15 are now under wide cultivation at farmers’ field.
2. BJRI has developed another 33 technologies regarding crop- soil, disease-pest management, improved retting process etc. and also 37 of jute product development technologies that are now popular to environment friendly that aware to the people.

The following activities should be undertaken to revitalize jute production system and make BJRI, a dynamic entity-

- i. Different projects should be launched to produce quality jute seed production.
- ii. Improved technology on low cost retting should be disseminated to the growers.
- iii. Biotechnological research should be more emphasized for development high yielding, disease-pest free and quality fibre produceable JAF crops.
- iv. Programme should be taken to disseminate the developed technologies on jute and allied fibre crops.
- v. Also emphasis should be given to popularize various quality products on jute.

Table 3.4.1 Management structure of BJRI

Director General	Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	3	11	31	46	56	148 (PhD =19;12%)

BJRI Head Quarter located at Manik Miah Avenue, Sher-e-Bangla Nagar, Dhaka- 1215

Divisions of Agriculture Wing

1. Genetic Resources and Seed
2. Breeding
3. Agronomy
4. Pest Management
5. Fibre Quality Improvement
6. Fibre Quality Improvement
7. Jute Farming Systems
8. Farm Management

Divisions of Technology Wing

1. Mechanical Processing
2. Pilot Plant and Processing
3. Chemistry
4. Textile Physics
5. Microbiology and Biochemistry

The institute has one Central Jute Research Station at Manikgonj, 4 Regional Stations, 3 Sub Stations in various jute growing regions of Bangladesh and one breeder seed production farm at Dinajpur.

3.4.2 Objectives

BJRI has the following objectives-

- (i) Development of improved varieties of jute, mesta, and kenaf having variable photo periods with tolerance to pests
- (ii) Generation of location specific technologies for improvement of retting, kenaf, mesta, and technology transfer
- (iii) Generation of technologies for seed production after monsoon
- (iv) Collection, conservation, and maintenance of germplasms
- (v) Improvement of conventional jute products
- (vi) Generation of new diversified end-uses of jute for increase export potential
- (vii) Technological support to jute textile industries in updating their products
- (viii) Information generation to agriculture for quality production of jute fibre to use in jute industry.

3.4.3 Major research achievements of BJRI

BJRI achievements include the following-

- (i) Developed 38 improved varieties of jute including white, tossa, masta, and kenaf.
- (ii) Thirty three low cost production technologies and 37 product oriented technologies have been developed.
- (iii) Economic production technologies have been developed.
- (iv) A number of jute based profitable cropping patterns have been developed.
- (v) Fertilizer requirements have been determined and technologies for jute seed production have been generated of different agro-ecological regions developed.

- (vi) Improved retting method for quality fibre has been evolved.
- (vii) Various jute products such as: jute wool, jute blanket, jute textile for household use, water conveyances, mulching, UV protective umbrella, hats, etc. have been developed.
- (viii) Micro-crystal cellulose for pharmaceutical use has been evolved.

3.4.4 Present research activities of BJRI

3.4.4.1 Activities of agriculture wing: Division wise

1. Genetic Resources and Seed Division

Collection, conservation, characterization, evaluation, documentation and distribution of jute, kenaf and mesta germplasms, varietal development of JAF through biotechnological research, production, distribution and improvement of breeder seed.

2. Breeding Division

Varietal development and breeding for stress tolerant lines of jute, kenaf and mesta varieties, development of breeding materials with wider genetic background, varietal maintenance of deshi, tossa, kenaf and mesta varieties.

3. Agronomy Division

Increase per hectare yield of jute and allied fibre and seed through manipulation of agronomic, soil and fertilizer management practices, improvement of jute, kenaf and mesta varieties on the basis of crop-soil environment relations.

4. Pest Management Division

Management of fungal diseases through different *Trichoderma sp.*, investigation of transmission mode of leaf curling and leaf yellowing of kenaf, evaluation of botanicals for controlling jute pests.

5. Fibre Quality Improvement Division

Improvement of fibre quality through post harvest processing.

6. Jute Farming Systems Division

Technology verification, adoption and impact studies on jute and allied fibre.

7. Farm Management Unit

Region specific research on jute technologies at farmers level, production of quality jute seed and distribution among the farmers.

3.4.4.2 Activities of technology wing: Division wise

1. Textile Physics Division

Jute reinforced composites, Surface modification of jute and blended yarn by Plasm Polymerization, quality improvement of Jute and jute product by Chemical medication.

2. Chemistry Division

Development of diversified jute products, Jute reinforced composites and Textile testing equipment.

3. Mechanical Processing Division

Vegetable dyeing; biodegradable jute plastic.

4. Pilot Plant and Processing Division

Improvement of conventional jute products; generate new diversified end-uses of jute for increase export potential, technological support to jute textile industries; information generate for quality fibre to use in jute industry, etc.

3.4.5 Future research priority of BJRI

- i. Collection, conservation, characterization of jute, kenaf, and mesta germplasm
- ii. Development of stress, saline, water logging tolerant jute, kenaf and mesta varieties
- iii. Varietal improvement for high quality of jute, kenaf, and mesta through bio-technology
- iv. Development of integrated pest management approaches for controlling newly appeared pests and diseases of jute and allied fibre crops
- v. Development of jute marketing policy both at home and abroad
- vi. Feasibility study on jute stick marketing for farmers income
- vii. Improvement of fibre quality through improved retting process
- viii. Forecasting demands and supply of jute products for export and country use
- ix. Developed technology for reduction of traditional jute products
- x. Product development for diversified uses and export potential
- xi. Modified machinery and equipments for jute and jute products
- xii. Pilot scale production, technology transfer and entrepreneurship development
- xiii. Molecular basis of environmental stress tolerance
- xiv. Development of low cost fertilizer management technologies for jute and jute related cropping pattern
- xv. Development of transgenic plant for fungal and virus diseases of jute and allied fibre crops; isolation of toxins/enzymes from disease producing fungal pathogens and their use on disease resistant screening programme under laboratory condition.

Table 3.4.2 Discipline wise scientific manpower provision, existing and vacant posts in June, 2009 and status of retirement at BJRI

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
Plann, Training and Comm.	1	1	0	1	1	0	2	2	0	0	0	0	4	4	0	1	2	1
Breeding	1	1	0	3	3	0	5	4	1	4	4	0	13	12	1	3	1	2
Agronomy	1	1	0	3	3	0	5	4	1	4	4	0	13	12	1	2	4	3
Genetic Resources and Seed	1	1	0	3	3	0	3	1	2	3	3	0	10	8	2	1	2	2
Pest Management	1	1	0	2	2	0	3	1	2	4	4	0	10	8	2	2	2	2
Fibre Quality Improvement	1	1	0	1	1	0	2	1	1	2	2	0	6	5	1	1	1	1
Jute Farming Systems	1	1	0	1	1	0	2	2	0	3	3	0	7	7	0	1	1	1
Farm Management	0	0	0	3	2	1	6	5	1	15	12	3	24	19	5	2	3	4
Pilot Plant and Processing	1	1	0	3	2	1	3	3	0	4	2	2	11	7	4	1	4	3
Mechanical Processing	1	0	1	2	1	1	3	2	1	8	3	5	14	7	7	0	2	3
Chemistry, Microbiology and Biochemistry	1	1	0	6	3	3	7	5	2	8	6	2	22	15	7	2	2	5
Textile Physics	1	0	1	3	1	2	5	4	1	6	5	1	15	10	5	2	1	4
Total	11	9	2	31	23	8	46	34	12	61	48	13	149	114	35	18	25	31

Table 3.4.3 Discipline wise scientific manpower and PhD positions at BJRI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Planning, Training & Comm. (HRD and Communication)	1	0	1	1	2	0	0	0	4	1	0	1	1	1	0	1
Breeding (Genetic and Plant Breeding, molecular biology, genetic engineering, biotechnology, etc.)	1	0	3	2	5	0	4	0	13	2	1	2	1	0	0	2
Agronomy (Production, environmental physiology, plant stress physiology, cropping system, etc.)	1	1	3	2	5	0	4	0	13	3	1	1	2	2	0	3
Genetic Resources & Seed (Seed physiology, genetics, seed management, etc.)	1	1	3	0	3	0	3	0	10	1	1	0	0	2	0	2
Pest Management (IPM, insect biodiversity, insects physiology, pesticide toxicology, bacterial, fungal, viral, nematode, plant disease diagnostic, etc.)	1	0	2	0	3	1	4	0	10	1	0	2	1	1	0	2
Fibre Quality Improvement (Microbiology, chemistry, etc.)	1	0	1	0	2	0	2	0	6	0	1	0	0	1	0	1
Jute Farming Systems (Production agronomy, sociology, etc.)	1	0	1	0	2	0	3	0	7	0	0	1	0	1	0	1
Farm Management (Personnel, financial, logistic support, etc.)	0	0	3	0	6	0	15	0	24	0	0	2	0	3	0	4
Pilot Plant & Processing (Textile technology, physics, chemistry, etc.,)	1	1	3	1	3	0	4	0	11	2	1	0	1	3	0	3
Mechanical Processing (Textile technology, mechanical engineering, textile physics, etc.)	1	0	2	1	3	1	3	0	9	2	0	0	1	1	1	2
Chemistry, Microbiology and Biochemistry (chemistry, textile technology, etc.)	1	1	6	2	7	2	8	0	22	5	1	1	2	1	1	4
Textile Physics (Textile technology, textile physics, physics, etc.)	1	0	3	1	5	1	6	0	15	2	1	1	0	1	1	3
Total	11	4	31	10	46	5	48	0	144	19	7	11	9	17	3	28

3.4.6 Enhancement of institutional efficiency

BJRI Head Quarter is located at Manik Miah Avenue, Sher-e-Bangla Nagar, Dhaka- 1215. There are eight Divisions in Agriculture Wing and four Divisions in Technology Wing:

BJRI is mandated for conducting research on all aspect of jute, which include development of modern varieties of jute, kenaf and mesta with high potential for different ecosystems; develop component technologies for improving productivity of jute based cropping systems. BJRI also develops cultural management, disease and insect management of jute and also manufacturing new jute products for domestic and industrial use.

At present there are 149 scientific manpower provisions BJRI including one Director General and three Directors. In the institute chief scientific officer (CSO) to scientific officer (SO) provisions are 144 and present in position of 114 scientists and 35 posts are vacant (Table 3.4.2). In the table it is observed that out of 11 provisions 2 posts are vacant in the case of CSO, whereas in case of PSO out of 31 provisions 8 posts are vacant, as SSO 12 posts are vacant out of 46 provisions and in case of SO 8 posts are vacant out of 56 provisions. Therefore, at present filled in positions are 9 CSO, 23 PSO, 34 SSO and 48 SO working in different disciplines of BJRI. The scientific manpower development is essential for development of demand led technologies which are to be used by the farmers for sustainable development and thus increase the institutional efficiency.

3.4.7 Identification of skill gaps on the basis of priority research

At present BJRI has scientific manpower in positions of 114 (76.51%) out of 149 scientific provisions in their various divisions, whereas 35 (23.48%) scientific positions are vacant. Out of scientists only 19 are PhD holders in different divisions i.e. (12%), which is very much insignificant of PhD holders at BJRI (Table 3.4.2). The analyses of PhD holders in divisions wise are breeding (15%), genetic resources (10%), agronomy (23%), pilot plant and processing (18%), mechanical processing (22%) and there is no PhD holder in other disciplines. For proper enhancement of institutional efficiency the PhD holders of BJRI should be increased at least 30% gradually by the year 2025 in respective of divisions. To fulfillment of 30% PhD level in scientific manpower of BJRI, there should be a training plan, where gradually increase the scientific train manpower in a way that the scientific manpower attain the PhD level of 20 % by the year 2015, 25% by the year 2020 and 30% by the year 2025.

At BJRI on the basis of scientists' personal data analyses in their respective disciplines and for the address of future research priority areas, the following discipline wise skill gaps have been identified:

Lack of hybrid jute varieties, low fibre quality and yield, fibre length, fineness, low lignin, twist in the fibre, resilience, dye holding capacity, whiteness, lack of resistance to biotic and abiotic stresses specially tolerant to salinity areas, resistance to pre-mature flowering, more resilience of fibre for better carpets, better dye holding capacity, resilience in wollenised jute.

3.4.8 Training needs analyses on the basis of skill gap

For strengthening of research activities, BJRI needs to develop discipline wise scientific manpower through training in the field of plant molecular genetics, plant tissue culture, genetic engineering, biotechnology, seed technology, plant stress physiology, crop modeling, IPM, toxicology, insect physiology, virology, molecular plant pathology, soil physics, soil microbiology, soil micro-nutrient, soil nutrients, textile physics, jute chemistry, mechanical engineering, physics, chemistry for generating new diversified products of jute for increasing export potential, MIS, ICT, GIS, etc.

BJRI needs discipline wise skilled manpower for improvement of research activities and fill up the gap due to retirement of skilled manpower from the concerned disciplines. For these reasons, numbers of PhD and other training programs have been identified on the basis of number of scientists of the disciplines as placed in Table 3.4.4.

Table 3.4.4 BJRI scientific manpower development plan and enhancement of PhD level from 12% to 30% during the period of 2009-2025.

Year Discipline	2009-2015				2016-2020				2021-2025				Total			
	PhD*	Post D	Short T.	Sty/S/W	*PhD *	Post D	Short T.	Sty/S/W	•PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Planning, Training & Comm.	1	0	1	0	1	0	1	0	1	0	1	0	3	0	3	0
Breeding	2	1	3	1	2	1	4	1	1	1	3	1	5	3	10	3
Agronomy	2	0	3	1	3	0	4	2	3	0	5	2	8	0	12	5
Genetic Resources & Seed	3	1	2	1	2	1	3	1	1	0	2	1	6	2	7	3
Pest Management	1	0	2	1	2	0	3	1	1	0	2	1	4	0	7	3
Fibre Quality Improvement	2	0	2	1	1	0	2	1	1	0	2	1	4	0	6	3
Jute Farming Systems	1	0	2	1	1	0	2	1	1	0	2	1	3	0	6	3
Farm Management	3	0	4	1	5	0	6	2	3	0	8	3	11	0	18	6
Pilot Plant & Processing	1	0	1	1	3	0	1	1	3	0	3	2	7	0	5	4
Mechanical Processing	0	0	1	0	1	0	1	1	1	0	1	0	2	0	3	1
Chemistry, Microbio. & Biochemistry	5	0	2	1	0	0	8	3	1	1	8	3	6	1	18	7
Textile Physics	2	0	2	1	1	0	5	2	1	0	5	2	4	0	12	5
Total	23	2	25	10	22	2	40	16	18	2	42	17	63	6	107	43

* PhD at 20% level ** PhD at 25% level • PhD at 30% level

3.5 Bangladesh Institute of Nuclear Agriculture

Bangladesh Institute of Nuclear Agriculture (BINA) was established on 1st July, 1972 under Atomic Energy Commission of Bangladesh situated at Dhaka. Subsequently in the year 1975 the institute has been transferred to Bangladesh Agricultural University Campus Mymensingh. In 1982 the institute was placed under the Ministry of Agriculture and in 1984 ordinance was issued in the name Bangladesh Institute of Nuclear Agriculture. Its research efforts are mainly using nuclear techniques on agricultural crops for developing high yielding varieties of rice, jute, pulse, oilseed, vegetables. BINA has been successful in releasing 42 modern varieties of different crops such as rice, mustard, chickpea, mungbean, black gram and tomato.

Using the various isotopes the institute has been able to study on soil related problems including dynamic and behavior of the nitrogen, phosphorous and potassium on different soils, efficient use of fertilizers and physical aspects of soil and water management. The institute has developed bio-fertilizer for lentil, chickpea, mungbean, cowpea, soybean, etc. The institute identified various insects and disease of different crops and their control measures. The institute has also developed various production technologies packages for various crops. The institutes tested several improved varieties in the farmers' fields and popularized the varieties, which are now being grown by the farmers.

Table 3.5.1 Management structure of BINA

Director General	Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	2	12	18	25	36	94 (PhD=35; 37 %)

Head Quarters: Mymensingh

Divisions

- | | |
|-----------------------------|--------------------------------|
| 1. Plant Breeding | 2. Agronomy |
| 3. Plant Pathology | 4. Entomology |
| 5. Soil Science | 6. Plant Physiology |
| 7. Agricultural Engineering | 8. Training and Communication. |
| 9. Support Service | 10. Planning and Development |

Sub Stations=6

3.5.1 Objectives

- i. Development of high yielding varieties through mutation and conventional breeding techniques
- ii. Evolving control measures against pest and disease of crops
- iii. Assessment of fertility status of the soils and efficiency utilization of applied nutrients using radio isotopic techniques
- iv. Development of production packages of different crops
- v. Development of water use efficiency for crops
- vi. Arrange training programs for technology transfer.

3.5.2 Major research achievements of BINA

- i. Developed 42 modern varieties of different crops: 6 rice, 2 jute, 4 mustard, 3 groundnut, 4 chickpea, 5 mungbean, 1 blackgram, 3 tomato, etc.
- ii. Developed management packages for these varieties and new cropping patterns using these varieties have been developed. More over, quality seeds of the most promising varieties of BINA have been produced and distributed.
- iii. Pioneer in characterizing physical, chemical and microbiological properties, delineating plant nutrient status in Bangladesh soils, and conducting research using nuclear techniques.
- iv. Residual effect of fertilizer and legumes to succeeding crops detected.
- v. Irrigation scheduling and water requirement of rice, wheat, chickpea, lentil and mustard were developed.
- vi. Developed 7 peat-based rhizobial biofertilizers (substitute of urea) for 7 legume pulse/oil seed crops and the yield increase due to use of biofertilizers ranged from 15-150%.
- vii. Developed bio-fertilizer for lentil, peanut, chickpea, mungbean, cowpea and soybean.
- viii. Evolved rice based cropping patterns and nutrient management.
- ix. Irrigation scheduling and improved water management.

3.5.3 Present research activities of BINA

1. Plant Breeding: Varietal development of rice, jute, pulse, oil seed, tomato and onion using mutation breeding technique and biotechnological approaches for normal and harsh environments (like saline areas).
2. Research work on different aspects under 6 projects are going on such as i. Development of proper agronomic management packages for advanced mutants of crops at different AEZs. ii. On farm nutrient management for mutant varieties. iii. Adaptability and management studies for advanced lines/mutant varieties in problem areas in different cropping patterns at various AEZs. iv. Herbicide management for rice crop, v. A study on climatic changes on productivity of

- mutant crop varieties and vi. Development of suitable production technology packages and storage by using nuclear technique.
3. Plant Pathology: Screening and evaluation of breeding materials against major diseases.
 4. Entomology: Integrated pest, nutrient and water management programs.
 5. Soil Science: Studies include integrated soil fertility and nutrient management, micronutrients, arsenic contamination, biological nitrogen fixation, production and distribution, micronutrient, etc.
 6. Plant Physiology: Physiological evaluation of rice, pulse, oilseed, vegetable, spice, etc.
 7. Agricultural Engineering: Irrigation scheduling and improved water management.
 8. Training and Communication: Organizing training on developed technologies for the extension personnel, seminar, workshop, etc.

3.5.4 Future research priority areas of BINA

- i. Varietal improvement of different crops for biotic and abiotic stress environments through mutation breeding technique and or in combination with biotechnological approaches.
- ii. Development of crop production packages and new cropping pattern in saline and drought prone areas, quality seed production of promising BINA varieties and their dissemination and hybrid seed production.
- iii. Site-specific integrated nutrient management package.
- iv. Bio-fertilizer for cereal (rice, wheat, etc.) and vegetable crops, carbon sequestration, determination of pesticide residue in soil, plant and ecosystem, soil fertility, problem soils, etc.
- v. Plant-soil-water relationship through isotopic, nutrient dynamics (macro and micro)
- vi. Biotechnology on various crops and vegetables and use of molecular markers for developing pest and disease resistant crops.
- vii. Integrated pest, soil fertility and water management including residue and organic amendment.
- viii. Insect immunization through mutation rays
- ix. Development of technologies for improved management practices for various crops and vegetable due to climate change.
- x. Strengthening technology transfer through training, seminar, workshop, conference, field day, etc. and also farming system research and development.

Table 3.5.2 Discipline wise scientific manpower provision and vacant post at BINA in June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Plant Breeding	3	1	2	5	4	1	5	0	5	7	6	1	20	11	9	2	3
Crop Physiology	1	1	0	2	2	0	3	3	0	3	2	1	9	8	1	2	3	3
Soil Science	3	1	2	4	4	-	6	4	2	8	7	1	21	16	5	2	4	5
Entomology	1	0	1	1	1	0	2	2	0	3	3	0	7	6	1	0	2	2
Plant Pathology	1	1	0	1	1	0	2	1	1	2	2	0	6	5	1	1	2	1
Agricultural Engineering	1	1	0	1	1	0	2	2	0	3	3	0	7	7	0	2	1	2
Agronomy	1	0	1	1	1	0	1	1	0	3	3	0	6	5	1	0	1	2
TCP Div.	1	0	1	1	1	0	2	2	0	3	2	1	7	5	2	1	2	1
Electronics and Engineering Section	0	0	0	1	1	0	1	1	0	1	1	0	3	3	0	0	0	2
Planning and Development	0	0	0	1	1	0	1	0	1	3	3	0	5	4	1	1	1	1
Total	12	5	7	18	17	1	25	16	9	36	32	4	91	70	21	11	19	23

Table 3.5.3 Discipline wise scientific manpower and PhD positions at BINA in June, 2009

Discipline \ Type of position	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Plant Breeding (plant molecular genetics, biotechnology, genetics engineering)	1	2	4	1	0	3	6	2	11	8	1	1	2	1	2	2
Crop Physiology (environmental, plant stress, plant molecular)	1	1	2	1	3	2	2	1	8	5	1	1	1	2	1	2
Soil Science (microbiology, fertility chemistry, physics, plant analysis)	1	1	4	3	4	2	7	2	16	8	1	1	2	2	3	2
Entomology (IPM crops, insect biodiversity)	0	0	1	1	2	2	3	1	6	4	0	0	1	1	1	1
Plant Pathology (bacterial, fungal, viral)	1	0	1	1	1	1	2	1	5	3	1	0	1	1	1	1
Agri. Engineering (irrigation water management, farm machinery, bioprocess)	1	0	1	1	2	1	3	0	7	2	1	1	1	0	1	1
Agronomy (production, environmental, cropping system)	0	0	1	1	1	0	3	1	5	2	0	0	1	0	1	0
TCP	0	0	1	1	2	2	2	0	5	3	0	1	0	2	0	1
Support Service	0	0	1	0	1	0	1	0	3	0	0	0	0	0	0	2
Planning and Development Cell	0	0	1	0	0	0	3	0	4	0	0	1	0	1	0	1
Total	5	4	17	10	16	13	32	8	70	35	5	6	9	10	10	13

3.5.5 Enhancement of institutional efficiency

The head quarters of BINA at Mymensingh with 10 divisions and 6 sub-stations located in different regions and agro-ecological zones of Bangladesh.

BINA conducts research adopting nuclear techniques for the purpose of ensuring a stable and productive agriculture through evaluation of new crop varieties. BINA has developed some improved rice varieties and given thrust on development of improved varieties of oilseeds especially groundnut and sesame. In the case of pulse, several improved varieties of lentil and mong bean have been developed. BINA has also developed cultural management, disease and insect resistant varieties of vegetables like tomato.

At present the institute has scientific manpower provisions of 94 including Director General 1 and Director 2. In case of chief scientific officer (CSO) to scientific officer (SO) the institute has 91 scientific provisions and present position of 70 with vacant posts 21 (Table 3.5.2). In the Table it is observed that out of 12 provisions 7 posts are vacant in case of CSO, whereas in case of PSO out of 18 provisions 1 post is vacant, for SSO 9 posts are vacant out of 25 provisions and in the case of SO 4 posts are vacant out of 36 provisions. Therefore, at present filled in positions are 5 CSO, 17 PSO, 16 SSO and 32 SO working in different disciplines of BINA.

3.5.6 Identification of skill gaps on the basis of priority research at BINA

At present BINA has scientific manpower in positions of 70 (74%) out of 94 scientific manpower provisions and 21 (24%) scientific positions remain vacant. Out of 94 scientific provisions 35 scientists are PhD holders in different divisions i.e. (37%), which is just enough number of PhD holders at BINA (Table 3.5.2). The division wise analysis of PhD holders indicate that Plant Breeding (40%), Soil Science (38%), Plant Physiology (55%), Entomology (56%), Plant Pathology (50%), Agronomy (33%), Agricultural Engineering (20%) and so on for proper enhancement of institutional efficiency the Ph.D. holders of BINA should be increased at least 50% gradually by the year 2015. For fulfillment of 50% PhD level scientific manpower of BINA, there should have training plan where with objective of reaching 40%, 45% and 50% PhD scientific staff by 2020 at and 2025 respectively.

At BINA on the basis of scientists' personal data analyses in their respective disciplines and for addressing future research priority areas, the following discipline wise skill gaps have been identified:

- i. Plant molecular genetics, plant tissue culture, genetic engineering, bio-technology, etc.
- ii. Plant stress physiology, crop modeling, multiple cropping, etc.

- iii. Biological control, insect physiology, etc.
- iv. Mycology, virology, bacteriology, etc.
- v. Soil physics, soil microbiology, soil micro-nutrient, soil nutrients/ fertility assessment, etc.
- vi. Soil and water resource engineering, renewable energy utilization, ICT, MIS, etc.

3.5.7 Training needs analyses on the basis of skill gaps

For strengthening research activities, BINA needs to develop discipline wise scientific manpower through training in the field of plant mutation breeding, plant molecular biology, biotechnology, genetic engineering, plant stress physiology, microbiology, bio-fertilizer, nutrient management, seed technology, insect immunology pest and disease management, nutrient management through the use isotopic technique, soil and water resource management, value change, climate change, crop management, ICT, MIS, etc during the period of 2009-2025.

BINA needs discipline wise skilled manpower because of gap of retirement of skilled manpower from the concerned disciplines. The number of PhD and other training programs has been identified on the basis of number of scientists of the discipline and are presented in Table 3.5.4.

Table 3.5.4 BINA scientific manpower development plan and enhancement of PhD level from 37% to 50% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 40% level)				2016-2020 (PhD at 45% level)				2021-2025 (PhD at 50% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Plant Breeding	3	1	4	1	3	1	6	2	3	1	6	2	9	3	16	5
Crop Physiology	1	0	2	1	2	0	4	1	1	0	4	2	4	0	10	4
Soil Science	2	1	4	1	3	0	5	2	3	1	6	2	8	2	15	5
Entomology	0	0	2	1	1	0	2	1	2	0	2	1	3	0	6	3
Plant Pathology	1	0	2	1	1	0	2	1	2	0	2	1	4	0	6	3
Agri. Engineering	2	0	2	1	1	0	2	1	2	0	2	1	5	0	6	3
Agronomy	1	0	3	1	1	0	2	1	1	0	2	1	3	0	7	3
TCP	0	0	1	0	1	0	2	0	1	0	2	1	2	0	5	1
Electronics & Engineering Section	1	0	0	0	1	0	2	0	0	0	2	1	2	0	4	1
Planning and Development Cell	1	0	1	0	0	0	2	0	1	0	3	2	2	0	6	2
Total:	12	2	21	7	14	1	29	9	16	2	31	14	42	5	81	30

3.6 Bangladesh Sugarcane Research Institute

Bangladesh Sugarcane Research Institute (BSRI) is one of the oldest research institutes of Bangladesh conducting research on sugarcane, the raw material for sugar, *gur* and cane juice. Sugarcane is the only dependable cash crop in the low rainfall belt of the north-west and south-west parts of Bangladesh. Based on sugarcane, the sugar and *gur* industries have developed in the country.

According to the Food and Agriculture Organization (FAO), every individual needs to consume 13 kg sugar or 17 kg *gur* per annum. In Bangladesh, this quantity is still less than 3 kg per person. With the projected population of 153.33 million in the year 2020, the requirement of sugar will be 9.2 hundred thousand metric ton even if the intake of 6 kg sugar per person per year. At present, 7.3 million ton sugarcane is produced from 0.18 million hectares (roughly 0.1 million hectare in sugar mills zones and 0.08 million hectares in non-mill zones for *gur* production) of land per year. The yield of sugarcane is 40.52 ton hectare (46 t/ha in sugar mill areas and 36 t/ha in *gur* areas). To meet the demand of sugar and *gur*, 11.1 million tons sugarcane needs to be produced per year. As such the yield of cane must be increased from its present level to at least 65 t/ha.

BSRI is proud to serve the nation in attaining self reliance in the sugar and *gur* sector with its limited resources and manpower. Two basic functions are performed by this institute: (a) Development of sugarcane variety as well as improved production technology and (b) Dissemination of varieties and technologies to the farming community. Research wing consists of eight research divisions, one quarantine station and two regional stations, whereas technology transfer (TT) wing consists of two major divisions, six substations and three sections. The technology transfer wing generally conducts training for the farmers, extension workers, etc. and conducts demonstrations in the farmers' field, disseminates the messages through different form of publications, and collects feedback information.

Table 3.6.1 Management structure of BSRI

Director General	Director	Chief Scientific Officer	Principal Scientific Officer	Senior Scientific Officer	Scientific Officer	Total
1	2	16	26	23	46	114 (PhD 12 = 10%)

Head Quarters: Ishurdi, Pabna

Research Division

- | | |
|-------------------------------------|--------------------------------|
| 1. Breeding and Genetic Resource | 2. Agronomy and Farming System |
| 3. Physiology and Sugar Chemistry | 4. Soil and Nutrition |
| 5. Pathology | 6. Entomology |
| 7. Biotechnology (Proposed) | 8. Agricultural Engineering |
| 9. Training and Technology Transfer | 10. On-Farm Research |
| 11. Planning and Development | 12. Farm |

Regional Research Station : 1) RSRS, Thakurgaon, 2) RSRS, Gazipur

Quarantine Station : Joydebpur

Sub Stations : 1) Rajshahi, 2) Joypurhat, 3) Chuadanga, 4) Jamalpur
5) Rahmatpur, 6) Chunarughat (Proposed),
7) Sirajgonj (Proposed)

3.6.1 Objectives

- i. To develop of crops/plants in the production of sugar, *gur* and syrup.
- ii. To prepare production program of sugar, *gur* and syrup produceable carbohydrate enriched crops/plants.
- iii. To evolve other technologies for production of sugar, *gur* and syrup.
- iv. To conduct research on the preparation of sugarcane based farming and identifying its economic advantages.
- v. To take necessary measures regarding appropriate uses of technologies of sugar, *gur* and syrup producing crops/plants.
- vi. To develop and maintain germplasm bank by collecting diverse sugarcane varieties/clones.
- vii. With the prior approval of the Government, to take a sugarcane-related collaborative programme with national and international research, education and training institutes.
- viii. To extend cooperation to any individual or organization that are working in the field of sugarcane development research.
- ix. To publish a journal and reports on the basis of research results and recommendations of the institute.
- x. To help Government for sugarcane policy formulation and to advise the Government, local authority or any institution regarding any matter related to sugarcane.
- xi. To organize education and training for sugarcane farmers.
- xii. To take any necessary measures for implementation of the above objectives.

3.6.2 Major research achievements of BSRI

BSRI has developed and released 35 high yielding, high sugar varieties which are being cultivated in 99% areas of mills zone and about 60% of non-mill zone.

3.6.2.1 Sugarcane varieties based on maturity behavior

Early maturing varieties are : Isd 16, Isd 22, Isd 24, Isd 26, Isd 27 and Isd 33.

Medium maturing varieties are : Isd 18, Isd 19, Isd 20, Isd 28, Isd 29, Isd 31, Isd 32 and Isd 34.

Isd 15 (BO 96) is a late maturing variety.

3.6.2.2 Sugarcane varieties for stress (drought, water-logging, flood and salinity) prone areas

LJC, Isd 20, Isd 21, Isd 22, Isd 24, Isd 25, Isd 26, Isd 27, Isd 29, Isd 30 and Isd 31.

3.6.2.3 Sugarcane varieties suitable for *gur* making (having golden/light brown colour of *gur*)

Isd 16, Isd 21, Isd 22, Isd 24, Isd 25, Isd 29, Isd 30 and Isd 31.

3.6.2.4 Sugarcane varieties for ratooning

Isd 2-54, LJC, Isd 20, Isd 21, Isd 27, Isd 28, Isd 29, Isd 30, Isd 31, Isd 32, Isd 33 and Isd 34.

3.6.2.5 Sugarcane varieties for chewing purposes

Isd 24, Amrita

3.6.2.6 Spaced transplanting (STP) technology has been recommended which can make sugarcane farming more profitable. The salient features of STP are:

- i. It saves 60% seed cane
- ii. It ensures high population, uniform crop stand, higher stalk weight
- iii. It increases seed multiplication ratio (1:30) over conventional method
- iv. It increases 50%-80% yield and economic benefit
- v. It generates rural employments.

To make STP technology easier and handy, method of stalkless settlings of sugarcane has been developed. In this method production and transportation of sugarcane settlings are very easy and cheaper.

3.6.2.7 Developed intercropping packages

- i. Potato/onion/garlic with sugarcane in single row
- ii. Potato-mungbean/GM with sugarcane in paired row
- iii. Onion-mungbean/GM with sugarcane in paired row
- iv. Garlic-mungbean/GM with sugarcane in paired row
- v. Cabbage-mungbean/GM with sugarcane in paired row
- vi. Cauliflower-mungbean/GM with sugarcane in paired row
- vii. Broccoli-mungbean/GM with sugarcane in paired row
- viii. Mustard - GM with sugarcane in paired row
- ix. Lentil - GM with sugarcane in paired row.

3.6.2.8 Better ratoon management: This package of technologies ensures 25%-30% higher yield and 0.5-1.0 unit higher sucrose recovery in ratoon cane.

- i. Selection of suitable varieties
- ii. Deep harvesting
- iii. Fertilizers management
- iv. Stubble shaving and gap filling
- v. Pest and disease management, etc.

3.6.2.9 Agronomic management practices of sugarcane: These include land selection and preparation, selection of seedcane, planting time, planting method, optimum population, irrigation, weed management, harvesting technique etc.

Recommended and updated fertilizer doses and management practices for sugarcane, ratoon cane and its intercrops for 12 AEZs where sugarcane is cultivated.

3.6.2.10 Sugarcane disease management: Forty sugarcane diseases have been identified of which 10 are major and harmful.

- i. Use of disease-free clean seed of resistant varieties in high and medium high land to reduce the incidence of red-rot disease and to control mosaic disease is recommended.
- ii. Use of moist-hot-air-treated seed cane to control white leaf disease is recommended.
- iii. Use of hot water treated seed materials to control ratoon stunting and smut disease is recommended.
- iv. Uses of Bavistin treated seed cane to control sett-rot disease and urea in different doses to control striga (a root parasite of sugarcane) are recommended.

Sugarcane pests management: Sixty-nine sugarcane insects and mite pests have been identified of which 10 are major. Different control measures are as follows:

3.6.2.11 Biological control of TSB, SB and pyrilla

- Cultural and mechanical control measures.
- Chemical control measures of TSB, WG, Termite,
- RSB, SB, ESB
- IPM for sugarcane.

BSRI has developed a number of agricultural machineries and implements for sugarcane cultivation including improved power crusher and paired row trencher

3.6.3 Present major research activities of BSRI

- i. Varietal development of sugarcane for production of *gur* and chewing purposes
- ii. Development of varieties with resistance/tolerance to major diseases, insects and agro-climatic stresses
- iii. Development of management packages for intensive intercropping
- iv. Biological control of major pests and parasites
- v. Developing package for sugarcane pest control through IPM
- vi. Developing sugarcane varieties with B\F
- vii. Integrated nutrient and water management programs

3.6.4 Future research priority areas of BSRI

3.6.4.1 Crop Improvement: Cane and sugar yields have remained static in recent years. Factors responsible for the yield potential should be identified in relation to new varieties, ratoon yields, changes in farming systems, duration of the crop cycle, and pests and diseases. The major thrust will be to build up and enhance of genetic resources as a basis for developing varieties better able to cope with stresses.

Gur is a popular sweetener and chewing of cane is a regular habit of rural people. Therefore varieties suitable for *gur* and chewing purposes will be developed. Moreover, research will be conducted on sugar beet and ancillary sugar crops such as palmyra palm, date palm and maize as sources of *gur*, juice and syrup.

3.6.4.2 Crop Protection: Farmers face ever increasing losses from insect pests and diseases. The costs of controlling many of these problems are prohibitive. Research will be directed toward developing pest control technologies that are effective and safe and above all, acceptable to farmers. Because pesticides

are health hazards as well as costly, emphasis will be on biological control approaches such as the use of entomopathogens and parasites against stem borers, white grubs, and top shoot borers, and use of beneficial mycoflora and other micro-organisms against red rot and wilt pathogens and nematodes. Integrated pest management (IPM) and integrated disease management (IDM) strategies will be developed and disseminated to farming communities.

3.6.4.3 Biotechnology: Modern technologies, particularly biotechnology enables scientists to more rapidly incorporate desirable traits into new varieties. Biotechnologies, beginning with tissue culture, will be incorporated into breeding programs to increase the efficiency of the varietal improvement research. Incorporation of resistances and tolerances to insect pests, diseases and environmental will be emphasized. Tissue culture will be helpful for rapid multiplication of new promising varieties.

3.6.4.4 Crop and soil management: Research will emphasize formulation and validation of packages of technology for sugarcane production and ratoon management for important agro-ecologies. Nutrient uptake is essential for cane growth and development and therefore high and profitable yields. But only 30% of the N fertilizer applied to the soil is used by sugarcane. Integrated use of fertilizers as well as manipulations of the root environment to improve nutrient uptake will be tested. Practices for improving drainage of wet land will be developed and tested. In drought prone areas, emphasis will be given on establishing irrigation requirements, developing efficient irrigation systems, and optimizing the timing and quantities of irrigation water applied.

Crop diversification and intercropping: Sugarcane is planted at wide row spacing and several months pass before leaves develop to fully cover the soil between rows. The slow rate of leaf canopy closure provides an opportunity for farmer to intercrop short duration annual crops between the cane rows, there by diversifying their cropping systems as well as increase land productivity and adding more opportunities during a year to sell crops for cash. Intercropping with suitable winter vegetables, pulses and oil crops with sugarcane will be advanced further to enable farmers to increase income and produce cane in sustainable production systems. Research on farming systems will be strengthened by increasing the number of sites so that the main the agro ecological zones where sugarcane is grown are covered by the research program.

3.6.4.5 Crop physiology: The durations of the three phonological phases (tillering, elongation and ripening) have a direct bearing on cane and sugar production. Very often there is a temporal encroachment of one phase into the next that results in reduced cane and sugar yields. Adjustments of the durations of each phase genetically or by cultural management or both can increase productivity. Prospects for increasing yields by adjusting phase durations, with the objective of reducing overall duration without sacrificing yield potential, will be examined. Research to identify the physiological

bases for higher sucrose accumulation and water logging, drought, flood and salinity tolerances will also be strengthened.

3.6.4.6 Sugar and gur technology: To improve sugar recovery, a research program will be undertaken in collaboration with sugar mills. To enhance extraction of juice, and thereby increase *gur* production, new country crushers must be designed and developed.

3.6.4.7 Socio economics and technology transfer: Production technologies will be subjected to cost benefit analysis before they are released. Cost benefit analysis will also be conducted on those which have been released and adopted. The extent of adoption of released technologies will also be determined and the factors that govern adoption will be identified. Demonstrations of mature technologies in farmers' plots of major different AEZ will increase the rate of transfer of technology as well as generate feedback from participating farmers. Related activities will include short-term training of field level extension officers and innovative farmers to upgrade their knowledge and skills in order to accelerate the rate of technology transfer. Audio visual aids will be produced for the training program in order to promote awareness of the management requirements of BSRI-developed technologies.

3.6.4.8 Designing and developing agricultural implements and machinery: Field operations are often delayed beyond optimal dates or performed poorly because labor is not available in the quantity required or only available at a non economic wage rates. Engineers will design and develop prototypes of implements and machines to mechanize those field operations that are often delayed or insufficiently performed because of labor constraints.

3.6.5 Future research priority areas of BSRI

- i. Development of high yielding, high sugar, non-lodging varieties of sugarcane
- ii. Development of varieties with resistance/tolerance to major diseases, insects and agro-climatic stresses
- iii. Developing management packages for maximizing the yield and recovery of both plant and ratoon
- iv. Biological/integrated control of red rot, wilt through rhizosphere mycoflora Developing package for sugarcane pest control through IPVI
- v. Irrigation & water management to reduce the production cost of sugarcane.
- vi. Soil nutrients analysis and microbiology for improving production
- vii. Productive utilization of industrial byproducts
- viii. Study on constraints of recovery % in the industries
- ix. Technology transfer through farming and adaptive research and training to extension workers and farmers.

Table 3.6.2 Discipline wise scientific manpower provision, exiting and vacant post at BSRI in June, 2009

Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Breeding and Genetics Resource	1	1	0	2	2	0	2	2	0	5	3	2	10	8	2	3	3
Agronomy and Farming System	1	0	1	2	2	0	2	2	0	3	2	1	8	6	2	2	2	2
Soils and Nutrition	1	0	1	2	2	0	1	1	0	2	2	0	6	5	1	1	1	1
Physiology and Sugar Chemistry	1	1	0	2	2	0	1	1	0	3	2	1	7	6	1	1	2	2
Entomology	1	1	0	2	1	1	1	1	0	3	2	1	7	5	2	2	1	1
Pathology	1	1	0	2	1	1	1	0	1	3	1	2	7	3	4	1	1	1
Training and Technology Transfer	1	0	1	1	1	0	1	1	0	2	1	1	5	3	2	1	1	1
On-Farm Research	1	0	1	1	1	0	1	1	0	2	1	1	5	3	2	1	1	1
Agril. Economics	1	0	1	1	1	0	1	0	1	2	0	2	5	1	4	1	1	1
Agril. Engineering	1	0	1	1	1	0	1	1	0	2	2	0	5	4	1	1	1	1
Biotechnology	1	0	1	1	1	0	1	1	0	2	1	1	5	3	2	2	2	1
Planning Cell	1	0	1	1	0	1	1	1	0	1	1	0	4	2	2	1	0	1
RSRS, Thakurgaon	1	0	1	1	1	0	2	1	1	4	2	2	8	4	4	2	0	2
RSRS. Gazipur	1	1	0	1	1	0	1	0	1	3	2	1	6	3	3	1	0	1
Quarantine, Station, Gazipur	0	0	0	1	1	0	1	1	0	2	1	1	4	3	1	0	0	1
BSRI Sub station, Jamalpur	0	0	0	1	0	1	1	0	1	1	0	1	3	0	3	0	0	0
BSRI Sub station, Rajshahi	0	0	0	1	1	0	1	0	1	1	0	1	3	1	2	0	0	0
BSRI Sub station, Barisal	0	0	0	1	1	0	1	0	1	1	1	0	3	2	1	0	0	0
BSRI Sub station, Chuadanga	0	0	0	1	1	0	1	0	1	1	0	1	3	1	2	0	0	0
BSRI Sub station Joypurhat	0	0	0	1	1	0	1	0	1	1	1	0	3	2	1	0	0	0
BSRI Sub station Chunarughat	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0
BSRI Sub station Sirajgonj	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0
Management	2	1	1	0	0	0	0	0	0	0	0	0	2	1	1	2	0	0
Total	16	6	10	26	22	4	23	14	9	46	25	21	111	67	44	22	16	19

Table 3.6.3 Discipline wise scientific manpower and PhD positions at BSRI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	No.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Breeding and Genetics Resource	1	1	2	2	2	0	3	0	8	3	2	1	1	2	0	2
Agronomy and Farming System	0	0	2	1	2	0	2	0	6	1	1	1	0	2	0	2
Soils and Nutrition	0	0	2	1	1	0	2	0	5	1	1	0	0	1	0	1
Physiology and Sugar Chemistry	1	0	2	0	1	0	2	0	6	0	0	1	1	0	0	1
Entomology	1	0	1	1	1	0	2	0	5	1	1	1	0	1	0	1
Pathology	1	1	1	1	0	0	1	0	3	2	1	0	1	0	1	1
Training and Technology Transfer	0	0	1	0	1	0	1	0	3	0	0	1	0	1	0	1
On-Farm Research	0	0	1	0	1	0	1	0	3	0	0	1	0	1	0	1
Agril. Economics	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	1
Agril. Engineering	0	0	1	1	1	0	2	0	4	1	0	1	1	0	0	1
Biotechnology	0	0	1	1	1	0	1	0	3	1	1	1	1	1	0	1
Planning Cell	0	0	0	0	1	0	1	0	2	0	0	1	0	0	0	1
RSRS, Thakurgaon	0	0	1	0	1	0	2	0	4	0	0	2	0	0	0	2
RSRS, Gazipur	1	0	1	0	0	0	2	0	4	0	0	1	0	1	0	1
Quarantine Station, Gazipur	0	0	1	0	1	0	1	0	3	0	0	0	0	0	0	1
BSRI Sub station, Jamalpur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BSRI Substation, Rajshahi	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
BSRI Substation, Barisal	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0
BSRI Substation, Chuadanga	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
BSRI Substation, Joypurhat	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0
BSRI Sub station, Chunarughat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BSRI Substation, Sirajgonj	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Management	1	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0
Total	6	2	22	9	14	0	25	0	67	11	7	15	5	11	1	18

3.6.6 Enhancement of institutional efficiency

The head quarters of BSRI is at Ishurdi, Pabna with 12 divisions, 2 regional research stations, 1 quarantine station at Joydebpur and 5 sub-stations located in different regions and agro-ecological zones of Bangladesh.

BSRI conducts research to develop high yielding, disease and pest resistant sugarcane varieties. Its functions are to develop and maintain a germplasm bank through collection of sugarcane varieties, develop production programs of sugar, gur syrup producing carbohydrate enriched crops. Conduct research on sugarcane based farming systems and to identify its economic advantages; and take measures for utilization of technologies regarding sugar, gur and syrup producing sugarcane, sugar beet and other sugar crops.

At present the institute has scientific manpower provisions of 114 including Director General 1 and Director 2. In case of chief scientific officer (CSO) to scientific officer (SO) the institute has 111 scientific provisions and present in position of 70 scientists and 41 posts are vacant (Table 3.6.2). In the Table it was observed that out of 16 provisions 10 posts are vacant in case of CSO, where as in case of PSO out of 26 provisions 4 posts are vacant, as SSO 9 posts are vacant out of 23 provisions and in case of SO 21 posts are vacant out of 46 provisions. Therefore, at present filled in positions are 6 CSO, 22 PSO, 14 SSO and 25 SO working in different disciplines of BRRI.

3.6.7 Identification of skill gaps on the basis of priority research

BSRI has scientific manpower in positions of 67 (60%) out of 111 scientific manpower provisions in their various divisions, whereas 44 (40%) scientific positions remain vacant. Out of 111 scientific provisions only 11 scientists are PhD holders in different divisions i.e. (10%), which is very insignificant number of PhD holders at BSRI (Table 3.6.2). The analyses of PhD holders in division wise are plant breeding (27%), agronomy (12%), soil science (16%), plant physiology (0%), entomology (14%), plant pathology (28%), adaptive research (0%), farm machineries (20%), agricultural economics (0%) and so on. For proper enhancement of institutional efficiency the PhD holders of BSRI should be increased to at least 30% gradually by the year 2025 in respective of divisions. For enhancement of 30% PhD level scientific manpower of BSRI, there should have training plan where gradual increase of the scientific manpower and attain the PhD level of scientific manpower position by the years 2015 at 20%, 2020 at 25% and 2025 at 30% level.

At BSRI on the basis of scientists' personal data analyses in their respective disciplines and for addressing of future research priority areas, the following disciplinewise skill gaps have been identified:

- i. Plant molecular genetics, plant tissue culture, bio-technology, etc.
- ii. Crop production, plant stress physiology, multiple cropping, dry land farming, etc.
- iii. Biological control, toxicology, insect physiology, etc.
- iv. Mycology, virology, bacteriology, molecular plant pathology, etc.
- v. Soil microbiology, soil micro- nutrient, soil nutrients/ fertility assessment, etc.
- vi. Farm machinery development, food process engineering, agricultural waste management, renewable energy utilization, etc.
- vii. Rural sociology, value change, linking production and marketing, climate change, GIS, ICT, MIS, etc.

3.6.8 Training needs analyses on the basis of skill gap

For strengthening of research activities, BSRI needs to develop discipline wise scientific manpower by training in the field of plant breeding, plant molecular biology, biotechnology, production technology, stress physiology, seed technology, pest and disease management, soil & nutrient management, value change, climate change, sugarcane based cropping systems, ICT, MIS, etc during the period of 2009-2025.

BSRI needs discipline wise skill manpower because of retirement of skilled manpower from the concern disciplines. For this reason, numbers of PhD and trainings have been identified on the basis of number of scientists of the disciplines as mentioned in Table 3.6.4.

Table 3.6.4 BSRI scientific manpower development plan and enhancement of PhD level from 20% to 30% during the period of 2009-2025.

Type of Posts Discipline	2009-2015 (PhD at 20% level)				2016-2020 (PhD at 25% level)				2021-2025 (PhD at 30% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Breeding and Genetics Resource	2	1	4	2	1	1	3	1	2	1	4	2	5	3	11	5
Agronomy and Farming System	2	0	3	2	1	0	2	1	1	0	3	2	4	1	8	5
Soils and Nutrition	1	0	2	1	1	0	2	1	1	0	3	1	3	0	7	3
Physiology and Sugar Chemistry	1	0	3	2	1	0	2	1	2	0	3	1	4	0	8	4
Entomology	1	0	3	2	1	0	2	1	1	1	2	1	3	1	7	4
Pathology	1	1	3	2	1	0	1	1	1	1	2	1	3	2	6	3
Training and Technology Transfer	1	0	2	1	1	0	0	0	1	0	2	1	3	0	4	2
On-Farm Research	1	0	2	1	1	0	1	0	1	0	2	1	3	0	5	2
Agril. Economics	1	0	2	1	1	0	1	0	1	0	2	1	3	0	5	2
Agril. Engineering	1	0	2	1	1	0	1	0	1	0	2	1	3	1	5	3
Biotechnology	2	1	3	2	1	1	1	1	1	1	2	1	4	4	6	3
Planning Cell	1	0	2	0	0	0	0	0	1	0	2	1	2	0	4	1
RSRS, Thakurgaon	2	0	3	1	0	0	0	1	1	0	4	2	3	0	7	4
RSRS. Gazipur	1	0	2	1	1	0	2	1	0	0	2	1	2	0	6	3
Quarantine Station, Gazipur	1	0	1	1	0	0	2	1	1	0	1	0	2	0	4	2
BSRI Sub station. Jamalpur	0	0	1	0	0	0	1	0	1	0	1	0	1	0	3	0
BSRI Sub station, Rajshahi	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	0
BSRI Substation Barisal	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	0
BSRI Substation, Chuadanga	0	0	1	0	1	0	1	0	0	0	1	0	1	0	3	0
BSRI Substation Joypurhat	0	0	1	0	1	0	1	0	0	0	2	0	1	0	4	1
BSRI Substation Chunarughat	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	0
BSRI Sub station Sirajgonj	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	0
Management	0	0	0	2	0	0	1	0	0	0	1	0	0	0	2	2
Total	19	3	44	22	14	2	28	10	17	4	45	17	50	12	117	49

3.7 Bangladesh Forest Research Institute

Bangladesh Forest Research Institute (BFRI) was established at Chittagong in the year 1955. It is the only national institute for conducting research to increase the productivity of forest and forest resources and also for efficient utilization of forest products. For increasing the forest productivity BFRI's research areas are: production of quality planting materials, nursery and plantation techniques; pests and diseases management; biodiversity; exploration and conservation of medicinal plants, non-wood forest produces; tissue culture, watershed management and soil conservation, natural and planted mangroves, estimation of growth and yield of important forest species. For scientific and efficient utilization of forest products, BFRI conducts research on determining wood properties and its suitability for different end uses like furniture, housing and construction materials, poles, pulp and paper, particleboard, hardboard, etc. The institute is also engaged in developing techniques to increase service life of rural housing and construction materials, electric poles and railway sleepers. All these are aimed at employment and income generation, gender mainstreaming, socio-economic upliftment and ultimately poverty reduction of the rural poor to fulfill the targets of PRS & MDG.

Till to-date BFRI has developed more than 50 technologies which are being used by Forest Department (FD), Bangladesh Forest Industries Development Corporation (BFIDC), different Govt. and private organizations, NGOs, private planters, wood-based industries, small entrepreneurs, farmers, etc. and are contributing towards poverty reduction, economic and environment development of the country through enhancing production of tree resources and better utilization of woods. It has also contributed to primary health care activities through developing technologies for production and consumption of medicinal plants.

In addition to its regular research activities, BFRI also organizes trainings, workshops, seminars, field-days to transfer the developed technologies. It also extends technical and advisory services to the government and non-government organizations, private planters, wood based industries and individuals. BFRI has so far imparted training to more than 12,000 persons on the developed technologies.

Table 3.7.1 Management structure of BFRI

Director	Chief Research Officer (CRO)	Divisional Officer (DO)	Senior Research Officer (SRO) & equivalent	Research Officer (RO) & equivalent	Total
1	2	19	27	54	103 (PhD = 09; 8%)

Head Quarters: Chittagong

Director	
CRO, Forest Management Branch	CRO, Forest Utilization Branch
DO, Forest Botany Division	DO, Wood Working and Timber Engineering
DO, Silviculture Research Division	DO, Division Seasoning & Timber Physics Division
DO, Soil Science Division	DO, Veneer & Composite wood Products Division
DO, Minor Forest Products Division	DO, Wood Preservation Division
DO, Seed Orchard Division	DO, Pulp and Paper Division
DO, Silviculture Research Division	DO, Forest Chemistry Division
DO, Genetic Forest Division	
DO, Inventory Division	
DO, Forest Economics Division	
DO, Forest Protection Division	
DO, Plantation Trial Unit Division	
DO, Mangrove Silviculture Division	
DO, General Administration Division	
DO, Service Engineering Division	

Sub Stations=22 in various forest production areas of Bangladesh.

3.7.1 Objectives

The main objective of BFRI is to provide research supports to the Forest Department, Bangladesh Forest Industries Development Corporation and other forestry related organizations in performing the forestry activities. BFRI's research activities are aimed at developing appropriate technologies for sustainable productivity of forest land and forest industries without resource depletion.

The broad objectives of the institute are to:

1. Provide technological backup to the forestry sector for increased and sustained production of forest resources, helping development of forest plantation through application of generated technology, knowledge and sharing practical experiences.
2. Conduct research on social forestry and farming system, and devising social and agro-forestry models through participation of small and landless farmers and women.
3. Conduct research for increased production, preservation, minimum wastage, increased service life, optimum utilization and multipurpose use of fibrous raw materials like wood, bamboo, cane, etc. for small and cottage industries.

3.7.2 Major research achievements of BFRI

BFRI has developed more than 50 technologies which are being used by Forest Department (FD), Bangladesh Forest Industries Development Corporation (BFIDC), different Govt. and private organizations, NGOs, private planters, wood-based industries, small entrepreneurs, farmers, etc. and are contributing towards poverty reduction, economic and environment development of the country through enhancing production of tree resources and better utilization of woods. It has also contributed to

primary health care activities through developing technologies for production and consumption of medicinal plants.

- i. Nursery and plantation techniques for important forest tree species including mangrove and other quick growing species have been developed
- ii. Establishment of seed orchard for production of quality forest seeds
- iii. Branch cutting technique for mass propagation of bamboo
- iv. Site suitability assessment technique for planting tree species
- v. Appropriate technology for hill farming
- vi. Introduction of fast growing exotic tree species
- vii. Appropriate nursery technique of palmyra palm for mass plantation in the coastal area
- viii. Preparation of dendroecological key for the forest species of Chittagong zone
- ix. Techniques for pest and disease management for major plantation species
- x. Information on status, distribution and biology of wildlife species
- xi. Selection of mainland species (non-mangrove) for natural and man-made mangrove areas
- xii. Nursery and plantation techniques for cane and patipata
- xiii. Vegetative propagation techniques for important forest tree species
- xiv. Tissue culture technique for bamboo and hybrid acacia
- xv. Development of second rotation mixed plantation in existing keora plantation
- xvi. Propagation and conservation of medicinal plants
- xvii. Selection of site suitable species for different areas
- xviii. Volume, biomass, growth and yield of important forest tree species
- xix. Technique for enhancement of service life of rural housing materials
- xx. Seasoning of timber using solar energy
- xxi. Process for producing high quality pulp from low grade jute
- xxii. Novelty articles from laminated wood
- xxiii. Alternative local timber for railway sleepers
- xxiv. Manufacture of particleboard with minimum cost
- xxv. Utilization of rubber wood for furniture and other uses
- xxvi. Development of water resistant particleboard
- xxvii. Determined wood properties by physical and mechanical analyses of 60 indigenous wood species
- xxviii. Use of bamboos for making furniture, tiles, and other non-conventional items.

3.7.3 Present research activities of BFRI

- i. Silviculture studies on important village, hill and mangrove forest tree species
- ii. Improvement and standardization of nursery and plantation techniques for village, hill and mangrove forest tree species
- iii. Introducing fast-growing multipurpose tree species and provenance for maximizing yield of fuel-wood, pulpwood, poles, etc.
- iv. Studies on scientific and sustainable management of hill forests, Sundarban and coastal plantations
- v. Development of vegetative propagation including tissue culture techniques for bamboo and other forest tree species
- vi. Germplasm conservation of endangered forest tree species
- vii. Establishing seed orchards and seed production area (SPA) for quality seeds and planting materials
- viii. Taxonomic studies on forest flora and identification of woods of Bangladesh
- ix. Studies on exploration, management and conservation of non-wood forest produces including medicinal plants
- x. Studies on growth and yield of commercially important forest species
- xi. Studies on forest soil and their conservation & management
- xii. Selection of site-specific species for different region of Bangladesh
- xiii. Studies on integrated hill farming systems
- xiv. Pest and disease management of forest nurseries and plantations
- xv. Determining physical and economic rotation of forest species
- xvi. Developing techniques for better utilization of conventional, unconventional and unused timber species
- xvii. Determining physical, mechanical and seasoning properties of wood for end-use classification
- xviii. Preservative treatment of wood, bamboo, cane, sungrass, etc. to increase their service life
- xix. Popularizing use of treated housing materials in rural areas
- xx. Developing cost effective techniques for making plywood, particleboard and other composite products
- xxi. Determining chemical properties of wood and extract chemical products from forest produces.
- xxii. Conducting research for making pulp and hard-board from the fibrous raw materials.

3.7.4 Future research priority areas of BFRI

- i. Improvement of productivity through biotechnological approach
- ii. Identification of infested zone through biotechnological method and develop control measures for controlling pests & diseases in forest nursery and plantations
- iii. Improvement of plant species through genetic engineering for forest plantation
- iv. Developing technology for improvement of nursery, plantation techniques and forest management
- v. Identification of appropriate site-matching species for appropriate tree planting
- vi. Improvement of non timber economic crops (Bamboo, rubber, rattan, medicinal plants, social forestry, etc.)
- vii. Silviculture studies on important village, hill and mangrove forest tree species
- viii. Improving and standardizing nursery and plantation techniques for village, hill and mangrove forest tree species
- ix. Introducing fast-growing multipurpose tree species and provenance for maximizing yield of fuel-wood, pulpwood, poles, etc.
- x. Studies on scientific and sustainable management of hill forests, Sundarban and coastal plantations
- xi. Development of vegetative propagation including tissue culture techniques for bamboo and other forest tree species
- xii. Germplasm conservation of endangered forest tree species
- xiii. Establishing seed orchards and seed production area (SPA) for quality seeds and planting materials
- xiv. Taxonomic studies on forest flora and identification of woods of Bangladesh
- xv. Developing technologies for management and conservation of non-wood forest produces including medicinal plants
- xvi. Developing techniques for better utilization of conventional, unconventional and unused timber species
- xvii. Determining physical, mechanical and seasoning properties of wood for end-use classification
- xviii. Preservative treatment of wood, bamboo, cane, sun grass, etc. to increase their service life
- xix. Popularizing use of treated housing materials in rural areas
- xx. Developing cost effective techniques for making plywood, particleboard and other composite products
- xxi. Determining chemical properties of wood and extract chemical products from forest produces
- xxii. Conducting research for making pulp and hard-board from the fibrous raw materials.

Table 3.7.2 Discipline-wise scientific manpower provision, existing and vacant posts at BFRI in June, 2009

Type of posts Discipline	Chief Research Officer (CRO)			Divisional Officer (DO)			Senior Research Officer (SRO)			Research Officer (RO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Forest Management Branch	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Forest Products Branch	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0
Silviculture Research	0	0	0	1	0	1	1	1	0	5	2	3	7	3	4	0	1	2
Mangrove Silviculture	0	0	0	1	0	1	2	2	0	3	0	3	6	2	4	0	2	2
Plantation Trial Unit	0	0	0	1	1	0	1	1	0	4	2	2	6	4	2	1	1	1
Silviculture Genetics	0	0	0	1	1	0	2	2	0	3	0	3	6	3	3	1	1	1
Seed Orchard	0	0	0	1	1	0	3	1	2	9	4	5	13	6	7	1	2	1
Forest Botany	0	0	0	1	1	0	2	1	1	2	1	1	5	3	2	1	0	2
Forest Inventory	0	0	0	1	1	0	2	0	2	2	1	1	5	2	3	0	0	1
Forest Economics	0	0	0	1	1	0	3	1	2	1	1	0	5	3	2	0	0	1
Soil Science	0	0	0	1	0	1	1	1	0	5	2	3	7	3	4	1	0	1
Minor Forest Products	0	0	0	1	0	1	1	1	0	2	1	1	4	2	2	0	0	1
Forest Protection	0	0	0	1	1	0	1	1	0	2	1	1	4	3	1	1	0	1
Wildlife	0	0	0	0	0	0	1	0	1	1	1	0	2	1	1	0	0	1
Wood Working & Timber Engineering	0	0	0	1	1	0	1	0	1	1	1	0	3	2	1	1	0	1
Seasoning and Timber Physics	0	0	0	1	1	0	1	0	1	1	1	0	3	2	1	1	0	1
Wood Preservation	0	0	0	1	1	0	1	0	1	1	1	0	3	2	1	0	0	1
Veneer and Composite Wood Products	0	0	0	1	1	0	1	0	1	2	1	1	4	2	2	0	1	1
Forest Chemistry	0	0	0	1	1	0	1	0	1	1	0	1	3	1	2	0	1	1
Pulp and Paper	0	0	0	1	0	1	2	1	1	1	0	1	4	1	3	0	1	1
Administration and Support Service	0	0	0	2	1	1	0	0	0	8	6	2	10	7	3	0	2	2
Total:	2	0	2	19	13	6	27	13	14	54	26	28	102	52	50	10	12	23

Table 3.7.3 Discipline-wise scientific manpower and PhD positions at BFRI in June, 2009

Type of posts Discipline	Chief Research Officer (CRO)		Divisional Officer (DO)		Senior Research Officer (SRO)		Research Officer (RO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Forest Management Branch	1	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Forest Products Branch	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Silviculture Research	0	0	1	0	1	0	5	0	7	0	0	0	0	1	0	2
Mangrove Silviculture	0	0	1	0	2	1	3	0	6	1	0	0	1	1	0	2
Plantation Trial Unit	0	0	1	1	1	0	4	0	6	1	0	1	0	1	0	1
Silviculture Genetics	0	0	1	0	2	0	3	0	6	0	0	1	0	1	0	1
Seed Orchard	0	0	1	0	3	0	9	0	13	0	0	1	1	1	0	1
Forest Botany	0	0	1	0	2	0	2	0	5	0	1	0	0	0	0	2
Forest Inventory	0	0	1	0	2	0	2	0	5	0	0	0	0	0	0	1
Forest Economics	0	0	1	0	3	0	1	0	5	0	0	0	0	0	0	1
Soil Science	0	0	1	0	1	1	5	0	7	1	1	0	0	0	0	1
Minor Forest Products	0	0	1	1	1	0	2	0	4	1	0	0	0	0	0	1
Forest Entomology	0	0	1	1	1	0	2	0	4	1	1	0	0	0	0	1
Wildlife	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	1
Wood Working & Timber Engineering	0	0	1	0	1	0	1	0	3	0	0	1	0	0	0	1
Seasoning and Timber Physics	0	0	1	1	1	0	1	0	3	1	1	0	0	0	0	1
Wood Preservation	0	0	1	1	1	0	1	0	3	1	0	0	0	0	0	1
Veneer and Composite Wood Products	0	0	1	0	1	0	2	0	4	0	0	0	1	0	0	1
Forest Chemistry	0	0	1	1	1	0	1	0	3	1	0	0	1	0	0	1
Pulp and Paper	0	0	1	0	2	1	1	0	4	1	0	0	1	0	0	1
Administration	0	0	2	0	-	0	8	0	10	0	0	0	0	2	0	2
Total:	2	1	19	6	27	3	54	0	102	10	4	6	5	7	0	23

3.7.5 Enhancement of institutional efficiency

The head quarters of BFRI at Chittagong with 20 divisions, 10 regional stations located in different regions of Bangladesh.

BFRI is to provide research supports to the Forest Department, Bangladesh Forest Industries Development Corporation and other forestry related organizations in performing the forestry activities. BFRI's research activities are aimed at developing appropriate technologies for sustainable productivity of forest land and forest industries without resource depletion.

BFRI collecting species of different plants materials suitable with high potential for different ecosystems; develop component technologies for improving productivity of forest materials. BFRI also develops cultural management, diseases and insects management technologies, production & post harvest product development, quality control, maintenance, etc.

The institute has scientific manpower provisions of 103 including one Director and 2 Chief Research Officer (CRO). In case of Chief Research Officer (CRO) to Research Officer (RO) the institute has 102 scientific provisions and present in position of 52 and 51 posts is remaining vacant (Table 3.7.2). In the Table it was observed that out of 2 provisions the 2 posts are vacant in case of CRO, whereas in case of Divisional Officer (DO) out of 19 provisions 6 posts are remain vacant, as Senior Research Officer (SRO) 14 posts are vacant out of 27 provisions and in case of RO 28 posts are vacant out of 54 provisions. Therefore, at present filled in positions are DO 13, SRO 13 and RO 26 working in different disciplines of BFRI.

3.7.6 Identification of skill gaps on the basis of priority research

BFRI has scientific manpower in positions of 52 (50%) out of 103 scientific manpower provisions in their various divisions, whereas 51 (50%) scientific positions remain vacant. It may be mentioned that out of 103 scientific provisions only 9 scientists are PhD holders in different divisions i.e. (8%), which is very much insignificant number of PhD holders at BFRI (Table 3.7.2). The analyses of PhD holders in different divisions out of 19 DO positions 6 are PhD holders, where in case SRO out of 27 posts 3 are PhD holders, but in case of RO there is no PhD holders out of 54 posts. For proper enhancement of institutional efficiency the PhD holders of BFRI should be increased at least 25% gradually by the year 2025 in respective of divisions. To fulfillment of 25% PhD level of scientific provisions of BFRI, there should have training plan, where gradual increase the scientific manpower of the PhD level of scientific manpower position by the years 2015 at 15%, 2020 at 20% and by the year 2025 at 25% level.

At BFRI on the basis of scientists' personal data analyses in their respective disciplines and for the address of future research priority areas, the following discipline wise skill gaps have been identified:

- i. Plant tissue culture, propagation, genetic engineering, etc.
- ii. Seed technology, nursery plant stress physiology, biological control of pests, etc.
- iii. Timber Physics, Forest Chemistry, Forest Botany, Plant Morphology, Wood Products, Veneer and Composite Production, Wood Seasoning, Wood Preservation, GIS, MIS, ICT, climate change, etc.
- iv. Soil and water management, forest waste utilization, etc.
- v. Rural sociology & marketing, value change, etc.

3.7.7 Training needs analyses on the basis of skill gaps

BFRI needs to develop discipline wise scientific manpower for strengthening of research activities by training in the field of tissue culture, plant molecular biology, genetic engineering, stress physiology, nursery management, pest & disease management, soil and water management, value change, climates change, timber physics, forest chemistry, forest botany, wood seasoning, wood preservation, ICT, MIS, GIS, etc during the period of 2009-2025. On the basis of scientists' personal data analyses and future research needs the following training have been identified for the scientists of BFRI from the period from 2009-2025, which is placed in Table 3.7.4.

Table 3.7.4 BFRI scientific manpower development plan and enhancement of PhD level from 8% to 25% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 15% level)				2016-2020 (PhD at 20% level)				2021-2025 (PhD at 25% level)				Total (2009-2025)			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Forest Management Branch	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3
Forest Products Branch	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3
Silviculture Research	1	0	2	1	1	0	2	1	0	0	2	1	2	0	6	3
Mangrove Silviculture	0	0	2	1	2	0	2	1	0	0	2	1	2	0	6	3
Plantation Trial Unit	1	0	2	2	1	0	2	1	0	0	2	1	2	0	6	4
Silviculture Genetics	1	1	2	2	1	1	3	1	0	0	2	1	2	2	7	4
Seed Orchard	2	0	4	2	2	1	4	1	0	0	3	1	4	1	11	4
Forest Botany	1	1	2	1	1	0	2	1	1	0	2	1	3	1	6	3
Forest Inventory	1	0	2	1	0	0	2	1	1	0	1	0	2	0	5	2
Forest Economics	1	0	2	1	0	0	2	1	1	0	1	0	2	0	5	2
Soil Science	1	0	2	1	1	0	2	1	0	0	2	1	2	0	6	3
Minor Forest Products	0	0	1	1	1	0	1	0	0	0	1	1	1	0	3	2
Forest Entomology	1	0	1	1	0	0	1	0	0	0	2	1	1	0	4	2
Wildlife	1	0	1	1	0	0	1	0	0	0	1	0	1	0	3	1
Wood Working & Timber Engineering	1	0	1	1	0	0	1	0	0	0	1	1	1	0	3	2
Seasoning and Timber Physics	1	0	1	1	0	0	1	0	0	0	1	0	1	0	3	1
Wood Preservation	0	0	1	1	0	0	1	0	0	0	1	0	0	0	3	1
Veneer and Composite Wood Products	1	0	2	1	1	0	0	0	1	0	2	1	3	0	4	2
Forest Chemistry	0	0	2	1	1	0	0	0	0	0	1	1	1	0	3	2
Pulp and Paper	0	0	2	1	1	0	1	0	0	0	1	1	1	0	4	2
Administration and Support Service	1	0	2	2	0	0	2	0	1	0	4	1	2	0	8	3
Total:	15	2	34	26	13	2	30	12	5	0	32	17	33	4	96	55

3.8 Bangladesh Tea Research Institute

Bangladesh Tea Research Institute (BTRI) is a scientific organization of the Bangladesh Tea Board under the Ministry of Commerce. It was established in 1957 with view to providing technical support to the Tea Industry of Bangladesh. The Research programmes of the Institute are mostly adaptive and field oriented in order to meet the current need of the Industry. Although BTRI has a research responsibility, its mandate required that it provides advisory services to planters also. It accomplishes this through direct scientists-to-planter contact, often through participatory research on tea estates, through training, and the distribution of generated technologies through publications. A large portion of BTRI's resources is devoted to these important linkages.

3.8.1 Mandate of the institute

The institute does not have any defined official mandate mentioned anywhere so far. However, the theme spelled out in a meeting of the then Pakistan Tea Board has been the guiding principle for the functioning of the institute, which is often quoted, as “Mandate”. In 1952 Tea Board initiated the establishment of a tea research station by a resolution in its 52nd meeting “with a view to investigating and solving various problems related to growing and manufacturing of tea for placing the industry on a sound scientific footing”. Thus the institute came into being on 28th February 1957 at its present site at Srimangal. With the progress of time and demand of the current millennium setting up of a philosophical or conceptual framework in order to have guidelines on broad statement of policies governing the diversity of research activities and keeping conformity with other similar national and international institutions.

It should be revised to a formal Mandate as:

- i. Conducting research and strategic applied and adaptive fundamental research in all aspects and conditions of tea for generating basic knowledge and evolving improved environmentally sound technologies, tea clones or varieties for raising sustained productivity, production and processing.
- ii. Collecting, evaluating, conserving and exchanging gene resources of tea
- iii. Contributing to manpower development by assisting, guiding and supporting institutions devoted to academic pursuits of teaching, research and or extension of tea or allied disciplines.
- iv. Promoting Fish-line extension services including adaptive trials, on farm research, farming system research, extension research, training, demonstrations and communication of latest technologies.

- v. Building strong scientific relations and linkage with national and international agencies for strengthening research and development efforts.
- vi. Developing information and communication mechanisms including library and documentation, publications, internet network and MIS and GIS for national and international interactions, national planning and policy making.

Table 3.8.1 Management structure of BTRI

Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	3	7	10	15	36 PhD (4); 11%

There are eight Research Divisions at BTRI. The Divisions are stated below:

1. Soil Chemistry
2. Biochemistry
3. Botany
4. Agronomy
5. Entomology
6. Plant Pathology
7. Technology
8. Statistics & Economics

3.8.2 Objectives

- i. To increase yield and improve quality of Bangladeshi tea through research.
- ii. To render advisory service to tea industry.
- iii. To transfer proven and adaptive newly innovated technologies to the tea industry.

3.8.3 Major activities of BTRI

- i. Evolving of high yielding and quality clones of tea.
- ii. Development of bi- and poly-clonal seed stocks for seed orchards (Seedbaries).
- iii. Conservation of gene resources of tea.
- iv. Raising vegetative cuttings in the nursery using modern technique and supply of rooted and fresh cuttings of improved clonal materials to tea estates.
- v. Evaluation of chemical composition of processed and/or unprocessed tea for quality assessment.
- vi. Standardization of quality and specification of Bangladesh tea in the international market.

- vii. Formulation of fertilizer policy for tea and ancillary crops.
- viii. Rehabilitation of soil, soil-fertilizer relationship analysis and understanding.
- ix. Adoption of appropriate methodology in improving the soil condition in existing-, proposed- and rehabilitated tea areas.
- x. Standardization of cultural practices like- planting, spacing, pruning, plucking, mulching, planting shade trees and green crops, grafting, etc.
- xi. Management and control of various insect, mite and nematodes pests, diseases and weeds of tea and ancillary crops.
- xii. Pest surveillance and monitoring.
- xiii. Investigation into the manufacturing problems and improvement of factory machinery.
- xiv. Possibility of multiplication of tea through micro-propagation.
- xv. Regular advisory services to the tea estates.
- xvi. Economic study of tea cultivation.

3.8.4 Achievements of BTRI

Achievements of high productivity and quality excellence of Bangladesh tea are the main objectives of the Institute. Without the research and advisory services from BTRI and its alliance with the industry, the development would have been much slower. Since its establishment, the institute has been able to release 13 outstanding clones superior to average tea of Bangladesh in respect of yield and quality. Besides, BTRI released bi-clonal and polyclonal seed stocks for the production of good quality of seeds. The conservation of gene pool and micro propagation is also in progress.

The institute has also been able to replace ammonium sulphate by urea and TSP rock phosphate, which are cheaper as well as more suitable under the existing soil conditions. Appropriate fertilizer recommendations have also been formulated. Some of the important agro-techniques like pruning, plucking, population density, nursery management and other field practices have been optimized and standardized by the institute.

It is estimated that about 15% crop loss is incurred due to pest and disease attack. Pest Management Division is able to standardize 30 kinds of pesticides to control mites, diseases and weeds. Apart from these, improvement of tea manufacturing processes, packing materials, crop diversification, soil rehabilitation methods have been recommended by the institute.

3.8.5 Present research activities of BTRI

- i. Development of superior clones and improved seed stocks in order to attain higher yield with resistance to drought, pest and diseases.
- ii. Soil conservation and restoration of soil fertility through bio-fertilizers and upgrading existing fertilizer policy.
- iii. IPM: Combined application of biotic and Abiotic factors/components to avoid chemical pesticides and fungicides and for the environmental safety.
- iv. Soil mapping for efficient land use, drainage and irrigation.
- v. Development of less developed and small holding tea gardens for better yield and quality tea through participatory research and appropriate technology transfer mechanisms.
- vi. Socio-economic study of tea industry.

3.8.6 Future research priority areas of BTRI

- i. Evolving high yielding and quality clones of special feature
- ii. Raising organic matter status of tea soils
- iii. Utilization of biotechnology for plant improvement
- iv. Drainage irrigation and drought management
- v. Physiology of tea in local environment and improvement of harvest index
- vi. Biotechnology to improve soil fertility
- vii. Application of IPM with different control options of pests
- viii. IPM components with particular emphasis on bio-control agents
- ix. Pesticide residue in tea
- x. VAM application in tea culture
- xi. Vermi-culture application in tea
- xii. Energy source utilization and efficiency
- xiii. Crop diversification
- xiv. Socio-economic study of tea industry, socio economic impact
- xv. Marketing and sales promotion
- xvi. GIS & tea environment study.

Table 3.8.2 Discipline wise scientific manpower provision, exiting and vacant post at BTRI in June, 2009

Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Soil Chemistry	1	1	0	1	1	0	1	1	0	3	3	0	6	6	0	1	1
Biochemistry	0	0	0	1	1	0	1	0	1	1	0	1	3	1	2	0	1	0
Botany	1	1	0	1	1	0	1	1	0	3	3	0	6	6	0	1	1	2
Agronomy	0	0	0	1	1	0	2	0	2	2	2	0	5	3	2	1	1	1
Entomology	0	0	0	1	0	1	1	0	1	2	1	1	4	1	3	1	1	1
P. Pathology	1	1	0	1	1	0	1	0	1	1	1	0	4	3	1	1	1	1
Technology	0	0	0	0	0	0	1	0	1	1	1	0	2	1	1	0	0	1
Stat. Economics	0	0	0	1	1	0	1	0	1	0	0	0	2	1	1	0	1	0
Sub-Stations	0	0	0	0	0	0	1	0	1	2	2	0	3	2	1	0	0	2
Total	3	3	0	7	6	1	10	2	8	15	13	2	35	24	11	5	7	9

Table 3.8.3 Discipline wise scientific manpower and PhD position at BTRI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement							
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025			
												PhD	MS	PhD	MS	PhD	MS	
Soil Chemistry	1	1	1	0	1	0	3	0	6	1	0	1	0	1	0	1	0	1
Biochemistry	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Botany	1	0	1	0	1	0	3	0	6	0	0	1	0	1	0	0	2	0
Agronomy	0	0	1	0	0	0	2	0	3	0	0	1	0	1	0	1	0	1
Entomology	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	1	0
Plant Pathology	1	1	1	1	0	0	1	0	3	2	1	0	1	0	0	0	1	0
Technology	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0
Statistics & Economics	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0
Substation	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2
Total	3	2	6	2	2	0	13	0	24	4	2	3	2	5	0	9	0	9

3.8.7 Enhancement of institutional efficiency

The head quarters of BTRI at Sri Mongal, Moulibazar with 8 divisions. BTRI provides research program especially on client oriented. As a result the scientists can not always use their wisdom to develop technologies because these are not desired by the tea planters and blenders. BTRI is to provide research information to the Tea Board and its research activities are aimed at developing appropriate technologies for sustainable productivity of tea areas and tea manufacturing industries.

BTRI is to develop high yielding varieties of tea clones with biotic and abiotic stresses, build up bi-poly clone seed reserve in vitro mass propagation through tissue/anther culture to overcome incompatibility in the hybrid population. BTRI also develops cultural management, disease and insect management technologies, production and post harvest product development, quality control, maintenance, etc.

The Bangladesh Tea Research Institute should have independent authority to enable the institute to manage research activities and authority for giving deputation or loan if admissible to the manpower of the institute.

At present the institute has scientific manpower provisions of only 36 including one Director. In the case of Chief Scientific Officer (CSO) to Scientific Officer (SO) there are 35 scientific provisions at present 24 positions have been occupied scientists and 11 posts remain vacant (Table 3.8.2). In the Table it is observed that the 3 provisions of CSO were filled in, whereas in the case of PSO out of 7 provisions 1 post remains vacant, as SSO out of 10 posts 8 posts remain vacant and in the case of SO 2 posts are vacant out of 15 provisions. Therefore, at present filled in positions are CSO 3, PSO 6, SSO 2 and SO 13 working in different disciplines of BTRI.

3.8.8 Identification of skill gaps on the basis of priority research

At present BTRI has scientific manpower in positions of 24 (68%) out of 35 scientific manpower provisions in its various divisions, where 11 (31%) scientific positions are vacant. It may be mentioned that out of 35 scientific provisions only 4 scientists are PhD holders in different divisions i.e. (11%), which is very much insignificant number of PhD holders at BTRI (Table 3.8.2). For proper enhancement of institutional efficiency the PhD holders of BTRI should be increased at least 40% gradually by the year 2025 in respective of divisions. For fulfillment of 40% PhD level of scientific provisions of BTRI, there should have training plan, where gradually increased the PhD holder scientific manpower holder's the years to 20% in 2015, 30% in 2010 and 40% level in 2025.

At BTRI on the basis of scientists' personal data analyses in their respective disciplines and for the addressing future research priority areas, the following skill gaps have been identified:

- i. Development of high yielding varieties of tea with the addition of aroma and exiting color through breeding
- ii. Development of production improvement technology
- iii. Reduction of caffeine without changing the other quality of tea
- iv. Pest resistance, faster growth, improvement of colons
- v. Development of outstations production system
- vi. Soil health improvement through IPNS
- vii. Development of soil management technology for improve tea production

3.8.9 Training needs analyses on the basis of skill gap

For strengthening research activities, BTRI needs to develop discipline wise scientific manpower through training in the field of soil fertility, tea product quality, genetic engineering, physiology, tea production, IPM, pest management, bacterial, viral and fungal treatment, tea products development, production economic, marketing and policy, social impact, farm management, ICT, MIS, GIS, etc. during the period of 2009-2025.

BTRI needs discipline wise skill manpower because of retirement of skilled manpower from the concern disciplines. The number of PhD holders and training has been identified on the basis of number of scientists of the discipline as mentioned in Table 3.8.4.

Table 3.8.4 BTRI scientific manpower development plan and enhancement of PhD level from 11% to 40% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 20% level)				2016-2020 (PhD at 30% level)				2021-2025 (PhD at 40% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Soil Chemistry	1	0	1	1	1	0	1	1	0	0	2	0	2	0	4	2
Biochemistry	1	0	1	1	0	0	1	1	0	0	1	0	1	0	3	2
Botany	1	0	1	1	1	0	2	1	1	0	2	1	3	0	5	3
Agronomy	1	0	1	1	1	1	2	2	1	0	1	1	3	1	4	4
Entomology	1	0	1	0	1	0	2	1	0	0	1	1	2	0	4	2
Plant Pathology	0	1	1	0	1	0	2	1	1	1	1	1	2	0	4	2
Technology	0	0	1	1	0	0	1	1	1	0	1	1	1	1	3	3
Statistics & Economics	0	0	1	0	1	0	1	0	0	0	1	1	1	1	3	1
Substation	0	0	2	0	0	0	2	0	0	0	2	0	0	0	6	0
Total:	5	1	10	5	6	1	14	8	4	1	12	6	15	3	36	19

3.9 Bangladesh Fisheries Research Institute

The fish and fisheries are integral part of the culture and heritage of Bangladesh. The sector plays a significant role in nutrition, employment generation and foreign exchange earnings. Keeping in view of the immense potentials of the sector in providing better nutrition and job opportunities, particularly to the poorest of the poor, and the urgency for optimum scientific utilization of the aquatic heritage, the President of the People’s Republic of Bangladesh was pleased to promulgate an Ordinance entitled “The Fisheries Research Institute Ordinance, 1984” on 11 July 1984. In pursuance of this Ordinance, the Fisheries Research Institute (FRI) was established in July 1984. In 1997, the FRI has been renamed as Bangladesh Fisheries Research Institute (BFRI) through the amendment of the 1984 Ordinance.

Though the Institute was established in 1984, it actually started functioning in 1986 with the recruitment of required manpower and creation of initial research facilities. Since then, the institute has been playing a key role in assisting the nation to achieve the goal of fisheries development as set out in successive development plans.

3.9.1 Mandate of the institute

The mandate of the Institute is-

1. To carry out basic and adaptive research for development and optimum utilization of all living aquatic resources and coordinate fisheries research activities in Bangladesh
2. To experiment and standardize techniques for maximizing productions and better management of living aquatic resources
3. To identify new production opportunities and develop them to usable levels
4. To develop skilled research manpower through training
5. To transfer developed technologies to the end users through training of extension workers, planners, fish farmers and other stakeholders
6. To advise the Government in all matters relating to research and management of our living aquatic resources.

Table 3.9.1 Management structure of BFRI

Director General	Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	2	4	4	22	48	81 (PhD=26; 32%)

3.9.2 Major research achievements of BFRI

- i. Study on the status of freshwater fish genetic resources in Bangladesh indicated that about 5/6 endemic species are threatened and need urgent conservation.
- ii. Controlled breeding technique of *Tor putitor* (mahaseer), *Labeo gonius* (gonia), *Labeo bata* (bata), *Cirrhinus arhiza* (reba) *Puntius sarana* and *Anabas testudeneus* (koi) has been developed.
- iii. Techniques for culture and breeding of *Ompok pabda*, *Mystus cavasius* and *B-gonionotus* have been perfected.
- iv. Genetically improved strain of *B. gonionotus* has been development through several generation of selection.
- v. Monosex male tilapia of GIFT strain has been produced successfully using hormone-treated feed and is being given to farmers for large-scale adoption.
- vi. Genetic clones in *Labeo rohita* (rohu) has been developed.
- vii. Optimized technique to produce 4-5" fingerlings of carps and extended the know how to different hatchery operators has been developed.
- viii. Techniques for breeding and culture of *Clarias batrachus* (magur) and *Heteropneustes fossilis* (shing) have been evolved.
- ix. Stocking density of *Macrobrachium rosenbergii* (prawn) has been standardized in out-door and in-door nursery system.
- x. Cost effective feeds from indigenous raw materials for carp broodstock management has been made.
- xi. A package of technology on rice-cum-fish farming in irrigated and floodprone ecosystem has been evolved.
- xii. Base line information has been generated on the occurrence of parasitic/bacterial pathogens in the fish culture and nursery operation systems of Bangladesh.
- xiii. Nine rural aquaculture technologies are being tested in farmers' field at 26 Thanas in different districts at different parts of the country.
- xiv. Fingerlings of *Pangassius pangasius*, *Mystus aor* and *Rita, rita* are collected from the river system, domesticated in the pond system and broods have been developed. Artificial breeding and culture technology of native *Pangassius pangasius*, *Mystus aor* and air fish are being developed. Techniques for controlled breeding and fingerling production of exotic pangas (*P. sutchi*) have been evolved.
- xv. Polyculture of carps in pen in borrow pit canals in different irrigation project areas yielded 1-2 t/ha/crop of 6 months with low cost supplemental feeding.
- xvi. Technology for prawn seed production in backyard hatchery has been developed.

- xvii. Productivity studies on Kaptai Lake indicated the possibility of five-fold increase of fish production through proper scientific management.
- xviii. On the basis of studies undertaken on Hilsa fishery development and management the following recommendations were made for effective management of the hilsa fishery.
- xix. Techniques for large-scale production of post-larvae under different hatchery operation systems (recirculatory and open) has been developed.
- xx. Proper stocking density and species combination of *P. monodon* with certain brackishwater finfish has been standardized.
- xxi. Range of desirable soil and water quality for effective management of shrimp-finch farming has been established.
- xxii. Stocking density of 6000/ha of mud crab, *Scylla serrata*, has been found as optimum density for controlled culture. The survival rates of male crabs were more or less independent with the increasing densities but that of females showed inverse relationship.
- xxiii. Studies on socioeconomic impacts and constraints of shrimp culture indicated certain urgent issues which need to be addressed for proper development of shrimp farming.
- xxiv. Preliminary survey on mangrove forestation at Khulna region indicated that part of it has been destroyed due to expansion of shrimp culture.
- xxv. Dry fish produced by solar dryer reduce bacterial load significantly compared to those produced by traditional methods. Time required to produce dry fish by solar dryer is less compared to traditional methods.
- xxvi. Quality fishmeal produced through improved methods yielded better nutritive value compared to traditional commercial fishmeal available in Bangladesh.
- xxvii. No co-relation between viral disease incidence water quality parameters were established so far.
- xxviii. It was found that modified system of culture of black tiger shrimp in non-acid sulfate soil may lower the risk of viral disease.
- xxix. Crop rotation between finfish and shrimp reduces the incidence of disease epidemic in shrimp farm. Successive semi-intensive shrimp crops/year in same pond increases the risk of disease occurrence.
- xxx. Polyculture of non-carnivore fish and shrimp appears to be promising and environmentally friendly. Sea bass raised with live tilapia in mixed culture attained 6.5kg in average within 3 and half years.

3.9.3 Present research activities of BFRI

3.9.3.1 Programme area freshwater aquaculture

1. Genetic studies and stock improvement of commercially important carp, pangas and tilapia species
2. Development of seed production and grow-out techniques for endangered fish (local koi, aor, guzzi, shoal, baim, meni & pabda) in Bangladesh
3. Evaluation of nutrient quality and shelf life of commercial feed ingredients and feeds on aquaculture production in Bangladesh
4. Determination of hazardous heavy metal in fish and shrimp and elucidation of their bioaccumulation mechanism
5. Investigation into the emerging fish diseases and their control strategies
6. Brood development and breeding performance of BFRI improved breeds at government & private hatcheries
7. Identification of disease and other problems associated with pangus culture in Mymensingh region and development of mitigation measures
8. Assessment of puffer fish in Bangladesh
9. Demonstrations of culture technologies of high valued endangered fish species at selected Upazillas (BFRI/DOF)
10. Development of quality feeds and feeding regimes of three important high valued fish species in Bangladesh
11. Maximize growth and minimize production cost of three important fish species with alternate feeding schedules under on-farm demonstration/ refinement
12. Coordinated regional project on production and dissemination of improved carp breeds
13. Study on growth and production performances of improved fish species in the seasonal and perennial ponds in Nilphamari region.

3.9.3.2 Program area marine fisheries

- i. Development of broods for mass seed production of striped mullet, *Mugil cephalus l*
- ii. Assessment of marine pollution of the near shore water along the Cox's Bazar and Chittagong coasts of the Bay of Bengal
- iii. Development of a low-cost emergency dryer to minimize spoilage of fish in absence of the sun
- iv. Diagnosis and control of shrimp diseases (Cox's Bazar component)

- v. Field demonstration of the improved BFRI model of set-bag-net (BFRI-SBN) in marine and estuarine habitats for sustainable management of the marine fisheries resources of Bangladesh.

3.9.3.3 Program area brackish water aquaculture

- i. Biology, breeding and seed production of selected estuarine finfish species (*M. gulis* &
- ii. *L. parsia*)
- iii. Crop diversification: production potential and impact of introducing genetically improved strains of tilapia in shrimp farms
- iv. Polyculture of mud crab, *Scylla serrata* with shrimp and other brackishwater finfishes
- v. Concurrent culture of shrimp (*Penaeus monodon*) and prawn (*Macrobrachium rosenbergii*) in brackish water environment
- vi. Brood development of giant freshwater prawn, *Macrobrachium rosenbergii*
- vii. On-farm trials and demonstration of improved mud crab (*Scylla serrata*) fattening practices.

3.9.3.4 Program area shrimp research

- i. Study on the causative agents and control measures for shrimp disease in Bagerhat
- ii. Assessment of the sustainability of freshwater prawn farming in gher systems in southwest Bangladesh (BFRI/BAU)
- iii. Development of best management practices of prawn (*Macrobrachium rosenbergii*) with tilapia (*Oreochromis* sp.) and other species
- iv. Traceability of banned antibiotics (nitrofurana, chloramphenol and metabolites) and other harmful chemicals in pre and post-harvest shrimp value chains (BFRI/BAU).

3.9.3.5 Programme area inland open water fisheries

- i. Domestication and brood development of important riverine species *Rita rita* and *Pangasius pangasius*
- ii. Cage culture of monosex tilapia in the river Dakatia, Chandpur (Chandpur component)
- iii. Hilsa fishery management research
- iv. Impact assessment of fish sanctuaries on production and biodiversity of floodplain fishes, Sylhet basin
- v. Demonstration of cage culture technology in the Meghna river at Kadamtoli, Gazaria, Munshigonj (Munshigonj component)
- vi. Coordinated regional project on production and dissemination of improved carp breeds
- vii. Study and documentation of the status of endangered fish species in Barishal region

- viii. Demonstration of improved carp nursery culture technology at Khepupara Upazila, Patuakhali
- ix. Cage culture of Monosex tilapia in Kaptai lake

3.9.4 Future research priority areas of BFRI

- i. Genetic studies and stock improvement of commercially important fishes
- ii. Hazardous heavy metal in fish and shrimp
- iii. Emerging fish and shrimp diseases and their control strategies
- iv. Culture technologies of high valued endangered fish species
- v. Development of quality feeds and feeding regimes
- vi. Marine pollution
- vii. Hilsa fishery management research
- viii. Production and biodiversity of open water and floodplain fishes
- ix. Post harvest technology
- x. Quality control, product development and value addition
- xi. Production management of open water fisheries
- xii. Water pollution
- xiii. Model development of multi-location fish production in various ponds/water bodies
- xiv. Development of fish marketing policies

Table 3.9.2 Discipline wise scientific manpower provision, exiting and vacant post at BFRI in June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Fish Genetics and Biotechnology	1	1	0	1	1	0	1	1	0	2	1	1	5	4	1	1	1
Fish Nutrition	0	0	0	0	0	0	2	1	1	3	3	0	5	4	1	0	1	2
Aquaculture	0	0	0	1	0	1	3	2	1	8	6	2	12	8	4	2	2	3
Fish Health Management	0	0	0	0	0	0	2	2	0	4	3	1	6	5	1	0	1	3
Post Harvest Technology	0	0	0	1	1	0	1	1	0	2	2	0	4	4	0	0	1	2
Openwater Management	0	0	0	0	0	0	2	1	1	6	5	1	8	6	2	1	2	2
Fish Pollution Dynamics/Stock Assessment	1	1	0	1	1	0	2	1	1	4	3	1	8	6	2	2	2	2
Fisheries Management	0	0	0	0	0	0	3	2	1	6	5	1	9	7	2	1	2	3
Brackishwater Aquaculture	1	1	0	0	0	0	2	2	0	5	4	1	8	7	1	1	1	2
Mariculture	1	1	0	0	0	0	1	1	0	3	3	0	5	5	0	0	2	1
Research Planning	0	0	0	0	0	0	1	1	0	2	2	0	3	3	0	1	1	1
Fisheries Socio Economy	0	0	0	0	0	0	1	1	0	2	2	0	3	3	0	0	0	1
Training & Communication	0	0	0	0	0	0	1	1	0	1	1	0	2	2	0	0	1	0
Total	4	4	0	4	3	1	22	17	5	48	40	8	78	64	14	9	17	23

Table 3.9.3 Discipline wise scientific manpower and PhD positions at BFRI in June, 20093

Type of posts Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Retirement Status					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Fish Genetics and Biotechnology	1	1	1	1	1	0	1	0	4	2	1	0	1	0	0	1
Fish Nutrition	0	0	0	0	1	1	3	3	4	4	0	0	1	0	2	0
Aquaculture	0	0	0	0	2	2	6	0	8	2	1	1	1	1	0	2
Fish Health Management	0	0	0	0	2	1	3	1	5	2	0	0	1	0	1	2
Post Harvest Technology	0	0	1	1	1	1	2	1	4	3	0	0	1	0	1	1
Openwater Management	0	0	0	0	1	1	5	1	6	2	0	1	1	1	1	1
Fish Pollution Dynamics/Stock Assessment	1	1	1	1	1	2	3	1	6	5	2	0	1	1	2	1
Fisheries Management	0	0	0	0	2	2	5	0	7	2	0	1	1	1	1	2
Brackishwater Aquaculture	1	1	0	0	2	1	4	0	7	2	1	0	1	0	0	2
Mariculture	1	1	0	0	1	1	3	0	5	2	0	0	1	1	0	1
Research Planning	0	0	0	0	1	1	2	0	3	1	1	0	1	0	0	1
Fisheries Socio Economy	0	0	0	0	1	0	2	0	3	0	0	0	0	0	0	1
Training and Communication	0	0	0	0	1	0	1	0	2	0	0	0	1	0	0	0
Total	4	4	3	3	17	13	40	7	64	27	6	3	12	5	8	15

3.9.5 Enhancement of institutional efficiency

The Head Quarters of BFRI is situated at Mymensingh and it has five research stations viz. Freshwater Station, Mymensingh, Riverine Station, Chandpur, Brackishwater Station, Paikgacha, Khulna, Marine Fisheries and Technological Station, Cox's Bazar and Shrimp Research Station, Bagerhat. BFRI conducts research to enhance the growth of fisheries production through optimal utilization of inland, brackish and marine water bodies and also develop policies relating to development of technologies and management fish culture and fish capture.

At present the institute has scientific manpower provisions of 81 including Director General 1 and Director 2. In case of chief scientific officer (CSO) to scientific officer (SO) the institute has 78 scientific provisions of which 14 posts are vacant (Table 3.9.2). In the Table it is observed that 4 posts of CSO are filled up, whereas in the case of PSO out of 4 provisions 1 post is vacant, as SSO 5 posts are vacant out of 22 provisions and in the case of SO 8 posts are vacant out of 48 provisions. Therefore, at present filled in positions are 4 CSO, 3 PSO, 17 SSO and 40 SO working in different disciplines of BFRI.

3.9.6 Identification of skill gaps on the basis of priority research

At present BFRI has scientific manpower in positions of 64 (82%) out of 78 scientific manpower provisions in their various divisions, whereas 14 (18%) scientific positions remain vacant. Out of 78 scientific provisions 26 scientists are PhD holders in different divisions i.e. (32%), which is insignificant number of PhD holders at BFRI (Table 3.9.2). The analyses of PhD holders in division wise are Fish Genetics and Biotechnology (25%), Fish Nutrition (100%), Aquaculture (25%), Fish Health Management (40%), Open Water Fish Culture (50%), Fisheries Management (28%), Brackish Water Aquaculture (28%), Mari Culture (20%), Socio Economics (0%) And Training & Communication (0%). For proper enhancement of institutional efficiency the PhD holders of BFRI should be increased at least 50% gradually by the year 2025 in respective of divisions. For fulfillment of 50% PhD level scientific manpower of BFRI, there should have a training plan where PhD holder scientists should gradually be increased the scientific manpower to attain the PhD level of scientific manpower position by the years 2015 at 40%, 2020 at 45% and 2025 at 50% level.

At BFRI on the basis of scientists' personal data analyses in their respective disciplines and addressing of future research priority areas, the following discipline wise skill gaps have been identified:

Research planning management, environmental stress, hazardous heavy metal in fish and shrimp, emerging fish and shrimp diseases, fish feed and nutrition, marine pollution, hilsa fishery management, open water fisheries management, post harvest technology, quality control, product development and value addition, fish molecular genetics, bio-technology, fish physiology, ICT, MIS, etc.

3.9.7 Training needs analyses on the basis of skill gaps

For increasing institutional efficiency, research activities should be given thrust in the areas like fish genetic, fish physiology, fish molecular biology for identification of fish diseases, bio-technology, fish feed and nutrition, fish health management, population dynamic, toxicology, brackish water management, mari culture, hatchery management, fisheries socio-economics, pearls culture, mussels culture and breeding, pond productivity and culture, post harvest technologies, ICT, MIS, etc. Thus scientific manpower needs to be developed for generation of new technologies to be used by the end users.

FRI needs discipline wise skill manpower because of retirement of skilled manpower from the concern disciplines. For this reason, numbers of PhD and trainings have been identified on the basis of number of scientists of the discipline as mentioned in Table 3.9.4. It may be pointed out that the development of fisheries research in Bangladesh it is necessary to be strengthen the institute by increasing manpower.

Table 3.9.4 BFRI scientific manpower development plan and enhancement of PhD level from 32% to 50% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 40% level)				2016-2020 (PhD at 45% level)				2021-2025 (PhD at 50% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Fish Genetics and Biotechnology	2	1	1	1	2	0	1	1	1	1	1	1	5	3	3	3
Fish Nutrition	0	1	3	1	0	0	2	1	1	0	1	1	2	2	6	3
Aquaculture	2	0	4	2	1	1	4	2	2	0	5	2	9	1	13	6
Fish Health Management	1	1	2	1	1	0	2	2	1	1	2	1	3	2	6	4
Post Harvest Technology	0	0	2	1	0	0	3	1	1	0	1	1	1	0	6	3
Openwater Management	1	0	3	2	1	1	3	2	1	0	2	1	6	1	8	5
Fish Pollution Dynamics/Stock Assessment	2	0	2	1	1	0	2	1	1	0	2	1	7	0	6	3
Fisheries Management	1	0	3	2	1	0	2	2	2	0	2	1	6	0	7	5
Brackishwater Aquaculture	2	0	3	1	1	1	2	2	1	0	2	1	5	1	7	4
Mariculture	2	0	2	1	1	0	2	1	1	1	1	1	5	1	5	3
Research Planning	1	0	1	1	1	0	1	1	1	0	1	1	3	0	3	3
Fisheries Socio Economy	1	0	2	1	1	0	2	0	0	0	1	1	2	0	5	2
Training and Communication	0	0	0	1	0	0	1	1	0	0	0	1	0	0	1	3
Total	15	3	28	16	11	3	27	17	13	3	21	14	54	11	76	47

3.10 Bangladesh Livestock Research Institute

Bangladesh Livestock Research Institute (BLRI), one of the leading national research institutes in the country, was established in 1984 through promulgation of an Ordinance that was later amended in 1996 by an act of Parliament. Since its establishment, the institute has been conducting demand-driven basic and applied research on feeds, feeding, disease prevention and control, breed development, management and housing, socio-economic issues, marketing and farming systems. The institute has, so far, developed 59 technologies and packages on livestock and poultry. Most of the technologies have been field-tested, demonstrated and transferred to farmers, farm owners and NGOs. Meanwhile, technologies on livestock feeds, fodder, poultry production, developed vaccine, and disease control strategies have created tremendous impacts on production, income, employment, poverty alleviation and welfare at farmers' level.

In BLRI, Poultry Disease Diagnostic Laboratory (PDDL) has been established in the year of 2000 by the financial assistance of JICA and the Govt. of Bangladesh. Technical cooperation and chemicals and reagents are being provided by JICA. The Govt. of Bangladesh has declared the PDDL as the National Reference Laboratory of Avian Influenza (NRL-AI) on 06 December 2006. The NRL-AI is playing an important role in the diagnosis of Avian Influenza in the country and it has established reputation in the international community. Immediately after getting samples from different parts of the country, necessary steps are being taken for quick analysis of those samples in the laboratory. As a result the incidence/outbreak of AI is reduced to some extent in the country.

BLRI developed fodders of improved varieties, which are being accepted by the farmers of different parts of the country. Particularly, the farmers of livestock producing area are regularly producing high yielding BLRI developed 3 Napier varieties of their dairy animals and as a result milk production of that area is increased remarkably. As the interest of the farmers for fodder production has been increased the demand for fodder cuttings from BLRI has also increased. Eight millions fodder cuttings has been supplied to the interested farmers including those of Monga areas (Kurigram, Lalmonirhat, Nilfamari and Gaibandha) of the country this year.

For the last few years BLRI has been implementing research on livestock breed development. In the mean time, 19 animals (BLRI Cattle Breed-1) have been distributed to Joypurhat and Badargang, Rangpur district. Performance of the distributed animals to the farmers is being tested. Besides, research and development work on conservation *in situ* and conservation *ex situ* of Red Chittagong Cattle (RCC) are being practiced. In the mean time five RCC progeny shows in five upazilas and training for 250 for Red Chittagong Cattle farmers have been completed to develop farmer awareness on RCC rearing in the

native breeding tract of RCC. To improve the productivity of native goat and sheep four bucks and 22 rams have been distributed among the farmers.

BLRI has been organizing training programme regularly for disseminating the developed technologies to farmers. Particularly, training course on cattle fattening, dairy production, goat & sheep production and broiler & layer production and management is highly accepted by farmers. Every year, BLRI organizes training programme for farmers, NGO personnel and Officers.

Table 3.10.1 Management structure of BLRI

Director General	Addl. Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	1	5	5	17	26	55 (PhD =14; 25%)

Head Quarters: Savar, Dhaka: Divisions

- | | | | |
|---|---|----|---|
| 1 | Animal Production Research Division | 2 | Poultry production Research Division |
| 3 | Goat and Sheep Production Research Division | 4 | Animal Health Research Division |
| 5 | System Research Division | 6 | Socio Economic Research Division |
| 7 | Support Service Division | 8 | Biotechnology Division (Proposed) |
| 9 | Training, Planning and Technology Testing Division (Proposed) | 10 | Regional Station = 2 (Baghabai, Sirajgonj and Naikhonchhari, Bandarban) |

3.10.1 Objectives

Objectives includes to-

- i. Develop feed and feeding technologies for livestock and poultry
- ii. Improve genetic quality of livestock, poultry and other economic importance animals
- iii. Develop livestock and poultry disease prevention and control measures
- iv. Develop low cost housing and management systems of livestock and poultry
- v. Strengthen research and extension linkage for technology transfer
- vi. Evaluate economics and marketing system of livestock and poultry products and their by-products.

3.10.2 Major research achievements of BLRI

- i. BLRI has developed 50 technologies, which include feed and fodder, disease management and vaccines production
- ii. Developed nine livestock production packages for adoption by the farmers
- iii. Identified various infectious diseases of cattle, goats, poultry birds, etc.
- iv. Developed Salmonella antigen, serum antibiotic combined treatment of PPR, Rinderpest competitive ELISA technique and ELISA based technique for control of Foot and Mouth disease
- v. Established National Reference Laboratory (NRL) for Avian Influenza (AI)

3.10.3 Present research activities of BLRI

- i. Farm waste nutrients recycling for feed production and pollution control
- ii. Inter or mixed cropping systems for increasing forage production
- iii. Selection and up gradation of native chicken, cattle, and goat and conservation of genetic resources
- iv. Efficacy testing of available vaccine and development of vaccine for FMD, Goat pox, PPR, Salmonellosis & Gumboro diseases
- v. Production packages of cattle, chicken, ducks and goats
- vi. Management packages and low cost housing for livestock and poultry
- vii. On farm research approaches to minimize research and extension gaps
- viii. Development of production packages of Rabbits, Ortrich, Turkey, Quail and pigs.

3.10.4 Future research priority areas of BLRI

- i. Increase and sustain of livestock production through genetic upgrading, disease control and improved feed system
- ii. Increase the supply animal products for both domestic consumption and export market
- iii. Explore the production potential of new animals and birds for adoption in the farm
- iv. Develop technologies for preserving, processing, storing, quality control and marketing of livestock and poultry products
- v. Technology generate to support on growing livestock and poultry industries
- vi. Undertake bio-technological research to meet the future challenges
- vii. Anti-biotic residue analysis
- viii. Identification of medicinal plan for animal disease treatment
- ix. Strengthen of linkages with extension, education and international organizations
- x. On-farm research.

Table 3.10.2 Discipline wise scientific manpower provision, existing and vacant posts at BLRI in June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Animal Production	1	1	0	0	0	0	3	2	1	4	4	0	8	7	1	1	2
Animal Health	1	0	1	1	1	0	3	1	2	5	5	0	10	7	3	2	3	2
Poultry Production	1	1	0	1	1	0	2	1	1	1	1	0	5	4	1	2	1	1
Goat and Sheep Production	1	0	1	1	1	0	4	4	0	7	6	1	13	12	1	3	4	1
Agril. Econ.	1	1	0	1	0	1	1	0	1	3	1	2	6	2	4	1	1	0
System Res.	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0
Region Baghabari	0	0	0	0	0	0	1	0	1	3	1	2	4	1	3	0	0	1
Naichonchhari	0	0	0	0	0	0	1	0	1	3	1	2	4	1	3	0	0	1
Training	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0
Res. Farm	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0
Total	5	3	2	5	4	1	17	10	7	26	19	7	53	37	16	10	11	8

Table 3.10.3 Discipline wise scientific manpower and PhD positions at BLRI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
	Animal Production (genetic evaluation & selection, genetics and breeding, nutrition and management, reproduction and animal biotechnology, waste management, animal ecology.)	1	1	0	0	2	2	4	0	7	3	1	0	1	1	1
Animal Health (microbiology, virology, pathology, immunology, epidemiology, vaccine production, physiology, parasitology)	0	0	1	1	1	1	5	0	7	2	1	1	1	2	1	1
Poultry Production (genetic evaluation & selection, genetics and breeding, nutrition and management, hatchery management, poultry physiology & repro.)	1	1	1	1	1	1	1	0	4	3	1	1	0	1	1	0
Goat and Sheep Production	0	0	1	1	4	0	6	0	12	1	1	2	1	3	1	0
Agril. Economics	1	1	0	0	0	0	1	0	2	1	0	1	1	0	0	0
System Research	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
Region Baghabari	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
Naichonchhari	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
Training	0	0	0	0	1	1	0	0	1	1	1	0	0	0	0	0
Research Farm	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Total	3	3	4	4	10	5	19	0	37	12	5	5	4	7	4	4

3.10.5 Enhancement of institutional efficiency

The head quarters of BLRI is at Savar, Dhaka with 9 Divisions, 2 Regional stations and 2 Sub stations located in different regions of Bangladesh.

BLRI is entrusted to generate and adopt technologies to solve livestock problems at the national and farm levels. The mandate is to take care of the livestock problems of small holders through multi and inter-discipline and inter institutional research. The institute conducts research to solve basic problems affecting livestock, poultry production both at farm and national level. Develop technologies pertinent to livestock and poultry production and strengthen research–extension-NGO linkages for expending quick dissemination of local developed and introduce techniques to the end users.

At present the institute has scientific manpower provisions of 55 including Director General 1 and Additional Director 1. In the case of chief scientific officer (CSO) to scientific officer (SO) the institute has 53 scientific provisions and 37 positions are filled up and 16 posts remain vacant (Table 3.10.2). In the Table it is observed that out of 4 provisions 1 post is vacant in the case of CSO, where as in the case of PSO out of 5 provisions 1 post is vacant, as SSO 7 posts are vacant out of 17 provisions and in the case of SO 7 posts are vacant out of 26 provisions. Therefore, at present filled in positions are 3 CSO, 4 PSO, 10 SSO and 19 SO working in different disciplines of BLRI.

3.10.6 Identification of skill gaps on the basis of priority research

BLRI has scientific manpower in positions of 37 (70%) out of 53 scientific manpower provisions in their various divisions, whereas 16 (30%) scientific positions remain vacant. Out of 53 scientific provisions 13 scientists are PhD holders in different divisions i.e. (24%), which is not sufficient number of PhD holders at BLRI (Table 3.10.2). The analyses of PhD holders in divisions wise are animal production (42%), animal health (28%), poultry production (75%), goat and sheep production only (16%). For proper enhancement of institutional efficiency the PhD holders of BLRI should be increased at least 50% gradually by the year 2025 in respective of divisions. To fulfillment of 50% PhD level scientific manpower of BLRI, there should have training plan where gradually increase the scientific manpower and attain the PhD level of scientific manpower position 40%, 45% and 50% level by the years 2015, 2020 and 2025, respectively.

3.10.7 Training needs analyses on the basis of skill gaps

For strengthening research activities BLRI needs to develop discipline wise scientific manpower through training in the field of animal breeding, molecular biology, biotechnology, reproductive physiology, animal production, genetic evaluation and selection, nutrition and management, animal health, microbiology, pathology, immunology, epidemiology, parasitology, poultry production and management, animal feed production and preservation, marketing of animal products for value change, ICT, GIS, etc. Thus scientific manpower needs to be developed for generation of new technologies to be used by the end users. On the basis of research needs the following training have been identified for the scientists of BLRI as mentioned in Table 3.10.4.

Table 3.10.4 BLRI scientific manpower development plan and enhancement of PhD level from 25% to 50% during the period of 2009-2025.

Year Discipline	2009-2015 (PhD at 40% level)				2016-2020 (PhD at 45% level)				2021-2025 (PhD at 50% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Animal Production	2	1	3	2	2	1	3	2	1	1	2	1	5	3	8	5
Animal Health	2	1	4	2	2	1	4	2	1	1	2	2	5	3	10	6
Poultry Production	0	1	2	1	1	1	2	1	1	1	2	1	2	3	6	3
Goat & Sheep Production	3	0	4	2	2	0	4	2	1	0	2	1	6	0	10	5
Agril. Econ.	1	0	1	0	2	0	1	0	0	0	1	1	3	0	3	1
System Res.	0	0	1	0	0	0	1	0	0	0	1	0	0	0	3	0
Region Baghabari	1	0	1	1	1	0	1	1	1	0	1	0	3	0	3	2
Naichonchhari	1	0	2	1	1	0	2	1	0	0	1	0	2	0	5	2
Training	0	0	1	1	0	0	1	1	0	0	1	1	0	0	3	3
Res. Farm	0	0	1	0	0	0	1	0	1	0	0	0	1	0	2	0
Total:	10	3	20	10	11	3	20	10	6	3	13	7	27	9	53	27

3.11 Soil Resource Development Institute

Soil Resource Development Institute (SRDI) from its inspection in the order of soil survey project of Pakistan (East Wing) in 1961, today at the dawn of new millennium stands on a firm infrastructure. Its aim was to conduct the reconnaissance soil survey (RSS) of the then East Pakistan. In 1969, central soil resources institute was established as follow up of the soil survey project. After the independence of Bangladesh, Department of Soil Survey was established in 1972 under the Ministry of Agriculture. Reconnaissance soil survey of the country was completed by 1975. Afterwards, the Department has undertaken detailed and semi-detailed soil survey, special survey of irrigation projects, explanatory soil guide and manual to ensure rational use of soil resource in the country.

In 1983 Soil Resource Development Institute was established under the Ministry of Agriculture and Forest by reorganizing then the department of Soil Survey. From 1986 onwards through successful completion of various projects the activities of the institute increased manifold. It is now prepared to face the challenge of future to make a breakthrough in crop production through improved soil management in Bangladesh, though SRDI still has in imbalance organogram.

SRDI has been working in the field of land use development, problem soil assessment, saline soil management and land reclamation, soil, water, plant and fertilizer sample analysis as well as soil conservation and watershed management. SRDI has surveyed the whole country except the Sundarban and already prepared 34 volumes of RSS report and 459 Upazila Nirdeshika. Recently updating of Upazilla Nirdeshika has been under taken.

Table 3.11.1 Management Structure of SRDI

Director	Chief Scientific Officer (CSO)	Principal Scientific Officer (PSO)	Senior Scientific Officer (SSO)	Scientific Officer (SO)	Total
1	4	19	41	134	199 (PhD =12; 6%)

Location: Khamarbari Road, Farmgate, Dhaka1215.

Division: 4

1. Development
2. Survey
3. Technical Support service
4. Soil Testing

Research Station: 2

1. Soil Conservation and Watershed Management Center (SCWMC)
2. Salinity Management and Research Center (SMRC)

3.11.1 Mandate

The mandates of the institute are as follows (The Bangladesh Gazette, Extra, Oct. 91983):

- i. Inventories and survey of soil and land resources
- ii. Interpretation and analysis of soil and land resources data (demand driven applied resource)
- iii. Advice and service related to soil
- iv. Farmers advisory service
- v. Analysis of soil, water, plant, fertilizer and heavy metal including arsenic
- vi. Quality control of soil analytical services done by laboratories of GO/NGOs.

3.11.2 Objectives

- i. Soil and land improvement, soil testing, classification, etc.
- ii. Determination of soil and water salinity
- iii. Establishment of location specific crop modeling
- iv. Agro-technology transfer and advisory services.

3.11.3 Past research achievements

- i. Published about 459 Upazila Soil Status Guidelines out of 460 Upazila containing soil classification and model of crop production
- ii. Also prepared location specific guidelines with coloured maps indicating soil status
- iii. Prepared various kinds of booklets for soil conservation, land improvement, watershed management, etc.

3.11.4 Current research activities

- i. **Development Division:** It consists of 4 Regional Offices viz. Dhaka, Chittagong, Rajshahi and Khulna and 5 District office. Co-ordination with the beneficiary agencies like DAE, BARI, BADC, BRRI, CDB, etc. by providing information on soils, land use, land capability, crop suitability, quality control of organic & inorganic fertilizer, etc.
- ii. **Survey Division:** It has 3 sections viz. Soil and Land Classification Survey Section, Soil Survey Interpretation Section and Soil Correlation Section. Co-ordination with allied Govt. and other agencies in national programs building on soil and land resource, correlation, soil and land classification, soil testing for crop specific areas, etc.
- iii. **Technical Support Services Division:** It consists of 5 sections viz. Laboratory, Training, Cartography, Publication & Record and Data Processing & Statistical Section (DPSS). Co-ordination with allied Government/Autonomous/other agencies in research/investigations

employing physical and chemical analyses as well as adaptive research works involving crop and soil relationships, preparation of updated upazila nirdeshika, etc.

- iv. **Soil Testing Division:** In this division there are 15 Regional Laboratories. They are Dhaka, Comilla, Rajshahi, Khulna, Mymensingh, Chittagong, Barishal, Bogra, Jamalpur, Dinajpur, Sylhet, Jhenaidah and Faridpur. These laboratories are engaged in soil, plant, fertilizer and water sample analysis to evaluate problems such as nutrient deficiency, toxicity, salinity, quality control, soil genesis and classification in coastal and hilly areas, etc.

There are two research stations under SRDI:

1. **Soil Conservation and Watershed Management Center (SCWMC)** located at Meghla, Bandarban responsible for generating technology on soil conservation and watershed management in hilly areas and to conduct research on hill farming.
2. **Salinity Management and Research Center (SMRC)** located at Batiaghata, Khulna, responsible for generating information on soil and water salinity in coastal areas and to conduct research on salinity management.

3.11.5 Future research priority areas of SRDI

- i. Sustaining and enriching soil fertility by adoption of new technology
- ii. Creating awareness for use of Upazila Nirdeshika
- iii. Watershed management and soil conservation in hilly region
- iv. Preparation of location specific model for crop production
- v. Soil testing for crop specific areas
- vi. Soil genesis and classification in coastal and hilly areas
- vii. Strengthening of soil analytical services to the research, extension, development agencies, etc.
- viii. Application of GIS at grass root level
- ix. Strengthening of farmers' service through mobile phone & CIC
- x. Developing soil management technologies
- xi. Updating soil classification
- xii. Updating fertilizer recommendation
- xiii. Soil degradation and environment
- xiv. Land use policy research
- xv. Addressing problem soils.

Table 3.11.2 Discipline wise scientific manpower provision, existing and vacant post at SRDI in June, 2009

Type of posts Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
	Development	1	0	1	4	2	2	0	0	0	4	4	0	9	6	3	2	2
a) District Office	0	0	0	0	0	0	20	12	8	30	18	12	50	30	20	5	6	9
Survey	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
a) Soil and land classification section	0	0	0	1	1	0	1	1	0	10	5	5	12	7	5	2	4	3
b) Soil survey interpretation	0	0	0	1	1	0	1	0	1	6	4	2	8	5	3	2	2	2
c) Soil correlation	0	0	0	1	1	0	1	1	0	2	1	1	4	3	1	0	1	1
Technical Support Service	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
a) Soil physics & mineralogy	0	0	0	1	0	1	1	1	0	4	2	2	6	3	3	1	1	2
b) Central laboratory H/Q, Dhaka	0	0	0	1	1	0	3	3	0	13	10	3	17	14	3	4	4	5
c) GIS	0	0	0	0	0	0	1	0	1	1	0	1	2	0	2	0	0	0
d) Training	0	0	0	1	0	1	1	1	0	2	2	0	4	3	1	1	1	1
Soil Testing	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
a) Regional laboratory	0	0	0	6	5	1	9	8	1	56	41	15	71	54	17	8	10	16
Upazila Nirdeshika	0	0	0	1	1	0	1	1	0	0	0	0	2	2	0	0	1	1
Research Centre	0	0	0	2	0	2	2	1	1	6	3	3	10	4	6	1	2	1
Total	4	0	4	19	12	7	41	29	12	134	90	44	198	131	67	26	34	43

Table 3.11.3 Discipline wise scientific manpower and PhD positions at SRDI in June, 2009

Discipline	Chief Scientific Officer (CSO)		Principal Scientific Officer (PSO)		Senior Scientific Officer (SSO)		Scientific Officer (SO)		Total		Status of Retirement					
	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	Ext.	PhD	2009-2015		2016-2020		2021-2025	
											PhD	MS	PhD	MS	PhD	MS
Development	0	0	2	1	0	0	4	0	6	1	1	1	0	2	0	2
a) District Office	0	0	0	0	12	0	18	1	30	1	0	5	0	6	2	7
Survey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Soil and land classification section	0	0	1	0	1	1	5	1	7	2	0	2	1	3	1	2
b) Soil survey interpretation	0	0	1	0	0	0	4	0	5	0	0	2	0	2	0	2
c) Soil correlation	0	0	1	0	1	0	1	0	3	0	0	0	0	1	0	1
Technical Support Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Soil physics & mineralogy	0	0	0	0	1	1	2	1	3	2	0	1	1	0	1	1
b) Central laboratory H/Q, Dhaka	0	0	1	0	3	1	10	0	14	1	1	3	0	4	0	5
c) GIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d) Training	0	0	0	0	1	0	2	0	3	0	0	1	0	1	0	1
Soil Testing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Regional laboratory	0	0	5	2	8	1	41	0	54	3	0	8	1	9	2	14
Upazila Nirdeshika	0	0	1	0	1	1	0	0	2	1	0	0	1	0	0	1
Research Centre	0	0	0	0	1	0	3	0	4	0	0	1	0	2	0	1
Total	0	0	12	3	29	5	90	3	131	11	2	24	4	30	6	37

3.11.6 Enhancement of institutional efficiency

The head quarters of SRDI are located at Dhaka with 4 divisions and 2 research stations located in different regions of Bangladesh.

SRDI is to make inventory of soil and land resources and to investigate soil related problems for agricultural research and development. The inventory also includes reconnaissance soil survey of the country on the basis of aerial photo interpretation and field and laboratory investigation of soils; detailed and semi-detailed soil surveys of development project areas and research farms for various beneficiary agencies; soil survey for location areas and problem soils; soil moisture, characterization of soil tracts of the country; and preparation of various maps and reports based on soil survey.

At present the scientific manpower provision of SRDI is 198 including one Director. In the institute chief scientific officer (CSO) to scientific officer (SO) provisions were 198 and present in position of scientists were 131 and 67 scientific posts were vacant (Table 3.11.2). In the Table it was observed that all 4 CSO positions are vacant, whereas in case of PSO out of 19 provisions 7 posts are vacant, as SSO 12 posts are vacant out of 41 provisions and in the case of SO 44 posts are vacant out of 134 provisions. Therefore, at present there are 12 PSO, 29 SSO and 90 SO working in different disciplines of SRDI.

3.11.7 Identification of skill gaps on the basis of priority research

There is scientific manpower in positions of 131 (66%) at SRDI out of 198 scientific manpower provisions and 67 (34%) scientific positions are vacant. Out of 199 scientific provisions only 12 scientists are PhD holders in different divisions i.e. (6%), which is very insignificant number of PhD holders at SRDI (Table 3.11.2). It may be mentioned that there is no CSO level scientist at SRDI, which is essential to take the responsibilities of scientific work at SRDI. On the other hand there are only 6% PhD holders, which is too low to perform the new dimensional quality scientific work. In addition at present 67 scientific posts are vacant, these vacant posts should immediately be filled up. There is huge amount of soil, plant, fertilizer analytical and research work including GIS, MIS could not be properly completed by the present strengthen of the scientific staff. For proper enhancement of institutional efficiency the PhD holders of SRDI would be increased at least 20% gradually by the year 2025. For fulfillment of 20% PhD level scientific manpower there should be training plan where the scientific manpower at the PhD level of will be increase to 10, 15 and 20% level in 2015, 2020 and 2025 respectively.

3.11.8 Training needs analyses on the basis of skill gaps

The institute needs to strengthen in the areas of GIS, ICT, MIS, etc. On the basis of future research needs the following training needs have been identified for SRDI such pedology, soil conservation, soil physics, soil microbiology, soil chemistry, soil mineralogy, soil bio-Chemistry, soil classification, geo information, land use planning, soil degradation, soil salinity management, environmental pollution, etc.

At SRDI on the basis of scientists' personal data analyses in their respective disciplines and for the address of future research priority areas have been identified and placed in Table 3.11.4.

Table 3.11.4 SRDI scientific manpower development plan and enhancement of PhD level from 06% to 25% during the period of 2009-2025.

Type of posts Discipline	2009-2015 (PhD at 15% level)				2016-2020 (PhD at 20% level)				2021-2025 (PhD at 25% level)				Total			
	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W	PhD	Post D	Short T.	Sty/S/W
Development	1	0	6	2	1	0	6	2	1	0	4	1	3.	0	16	5
a) District Office	5	1	25	2	4	1	20	2	3	1	18	2	12	3	63	6
Survey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Soil and land classification section	1	0	10	2	1	0	10	2	1	0	6	2	3	0	26	6
b) Soil survey interpretation	1	0	5	1	1	0	5	1	0	0	4	1	2	0	14	3
c) Soil correlation	1	0	2	1	0	0	2	1	0	0	2	1	1	0	6	3
Technical Support Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
a) Soil physics & mineralogy	1	0	4	1	1	0	4	1	0	0	4	1	2	0	12	3
b) Central laboratory H/Q, Dhaka	2	0	6	2	2	0	7	2	2	0	7	2	6	0	20	6
c) GIS	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	3
d) Training	0	0	2	1	0	0	2	1	0	0	2	1	0	0	6	3
Soil Testing	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	3
a) Regional laboratory	5	1	25	5	3	1	22	3	2	0	20	3	10	2	67	11
Upazila Nirdeshika	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research Centre	2	0	6	3	2	0	5	2	1	1	6	2	5	1	17	7
Total	21	2	91	22	15	2	83	19	10	2	73	18	46	6	247	59

4.0 Synthesis of NARS scientific manpower: present status and plan 2009-2025

4.1 Introduction

As already pointed out that the BARC is the apex body of the NARS. BARC is responsible for planning, developing and upgrading the manpower of the NARS institutes such as: (a) Bangladesh Agricultural Research Institute (BARI), (b) Bangladesh Rice Research Institute (BRRI), (c) Bangladesh Jute Research Institute, (d) Bangladesh Sugarcane Research Institute (BSRI), (e) Bangladesh Institute of Nuclear Agriculture (BINA), (f) Bangladesh Forest Research Institute (BFRI), (g) Bangladesh Tea Research Institute (BTRI), (h) Bangladesh Fisheries Research Institute (BFRI), (i) Bangladesh Livestock Research Institute (BLRI) and (j) Soil Resource Development Institute (SRDI).

BARC developed scientist's personal data sheet and divisional information format in association with the concerned NARS scientists. BARC requested to the all heads of NARS institutes for providing scientific manpower information through the developed personal data sheet and divisional format. Accordingly all the heads of NARS submitted scientific manpower as per supplied format (Annexure i & ii). Upon compilation of information BARC in consultation with the concerned NARS scientists as well as other related personnel finalized the manpower development plan 2009-2025.

As per information provided by the NARS the present scientific manpower provisions include Executive Chairman, Director Generals, Member Directors, Directors and four categories of scientists viz., Chief Scientific Officer (CSO), Principal Scientific Officer (PSO), Senior Scientific Officer (SSO) and Scientific Officer (SO) which are in number 1843 (Table 4.1). In the Table there is one Executive Chairman, 7 Director Generals, 28 Member Directors and Directors occupied 2% posts, where as 6% occupied by CSO (119), 15% occupied by PSO (281), 30% by SSO (554) and 47% occupied by SO (853) under the NARS scientific manpower provisions in June 2009. It may be mentioned here that in the NARS Chief Scientific Officer is the research key position. The ratio shows as 6%:15%:31%:47% of CSO: PSO: SSO: SO respectively and the resultant ratio come into 1: 2.5: 5: 8 of CSO: PSO: SSO: SO, respectively. But in some institutes like BRRI, BSRI and BLRI ratio are not as per equation. In the NARS institutions BARI is the largest multi-crop institute and has 705 scientific provisions. This was followed by the number of 236 scientists at BRRI. The lowest number is 36 scientists in BTRI, which was followed by 55 scientists at BLRI.

On the other hand NARS scientific manpower in terms of ratio observed that the highest percent of 38% manpower in BARI, which was followed by BRRI (13%), SRDI (11%) and BJRI (8%). The lowest percent of 2% manpower in BTRI, which was followed by BLRI (3%), BFRI and BARC (4%) as mentioned in Fig. 1.

In NARS institutes scientific manpower vacant positions are in the case of CSO=38 (2%), PSO= 62 (3%), SSO= 106 (5%) and SO= 183 (10%) and total scientific vacant position is 385 (20%) out of 1807 posts (Table 4.2). The highest vacant posts exist in BFRI (Forest) at 50%, which was followed by BSRI (36%), and SRDI (33%), while the lowest vacant position in BARI (8.74%). This is followed by BTRI, BFRI and BLRI in Table 4.2 and Fig. 2. Although CSO is the key position in the scientific group and among the groups of scientists, the actual field research workers are mainly Senior Scientific Officer (SSO) and Scientific Officers (SO). The Scientific Officer position is the entry point of the scientific forces of the NARS. Continued success of the NARS would depend on the quality of the scientists entering into the system at the initial stage.

4.2 Identification of NARS scientists' training needs on the basis of skill gaps

The scientists need higher technological knowledge and skill through manpower development in the identified skill gaps, so that future priority research can be addressed properly and might increase the productivity model to feed future generation. As per future research priority setting of NARS and on the basis of skill gaps analyses in different field of the NARS institutes scientific manpower development plan have been prepared. The skill gap in different fields are given below institute wise:

BARI: Plant breeding, molecular genetics, tissue culture, genetic engineering, bio-technology, production technology, seed technology, crop modeling, weed management, hill farming, farming system, dry land farming, plant physiology, IPM, toxicology, insect ecology, virology, bacteriology, plant disease diagnosis, horticulture breeding, tissue culture, fruits and vegetable production, floriculture, post harvest technologies, species production, soil physics, soil microbiology, soil and plant analysis, soil and water resource engineering, farm machinery, food process engineering, agricultural waste management, renewable energy utilization, production economic, rural sociology and marketing, value change, marketing and policy, food safety and quality, bio chemistry, bioinformatics, remote sensing, geo-informatics, HRD, DNA profile, molecular marker, ICT, MIS, GIS, climate change, etc. in various disciplines.

BRRI: Plant breeding, molecular genetics, genetic engineering, bio-technology, seed technology, plant stress physiology, crop modeling, weed management, multiple cropping, dry land farming, biological control, insect biodiversity, toxicology, insect physiology, mycology, virology, bacteriology, molecular plant pathology, soil physics, soil microbiology, soil micro-nutrient, soil nutrients/fertility assessment, crop modeling, bio chemistry, soil and water resource engineering, farm machinery system, agricultural waste management, renewable energy utilization, rural sociology and marketing, value change, farming system, climate change, HRD, ICT, MIS, etc.

BJRI: Plant molecular genetics, plant tissue culture, genetic engineering, bio-technology, seed technology, plant stress physiology, crop modeling, production technology, IPM, toxicology, insect physiology, virology, molecular plant pathology, soil physics, biochemistry and microbiology, soil micro-nutrient, textile physics, jute chemistry, mechanical processing, dying and printing, rural sociology, farming system, chemistry for generating new diversified products of jute for increasing export potential, HRD, MIS, ICT, GIS, etc.

BINA: Plant breeding, plant molecular biology, biotechnology, plant stress physiology, microbiology, bio-fertilizer, nutrient management, seed technology, IPM, pest and disease management, soil and water resources engineering, crop management, farming system, climate change, HRD, ICT, MIS, etc.

BSRI: Plant breeding, plant molecular biology, biotechnology, production technology, stress physiology, seed technology, IPM, insect biodiversity, pest and disease management, soil and nutrient management, value change, farm machineries, farming system, climate change, sugarcane based cropping systems, HRD, ICT, MIS, etc.

BFRI (Forest): Tissue culture, plant molecular biology, genetic engineering, stress physiology, seed orchard development, forest ecology, nursery management, IPM, pest and disease management, soil and water management, value change, climate change, timber physics, forest chemistry, forest botany, wood seasoning, wood preservation, farming system, HRD, ICT, MIS, GIS, etc.

BTRI: Tea botany, biotechnology, biochemistry, soil fertility, tea physiology, tea production, IPM, pest and disease management, bacterial, viral and fungal treatment, tea products development, production economic, marketing and policy, social impact, farm management, ICT, MIS, GIS, etc.

BFRI (Fish): Fish genetic, fish molecular biology for identification of fish diseases, fish biotechnology, fish physiology, fish feed and nutrition, fish health management, population dynamic, fish toxicology, brackish and open water management, hatchery management, fisheries socio-economics, pearls culture, mussels culture and breeding, pond productivity and culture, post harvest process technologies, HRD, ICT, MIS, etc.

BLRI: Animal breeding, molecular biology, animal biotechnology, reproductive physiology, animal production, genetic evaluation and selection, nutrition and management, animal health, microbiology, pathology, immunology, epidemiology, parasitology, poultry production and management, animal feed production and preservation, vaccine production, marketing of animal products, ICT, MIS, GIS, etc.

SRDI: The institute needs to be strong in the areas of for which gathered information to be used by the other related organizations. Soil physics, soil microbiology, soil chemistry, soil mineralogy, soil biochemistry, soil classification, geo information, land use planning, soil degradation, soil salinity management, environmental pollution, HRD, GIS, ICT, MIS etc.

BARC: For strong coordination and strengthening the NARS for proper management of research activities, research planning, monitoring and evaluation, research priority setting, etc. BARC needs short term training

in the fields of research management, planning, monitoring and evaluation, natural resource management, project preparation, institutional management, library science, irrigation and water management, financial management, bio-safety, HRD, IPR, WTO, TRIPS, MIS, ICT, GIS, ex-entry analysis including climate change, plant physiology, etc. BARC also needs post doctoral programs in the field of research management, human resource development, research priority setting, project management etc.

4.3 Discipline-wise NARS present scientific manpower with PhD and MS

It is observed that at present NARS existing scientific manpower is 1422 (79%) out of 1807 provisions and vacant posts is 385 (21%) as in June, 2009. Among the scientific manpower there is 350 PhD holders and 1072 MS or equivalent. There are various disciplines as mentioned in their respective of institutes. A compilation table is developed with similar disciplines and major subjects are presented in Table 2.3. It may be mentioned here that the disciplines are almost similar in the case of crop research institutes under the Ministry of Agriculture except technology division of Jute Research Institute and SRDI. The disciplines are differing each other in the case of Forest Research, Fisheries Research and Livestock Research Institutes. The subject of plant breeding, agronomy, soil science, plant pathology, entomology, agricultural engineering, etc. are common in all institutes except FRI and BLRI. But in case of BFRI there is no plant breeding and agronomy, whereas agricultural economics and social science are available all institutes except BJRI, BINA, BTRI and SRDI. The fields of planning, training and communication are available in NARS except BFRI and BTRI. It is also observed that the highest scientific manpower in the field of agronomy is about 197 with PhD 48, which is about 13% of the total NARS scientists. This was followed by genetics and plant breeding of 121 scientists with PhD holder of 35, which is about 8%, plant pathology 106 (7%) with number of 36 PhD and also soil science 101 (7%) scientists with 32 PhD holders of NARS scientists. The scientist in the field of horticulture is about 125 (8%) with PhD holders are 26 is only at BARI. The very lowest number of 10 biotechnological research scientists, which is (0%) with 4 PhD holders in the NARS. In the case of PhD the highest percent of PhD in the field of plant pathology of 33%, which was followed by plant breeding of 28%, agronomy 23%, entomology 22%, horticulture 20%. On the other hand in the existing scientists the highest percent PhD holder is found in BINA (37%), and which was followed by BFRI (Fish) (33%), BRRI (29%) and BLRI (25%). The lowest percent PhD is found in the institute of SRDI of 6% followed by BFRI 8% and BTRI of 11% and BJRI of 12%.

It may be mentioned here that in the NARS there are 5 multi commodity research institutes out of 10 agricultural research institutes such as BARI, BINA, BFRI, FRI and BLRI. The latest established institute of BFRI (Fish) and BLRI manpower and their dimension of research are not enough to cope up the research activities on national priorities. So these two research institutes including SRDI, BFRI (Forest) and BJRI should be strengthened more to enable them to take up national priority research.

4.4 NARS scientific manpower, its retirement, on going PhD and manpower development projection for the year 2009-2015

It is mentioned that the BARI is the biggest agricultural research institute in the NARS with the highest scientific post provision of 698 with 132 (18%) PhD out of 132 PhD holders 25 PhD along with 45 MS in total 82 scientists will be retiring during 2009-2015, which was followed by BRRI of 233 sanctioned posts with 69 (29%) PhD, SRDI 198 sanctioned posts with 12 (6%) PhD and BJRI of 144 sanctioned posts with 19 (13%) PhD and retirements of 36, 26 and 22 scientists, respectively. It appears that out of 1807 scientists sanctioned posts in the NARS, the total PhD is about 350 i.e. 19% (Table 4.4). The lowest manpower size of 35 at BTRI with 4 (11%) PhD which is followed by BLRI with 13 (24%) PhD. It is also observed that the highest retirement of PhD level scientists at BRRI is about 33 during the period of 2009-2015, which was followed by BARI of 25 and highest number of MS retirement of 45 scientists at BARI and is followed by SRDI of 21 and BSRI of 15.

On the other hand the highest number of 82 PhD needed at BARI during the period of 2009-2015, followed by BRRI of 49, BJRI of 23 and SRDI of 21. It is mentioned that the total requirement of PhD is 251, Post Doctoral of 42, Short-term training 504 and Study tour/ Workshop/ Seminar of 226 persons during the period of 2009-2015.

It should be mentioned here that the total retirement of scientific manpower in the NARS by the year 2015 would be about 231. Of them 100 PhD holders will be retiring i.e. 28% and maximum PhD level scientists will be retiring from BRRI, followed by BARI.

It is expected that by the year 2010 or 2011 all vacant posts including retiring positions will be filled up, thus manpower development would be necessary for the period from 2009-2015 to maintain flow of training for upgrading the scientists knowledge for better performance of national priority research. Therefore, additional training provisions would be required, such as post doctoral, short-term training, study tour, seminar/workshop as proposed against each of the institutes (Table 4.4).

4.5 NARS scientific manpower, its retirement, on going PhD and manpower development projection for the year 2016-2020

The NARS institutes scientists recruitment will be continued for the periods to fulfillment the retiring vacant posts, thus newly recruited scientists needs training leading to PhD, short term training. It is assumed that the training plan will be implemented and PhD holders' of scientists would be 489 in the year 2016. As per information the total retirement of 276 scientists during the period of 2016-2020 and PhD level scientists will be 109 i.e. (22%). It is therefore, necessary to prepare a plan for training of 219 promising scientists for PhD degree during 2016-2020 to replace the number of retired PhD as well

as to raise the present PhD level scientists (Table 4.5). In the table there are also provisions for Post Doc. of 35, short training of 455 and participation of study visit/ seminar /workshop of about 185 persons in abroad.

4.6 NARS scientific manpower, its retirement, on going PhD and manpower development projection for the year 2021-2025

The NARS institutes scientists recruitment will be continued for filling the scientific provisions and retiring vacant posts, thus newly recruited scientists need training leading to PhD, short term training at home and abroad. It is assumed that the training plan will be implemented in PhD holders' of scientists would be 611 in the year 2021. As per gathered information the total retirement of 353 scientists during the period of 2021-2025 and PhD level scientists would be 111 i.e. (18%). It is therefore, necessary to prepare a plan for training of 224 promising scientists for PhD degree during 2021-2025 to replace the number of retired PhD as well as to raise the present PhD level scientists (Table 4.6).

Therefore, it is important that scientists will be given 224 PhD level of job specific training, 38 post doc., 443 short-term job-specific training for about 2 (two) months each, 186 scientists to participate in the job-related study tour/workshops/seminars in each for 5-10 days in abroad. The training duration will be PhD 4 years, post doc, 12 months, short-term training 2 months, study visit 10 days and seminar/workshop 3-5 days .

4.7 Summary of NARS scientific manpower development planning for the year 2009-2025

It is observed that the NARS PhD programs needed by the year 2015 would be 251 PhD, by the year 2020 of 219 PhD and by the year of 2025 of 224 PhD level degrees (Table 4.8). It is mentioned here that the highest percent would be required for BFRI (Forest), which was followed by BRRI, BLRI. The lowest percent would be in SRDI and BARC (Fig. 3).

Recruitment of scientists would be continued and training plan will be implemented properly so that demand needs technology generation would be ensured, which would be used by end user for sustainable development in their future generation. It is mentioned in the Table 4.7 that the 251 PhD level training may be required 215, 219, 224 by the years 2015, 2020 and 2025, respectively. Whereas in case of post doctoral fellowships there would be requirement of 42, 35 and 38 NARS scientists by the years of 2015, 2020 and 2025, respectively. On the other hand in case of short-term training there would be of 504 by the year 2015, 455 by 2020 and 443 by 2025 for NARS scientists. In case of participation study visit/ seminar/ workshop there would be provisions of 226 by the year 2015, 185 by 2020 and 186 by 2025. The total PhD, post doctoral fellowship, short term training and study visit / seminar / workshop are 694, 117, 1402 and 597, respectively. The total PhD requirements for NARS would be 694 (Fig. 3), Post Doc. of 117 (Fig. 4), Short term training of 1402 (Fig. 5) and Sty tour/

seminar/workshop participants would be 597 (Fig. 6), therefore, grand total participants would be 2813 by the year 2025 (Table 4.8) and Fig. 7.

It may be mentioned here that there is no rational of NARS human resource development, therefore there is huge trained manpower gaps in the NARS. On the basis of present trained manpower the NARS manpower development plan has been prepared as mentioned below:

The above mentioned data confirm that the enhancement of PhD level of scientists at SRDI gradually increased from 6% to 25% and BFRI from 8% to 25% during the years 2009-2025. Whereas in the case of BSRI scientists PhD level gradually increased from 10% to 30% and BJRI from 12% to 30% during the years 2009-2025. But in the case of scientists of BTRI the PhD level would be gradually increased from 11% to 40% and BARI from 18% to 40% level during the years 2009-2025. On the other hand the present PhD level of scientists of BLRI is about 25%, BRRI 29%, FRI 32% and BINA 37% would be increased gradually to 50% PhD level during the years 2009-2025.

BARC has been also arranging/ going to arrange local short term training, seminar, workshop, meeting, field days, etc. for NARS scientists, administrators, officers', managers, field supports personnel such as follows:

Local Training Programs:

1. Foundation training for NARS junior scientists for a period of four months.
2. Research methodology training for NARS junior scientists for about two weeks
3. Administrative and financial management course for NARS PSO/CSO level scientists for about two week
4. Procurement training course for NARS concern personnel for about one week
5. Financial management course for NARS concern personnel for about one week
6. Monitoring and evaluation course for NARS concern scientists for about one week
7. Personnel management course for NARS officers / office staff for about one week
8. Research management for NARS scientists and research supporting personnel
9. ICT/MIS course for NARS concern personnel

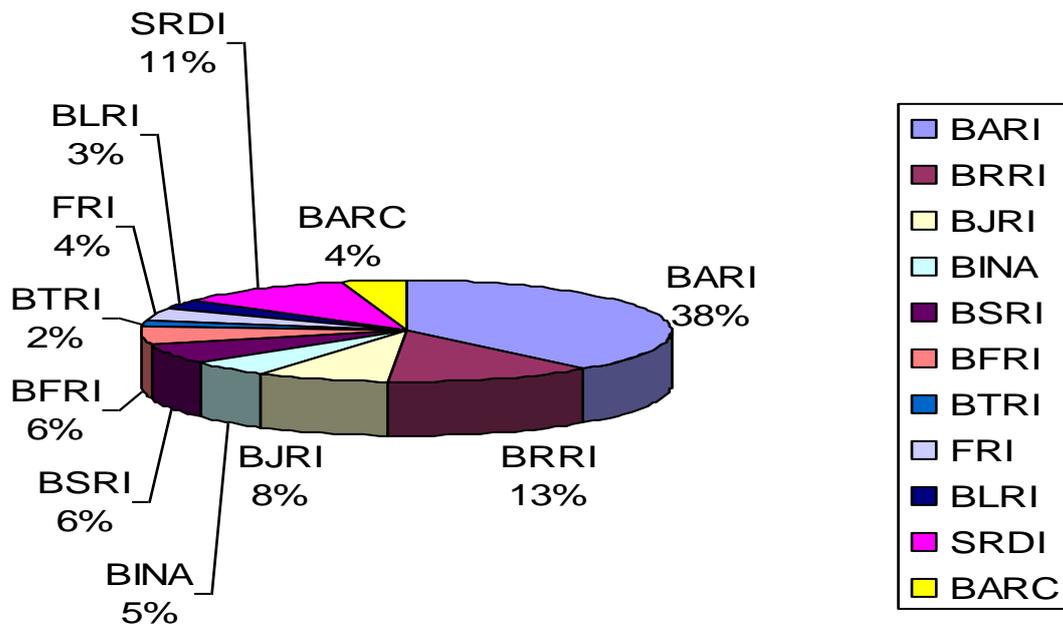
Local seminar, workshop, seminar, field days, etc. in various fields of agriculture including preparation of institutional master plan, strategic plan, HRD plan for NARS as mentioned in Table 4.9.

Table 4.1 Provision of scientific manpower at NARS (post-wise)

Sl. No.	Organization	EC/DG	MD /Director	CSO	PSO	SSO	SO	Total	% of PhD
1.	BARI	1	6	24	87	236	351	705	135 (18%)
2.	BIRRI	1	2	22	41	93	77	236	70 (29%)
3.	BJRI	1	3	11	31	46	56	148	19 (12%)
4.	BINA	1	2	12	18	25	36	94	35 (37%)
5.	BSRI	1	2	16	26	23	46	114	12 (10%)
6.	BFRI (Forest)	0	1	2	19	27	54	103	09 (8%)
7.	BTRI	0	1	3	7	10	15	36	4 (11%)
8.	BFRI (Fish)	1	2	4	4	22	48	81	26 (33%)
9.	BLRI	1	1	5	5	17	26	55	14 (25%)
10.	SRDI	0	1	4	19	41	134	199	12 (6%)
11.	BARC	1	7	16	24	14	10	72	23 (31%)
	Total:	8	28	119	281	554	853	1843	359 (19%)

NB: EC= Executive Chairman, DG= Director General, MD= Member Director, CSO= Chief Scientific Officer, PSO= Principal Scientific Officer, SSO= Senior Scientific Officer and SO= Scientific Officer.

Fig:1
Provision of Scientific Manpower at NARS



Provision of Scientific Manpower at NARS

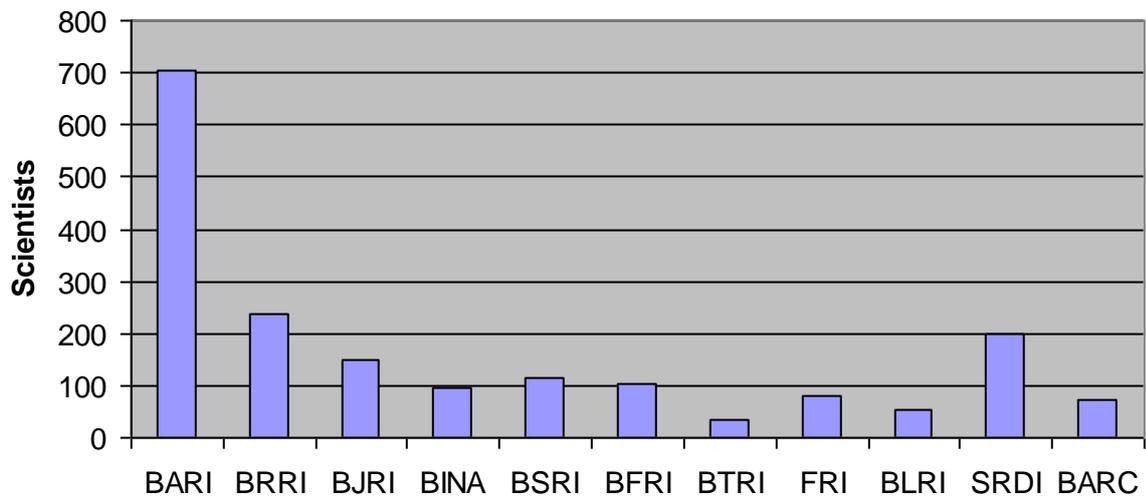


Table 4.2 Provision, existing and vacant positions of scientific manpower at NARS (post-wise) in June, 2009

Discipline	Chief Scientific Officer (CSO)			Principal Scientific Officer (PSO)			Senior Scientific Officer (SSO)			Scientific Officer (SO)			Total			Retirement Status		
	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	Prov.	Ext.	Vac.	2015	2020	2025
BARI	24	24	0	87	70	17	236	226	10	351	317	34	698	637	61	70	92	147
BRRRI	22	18	4	41	36	5	93	78	15	77	54	23	233	186	47	36	25	26
BJRI	11	9	2	31	23	8	46	34	12	56	48	8	144	114	30	18	25	31
BINA	12	5	7	18	17	1	25	16	9	36	32	4	91	70	21	11	19	23
BSRI	16	6	10	26	22	4	23	14	9	46	25	21	111	70	41	22	16	19
BFRI (Forest)	2	0	2	19	13	6	27	13	14	54	26	28	102	52	50	10	12	23
BTRI	3	3	0	7	6	1	10	2	8	15	13	2	35	24	11	5	7	9
BFRI (Fish)	4	4	0	4	3	1	22	17	5	48	40	8	78	64	14	9	17	23
BLRI	5	3	2	5	4	1	17	10	7	26	19	7	53	37	16	10	11	8
SRDI	4	0	4	19	12	7	41	29	12	134	90	44	198	131	67	26	34	43
BARC	16	9	7	24	13	11	14	9	5	10	6	4	64	37	27	14	17	5
Grand Total	119	81	38	281	219	62	554	448	106	853	670	183	1807	1422	385	231	275	357

NB: EC= Executive Chairman, DG= Director General, MD= Member Director, CSO= Chief Scientific Officer, PSO= Principal Scientific Officer, SSO= Senior Scientific Officer and SO= Scientific Officer, Exist.= Existing.

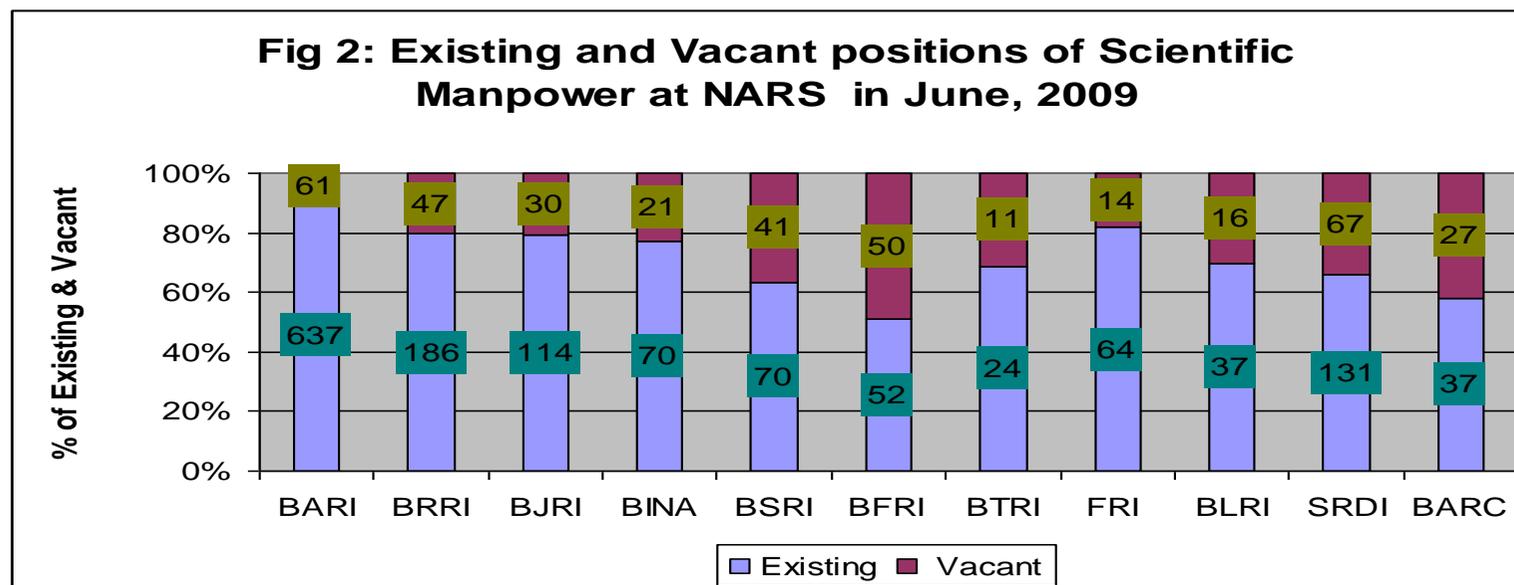


Table 4.3 Discipline-wise NARS present scientific manpower (CSO to SO) with their status (PhD and MS) in June, 2009

Institute Discipline	BARI		BARRI		BJRI		BINA		BSRI		BFRI		BTRI		FRI		BLRI		SRDI		BARC		Total		Grand Total
	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	PhD	MS	
Genetic & Breeding	14	50	8	13	2	11	8	3	3	5	0	6	0	4	0	0	0	0	0	0	0	0	35	86	121
Bio-technology	0	2	3	3	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	4	10	14
Genetic Resources	2	8	2	8	1	9	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5	28	33
Agronomy	26	122	8	7	3	10	2	3	1	5	0	0	0	4	0	0	0	0	0	0	6	0	46	151	197
Plant Physiology	0	0	2	5	0	0	5	3	0	6	1	3	0	0	0	0	0	0	0	0	0	0	8	17	25
Soil Science	17	41	4	10	0	0	8	8	1	4	1	2	0	4	0	0	0	0	0	0	1	0	32	69	101
Plant Pathology	21	48	7	10	1	4	3	2	2	4	0	0	2	2	0	0	0	0	0	0	0	0	36	70	106
Entomology	7	35	2	9	0	5	4	2	1	4	1	1	1	2	0	0	0	0	0	0	1	0	17	58	75
Horticulture	25	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	26	99	125
Agril. Engineering	3	14	12	18	0	0	2	5	1	4	0	2	0	0	0	0	0	0	0	0	1	0	20	42	62
Agril. Econ. SS.	12	14	3	6	0	0	0	0	0	4	0	2	0	0	0	3	1	1	0	0	2	0	18	30	48
Agril. Statist.	0	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	5
Plan, Train. & Co.	3	22	3	1	1	4	3	6	0	4	0	0	0	0	0	0	0	0	0	4	3	0	13	41	54
Adaptive. & Farming Sy.	1	40	11	17	0	7	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	11	70	81
Jute Fibre Quality	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
Pilot Plant & Processing	0	0	0	0	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	11
Mechanical Processing	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	10
Chemistry, Microbi. & Biochemistry	1	8	1	5	4	17	0	0	0	0	1	2	1	2	0	0	0	0	0	0	2	0	10	35	45
Textile Physics	0	0	0	0	2	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	15
Silviculture	0	0	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	1	6	7
Seed Orchard	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	7	7
Minor Forest Production	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	2	3
Forest Processing	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	2	8	10
Technology	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	0	0	0	0	0	0	3	3	6
Fish Nutrition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0	4
Fish Breeding	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	1	0	1	3	4
Fish Health Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	0	0	0	0	0	0	4	10	14
Fisheries Toxicology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	2	3	5
Aquaculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	0	0	0	0	0	0	4	7	11
Animal Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	3	4	7
Animal Health	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	0	0	0	0	2	5	7
Poultry & Goat Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	0	0	1	0	5	7	12
System Research	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	2
Soil Classification	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	49	0	0	4	49	53
Soil Physic & Micro-Bio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	66	0	0	8	66	74
Research Management	0	0	2	3	1	22	0	3	2	3	1	2	0	0	8	13	2	5	0	0	0	18	17	45	62
Total	132	505	69	117	19	125	35	35	12	55	9	43	4	20	26	38	13	23	12	119	19	18	350	1072	1422

Table 4.4 NARS scientific manpower, its retirement, and HRD plan for the year 2009-2015

Sl. No.	Organization	Scientific Manpower Provision (June, 2009)	PhD in position with percent (June, 2009)	Status of Retirement (2009-2015)			PhD Needed (2009-2015)	Post-Doc. Needed (2009-2015)	Short-term Training Needed (2009-2015)	Study Tour/ Workshops/ Seminars Needed (2009-2015)
				PhD	MS	Total				
1.	BARI	698	132 (18%)	25	45	70	82	10	170	62
2.	BARRI	233	69 (29%)	28	8	36	49	9	46	23
3.	BJRI	144	19 (13%)	7	11	18	23	2	25	10
4.	BINA	91	35 (38%)	5	6	11	12	2	21	7
5.	BSRI	111	12 (10%)	7	15	22	19	3	44	22
6.	BFRI (Forest)	102	9 (8%)	4	6	10	15	2	34	26
7.	BTRI	35	4 (11%)	2	3	5	5	1	10	5
8.	BFRI (Fish)	78	26 (34%)	6	3	9	15	3	28	16
9.	BLRI	53	13 (24%)	5	5	10	10	3	20	10
10.	SRDI	198	12 (6%)	2	24	26	21	2	91	22
11.	BARC	64	19 (29%)	9	5	14	0	5	15	23
	Total	1807	350 (19%)	100	131	231	251	42	504	226

Table 4.5 NARS scientific manpower, its retirement, and HRD plan for the year 2016-2020

Sl. No.	Organization	Scientific Manpower Provision (2009)	PhD (present + on going) (2015)	Status of Retirement (2009-2015)			Total PhD Needed (2016-2020)	Post-Doc Needed (2016-2020)	Short-term Training Needed (2016-2020)	Study Tour/ Workshops/ Seminar Needed (2016-2020)
				PhD	MS	Total				
1.	BARI	698	190	35	57	92	77	11	127	40
2.	BARRI	233	85	16	9	25	34	4	42	23
3.	BJRI	144	33	9	17	26	22	2	40	16
4.	BINA	91	42	9	10	19	14	1	29	9
5.	BSRI	111	21	5	11	16	14	2	28	10
6.	BFRI (Forest)	102	20	5	7	12	13	2	30	12
7.	BTRI	35	7	2	5	7	6	1	14	8
8.	BFRI (Fish)	78	35	12	5	17	11	3	27	17
9.	BLRI	53	17	4	7	11	11	3	20	10
10.	SRDI	198	26	4	30	34	15	2	83	19
11.	BARC	64	13	8	9	17	2	4	15	21
	Total	1807	489	109	167	276	219	35	455	185

Table 4.6 NARS scientific manpower, its retirement, and HRD plan for the year 2021-2025

Sl. No.	Organization	Scientific Manpower Provision (2009)	PhD (present + on going) (2020)	Status of Retirement (2021-2025)			PhD Needed (2021-2025)	Post-Doc Needed (2021-2025)	Short-term Training Needed (2021-2025)	Study Tour/ Workshops/ Seminar Needed (2021-2025)
				PhD	MS	Total				
1.	BARI	698	233	56	91	147	101	12	118	35
2.	BARRI	233	104	20	6	26	32	6	38	21
3.	BJRI	144	39	3	28	31	18	2	42	17
4.	BINA	91	47	10	13	23	16	2	31	14
5.	BSRI	111	30	1	18	19	17	4	45	17
6.	BFRI (Forest)	102	26	0	23	23	5	0	32	17
7.	BTRI	35	11	0	9	9	4	1	12	6
8.	BFRI (Fish)	78	37	8	15	23	13	3	21	14
9.	BLRI	53	24	4	4	4	6	3	13	7
10.	SRDI	198	41	6	37	43	10	2	73	18
11.	BARC	64	19	3	2	5	2	3	18	20
	Total	1807	611	111	246	353	224	38	443	186

Table 4.7. Summary of NARS Scientific manpower development plan for the years 2015, 2020 & 2025

Sl. No.	Organization	Scientific Manpower Provision (2009)	PhD Needed (2009-2015)	Post-Doc. Needed (2009-2015)	Short-term Training Needed (2009-2015)	Study Tour/ Workshops /Seminars Needed (2009-2015)	Total PhD Needed (2016-2020)	Post-Doc Needed (2016-2020)	Short-term Training Needed (2016-2020)	Study Tour/ Workshops /Seminar Needed (2016-2020)	PhD Needed (2021-2025)	Post-Doc Needed (2021-2025)	Short-term Training Needed (2021-2025)	Study Tour/ Workshops /Seminar Needed (2021-2025)
1.	BARI	698	82	10	170	62	77	11	127	40	101	12	118	35
2.	BRRI	233	49	9	46	23	34	4	42	23	32	6	38	21
3.	BJRI	144	23	2	25	10	22	2	40	16	18	2	42	17
4.	BINA	91	12	2	21	7	14	1	29	9	16	2	31	14
5.	BSRI	111	19	3	44	22	14	2	28	10	17	4	45	17
6.	BFRI (Forest)	102	15	2	34	26	13	2	30	12	5	1	32	17
7.	BTRI	35	5	1	10	5	6	2	14	8	4	1	12	6
8.	BFRI (Fish)	78	15	3	28	16	11	3	27	17	13	3	21	14
9.	BLRI	53	10	3	20	10	11	3	20	10	6	3	13	7
10.	SRDI	198	21	2	91	22	15	2	83	19	10	2	73	18
11.	BARC	64	0	5	15	23	2	4	15	21	2	4	18	20
	Total	1807	251	42	504	226	219	36	455	185	224	40	443	184

Fig 3: NARS Scientific manpower development (Ph. D)

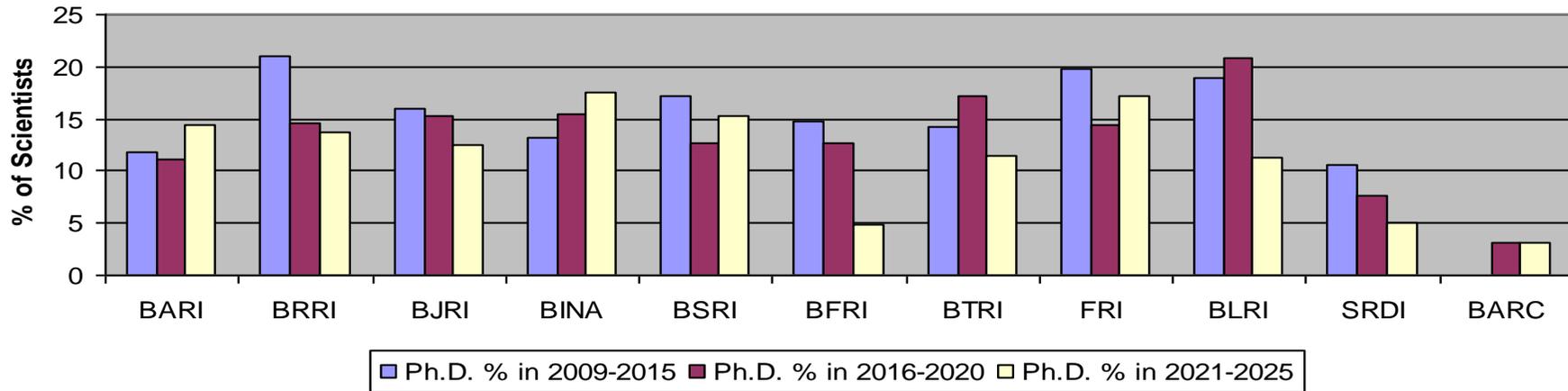


Fig. 4 NARS Scientific manpower development (Post-Doc.)

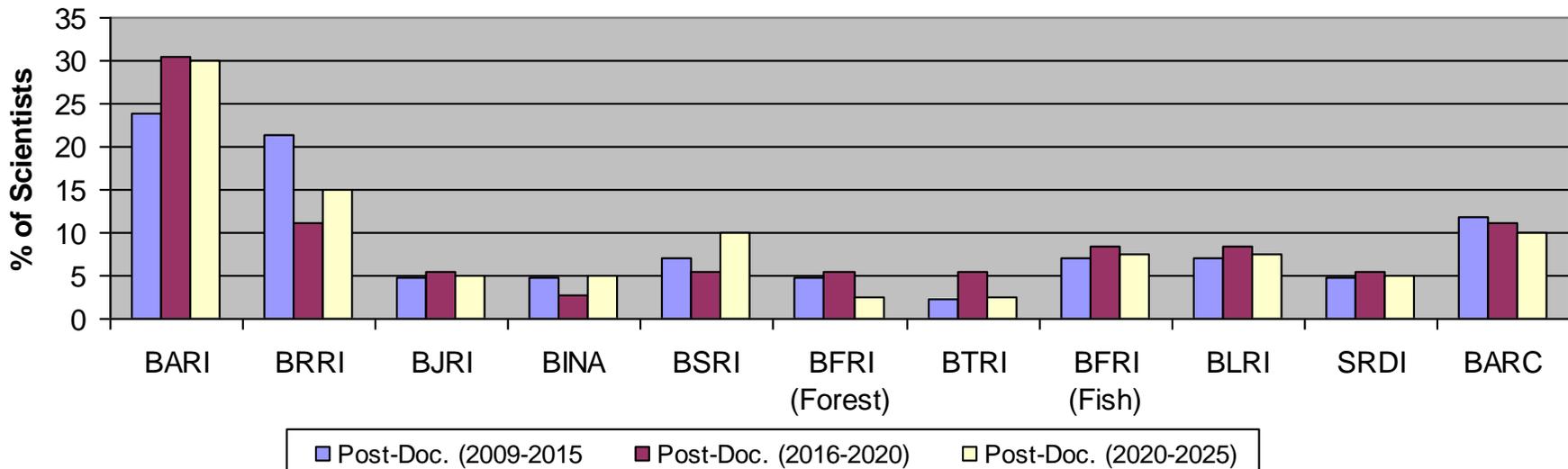


Fig 5: NARS Scientific manpower development (Short-term Training)

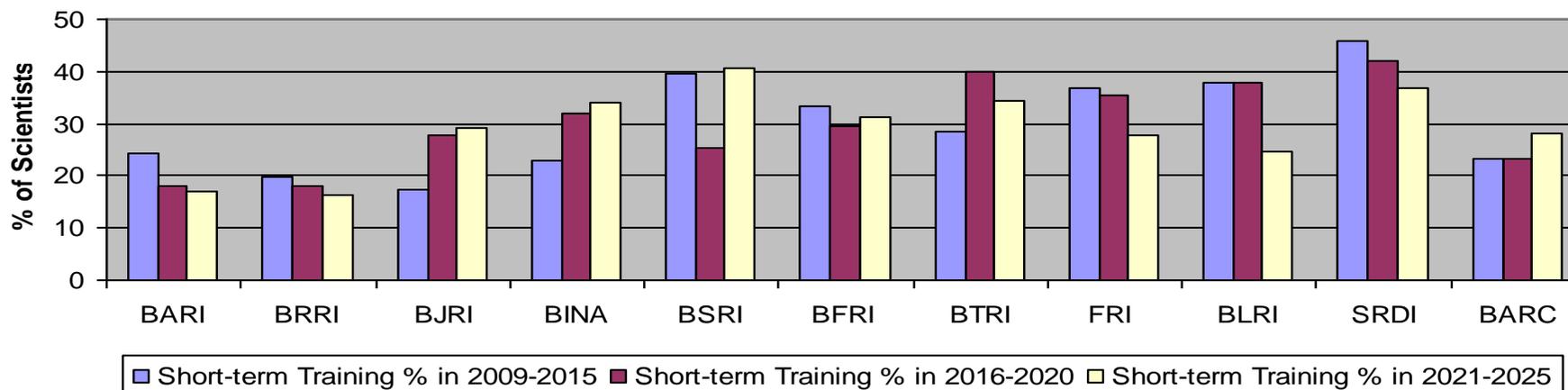


Fig 6: NARS Scientific manpower development (Study Tour/Seminar/Workshop)

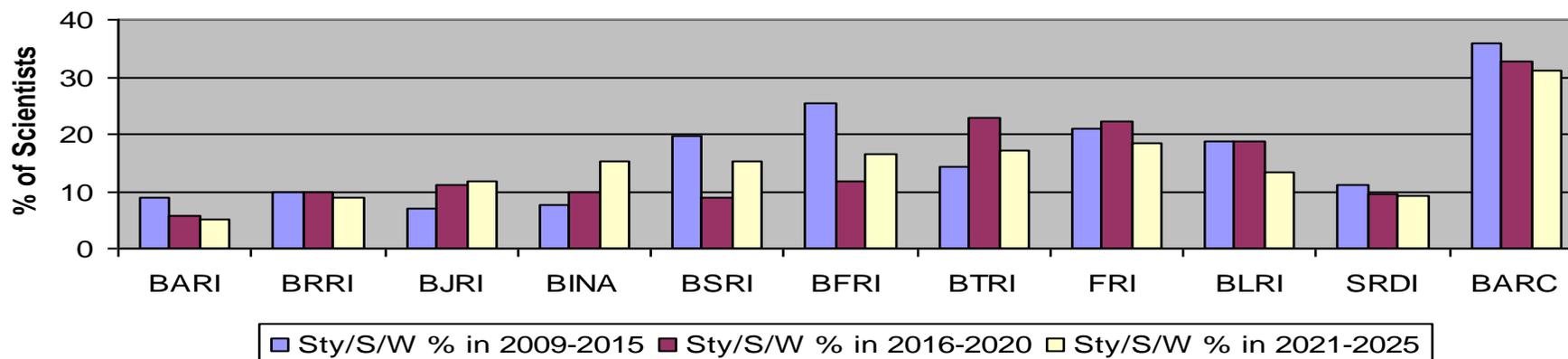


Table 4.8 Summary of total NARS scientific manpower development plan for the year 2009-2025

Sl. No.	Organization	Total PhD needed (2009-2025)	Total Post Doc. needed (2009-2025)	Total Short-term training needed (2009-2025)	Total Study tour/ seminar/ workshop needed (2009-2025)	Grand Total (2009-2025)
1.	BARI	260	33	415	137	845
2.	BRII	115	19	126	67	327
3.	BJRI	63	6	107	43	219
4.	BINA	42	5	81	30	158
5.	BSRI	50	9	117	49	225
6.	BFRI (Forest)	33	4	96	55	188
7.	BTRI	15	5	36	19	75
8.	BFRI (Fish)	39	9	76	47	188
9.	BLRI	27	9	53	27	116
10.	SRDI	46	6	247	59	358
11.	BARC	4	13	48	64	128
	Total:	694	118	1402	597	2827

Fig 7: Summary of Ph.D., Post Doc., Short Training, Study tour/ Seminar/ Workshop (2009-2025)

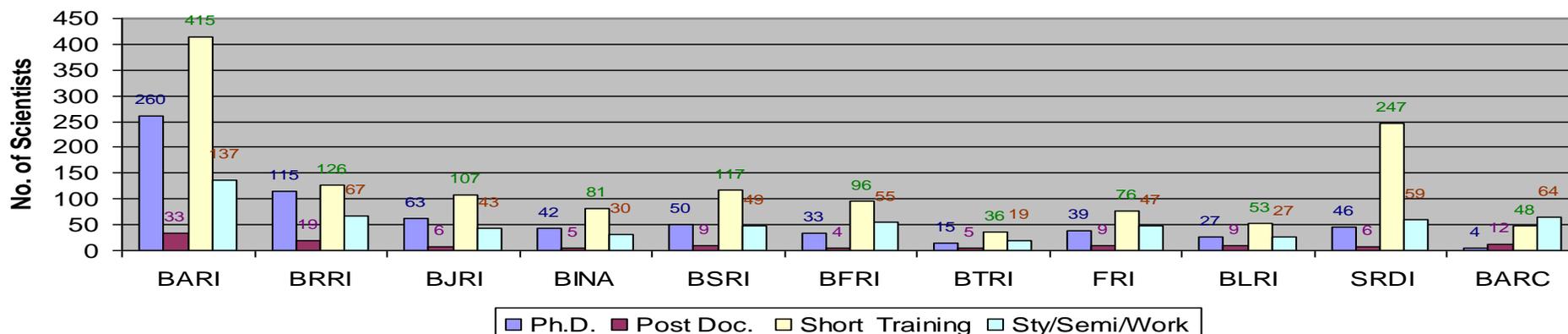


Table 4.9 BARC's local manpower development plan for NARS personnel for the year 2009-2025

Sl. No.	Type of training Training course	PhD (2009-2015)	Short-term training (2009-2015)	Seminar/workshop/meeting (2009-2015)	PhD (2016-2020)	Short-term training needed (2016-2020)	Seminar/workshop/meeting (2016-2020)	PhD needed (2021-2025)	Short-term training (2021-2025)	Seminar/workshop/meeting (2021-2025)	Total PhD (2009-2025)	Total Short-term training (2009-2025)	Total Seminar/workshop/meeting (2009-2025)
1.	PhD	171	0	0	185	0	0	215	0	0	571	0	0
2.	Foundation Training	0	240	0	0	200	0	0	200	0	0	640	0
3.	Research methodology	0	180	0	0	150	0	0	150	0	0	480	0
4.	Administration and financial management	0	180	0	0	150	0	0	150	0	0	480	0
5.	Procurement	0	180	0	0	150	0	0	150	0	0	480	0
6.	Financial management	0	180	0	0	150	0	0	150	0	0	480	0
7.	Monitoring and evaluation	0	180	0	0	150	0	0	150	0	0	480	0
8.	Research management	0	210	0	0	120	0	0	120	0	0	450	0
9.	Personnel management	0	210	0	0	180	0	0	180	0	0	570	0
10.	ICT/MIS	0	60	0	0	30	0	0	30	0	0	120	0
11.	Local Seminar, Workshop, Seminar, Meeting,. Field days, etc	0	0	3000	0	0	3500	0	0	4000	0	0	10500
	Total	171	1620	3000	185	1280	3500	215	1280	4000	571	4180	10500

5.0 Implementation plan of HRD program

5.1 Allocation and Selection Committee (SC)

Allocation of courses/scholarship would be done by BARC. The Committee will be composed of the following members:

- | | |
|--|--------------------|
| 1) Executive Chairman, BARC | - Chairman |
| 2) Concern Director General / Director | - Member |
| 3) Concern Member Director, BARC | - Member |
| 4) Member Director (P&E), BARC | - Member |
| 5) Subject Matter Specialist | - Member |
| 6) Director (Training), BARC | - Member Secretary |

5.2 TOR for the Committee

Allocate scholarships for all types of training to ARIs (2) Advise the ARIs to prioritize areas/jobs where the scientists would require training. (3) Advise the institute to nominate candidate for the job-specific training for each allocation, stating the skills they are needed to acquire and qualifications, experience with performance.

5.3 Institute wise selection committee (ISC)

The preliminary selection of the candidates will be done by a local level institutional committee comprising of the following personnel:

- | | |
|---|--------------------|
| 1) Director General/ Director | - Chairman |
| 2) Director (Res.) | - Member |
| 3) Concerned Head of Division | - Member |
| 4) Representative from BARC | - Member |
| 5) Director (Training)/ Concern Training Unit | - Member Secretary |

5.4 TOR of the Committee

- 1) The Committee will select field of training for short-term, higher-degrees, and study tour/workshops/ seminars.
- 2) The Committee will identify and select the jobs where the working scientists are lacking skills.
- 3) Based on the research areas, the importance of the jobs and the existing skill-gaps, the Committee will select the specific job areas, where the scientists would be required to acquire skills, and select the candidates.

- 4) The Committee will select and nominate candidate against each allocation and send the nominations to the Allocation and Selection Committee (Courses/ Scholarship) along with work experiences and performances of candidates.

5.5 Suggested selection criteria

5.5.1 General

- 1) Physical fitness of the candidate is essential to undertake hard and laborious studies/training.
- (2) Work experience in the regional research centers/sub-stations will have plus point. (3) Demonstration of evidence/track record as to candidate's ability/personality to make good impression of Bangladesh during training period abroad. (4) Demonstration of potential/good track record of the candidate's ability for self-growth and advancement after training.

5.5.2 PhD degree

Educational qualifications and experiences:

- 1) Minimum MS/M.Sc (Ag)/Equivalent degree in relevant discipline. (2) Minimum of two first classes/divisions. (3) Minimum three years of active service in the NARS in relevant field/discipline after obtaining Master degree. (4) Work experience in the research centers/sub-stations will have plus point. (5) Job specific/discipline specific degree only. (6) Age limit: Maximum 40 (forty) years for foreign PhD, and 45 (forty five) years for in-country PhD

5.5.3 Post Doctoral studies

Educational qualifications and experiences:

- 1) Minimum PhD/Equivalent degree in relevant discipline. (2) Minimum 3(three) years active service in the NARS after obtaining PhD Degree. (3) Post-Doctoral Studies will be only in candidate's relevant field/disciplines/ research areas. (5) Age limit: Maximum 50 (fifty) years. In some special fields the age limit should be relaxable.

5.5.4 Short-term training/study tours/workshops abroad

- 1) All scientists, technicians and research supporting personnel, having active services, short or long, in the NARS will be eligible. (2) Training/participation should be in the candidate's own field/discipline where he/she is actively working (3) Age limit: Maximum 55 (fifty five) years. Relaxable for study tour/workshop/ seminars.

5.6 Implementation of manpower development plan

Each of the NARS institutes has developed five years national research and development projects on the basis of their requirements. As per requirement of manpower development program the institute has been also included in the project. Upon approval of the project from the competent authority the

concerned institute's training division/section will process for the proper implementation of training programs and process for the placement of candidates in various universities/ institutes in home and abroad along with monitoring and evaluation of training programs till the returning of the trainees' own institutes. The major steps are as follows:

5.6.1 Steps for PhD/ MS/ Post Doctoral program abroad

- 1) Preparation of an announcement for awarding PhD and MS with indicating specific field of training, duration, and requirement of candidates' performance.
- 2) Announcement circulation for nomination of suitable candidates.
- 3) Supply of prescribed application forms and self-score sheet for filled in by the candidates.
- 4) Receiving application forms along with self score sheet in time.
- 5) Scrutinizing application forms and self score sheet.
- 6) Preparation a list of candidates field wise in a format stating name and designation, organization, date of birth, date of joining in service, previous training, justification of training, etc. with the candidates self scoring.
- 7) Arrangement of selection committee meeting for selecting the suitable candidates.
- 8) Final approval of the decision of the Selection Committee may be taken by the training division/ section from the concerned head of the organization.
- 9) Issuance of award letters stating the submission of all necessary documents for admission from various universities abroad and other related papers for Govt. approval.
- 10) Identification of suitable universities abroad for proper placement.
- 11) Processing case by case of individual candidate's admission in specific field and specific university abroad. For admission dispatch of application forms, transcripts, recommendations letters, TOFEL score, etc. as per requirement of the university.
- 12) Maintenance of individual candidates files by the training unit of BARC.
- 13) Upon admission of candidates in suitable universities abroad, BARC will forward the proposal as case by case to the concerned ministry copy to Ministry of Agriculture.
- 14) All pre-departure arrangements, including visa, finance, ticket, etc. are to be made by the training unit of BARC.
- 15) The scholar is given an orientation about the country and university where they will go and collect information accordingly.
- 16) Continuous correspondence and monitoring regarding the academic progress of scholar are maintained.
- 17) Official as well as personal problems of scholars are to be hard and managed.

- 18) On completion of study abroad and upon arrival, each scholar must submit a report which will be reviewed.
- 19) The training unit has the responsibility to follow up the trained personnel and their appropriate position in their job.

5.6.2 Steps for local PhD/ MS

- 1) All steps that are followed for award of foreign fellowships, as mentioned above in 5.6.1.
- 2) Govt. clearance, visa, ticket, English test, etc.

5.6.3 Steps for short-term training, study tour, seminar/ workshop abroad

- 1) Upon selection of suitable candidates should follow the procedure as in 5.6.1. The institutes will forward the nominations to the BARC for their placement.
- 2) BARC's training unit sorting the available nominations from various NARS institutes and compile discipline wise for placement in a suitable institute in a group or individual as per merit of the trainees.
- 3) Approval will be given by the Executive Chairman of BARC for placement on discipline-by-discipline in different countries abroad.
- 4) Identification of universities/ institutes will be done for the selected candidates for proper placement in abroad.
- 5) Request should be made to the foreign universities/ institutes for concerned training with relevant papers and documents.
- 6) Upon approval of the training program/ study tour from abroad, relevant papers will be collected from the candidates for onward transmission to the Govt. for approval.
- 7) Upon approval by the Govt. the request for issuance of visa and arranging ticket, transfer currency, etc. should be made.
- 8) Pre-departure also made for short term training and study tour, but in the case of seminar/ workshop no need of pre-departure arrangement.
- 9) On completion of study abroad and upon arrival each scholar must submit a report which will be reviewed and recommendations will be made for incorporation by the institute's program.
- 10) The training unit has also responsibility to follow up the trained personnel and their appropriate position in their job and their post evaluation.

5.6.4 In-country short-term training, seminar/workshop

1. As per provision of the project proposal the training unit of BARC or institute concerned the annual local training plan will be prepared with estimated budget and got its approval from the head of the organized.
2. In the case of BARC's local foundation or management training BARC will request the PATC or BARD for arranging such types training and provide funds and do monitoring and evaluation of training programs. In these programs BARC will seek nominations from NARS institutes.
3. Also BARC will provide funds for organizing specific fields of training in the respective institutes/ universities.
4. BARC will arranges national and international seminar/ workshop on the basis of national needs and will also provides funds for arranging seminar/ workshop/ field days by the institutes/ universities.

5.6.5 Placement of NARS scientists for manpower development in home and abroad for the year 2009-2025

5.6.5.1 Degree training: The NARS training plan for the period of 2010 to 2025 as mentioned in Table 4.1 will be implemented as per procedure for implementation of training programs at home and abroad. It is observed that in the NARS manpower development plan provisions of 251 PhD in the years of 2009 to 2015. Among them 146 PhD programs are allocated for Bangladesh, 91 PhD are allocated for TWC and the rest 14 are allocated for Developed Countries. Similarly in the year 2016-2020 there are provisions of 219 PhD in which 143 PhD are allocated for Bangladesh, 69 PhD are allocated for TWC and only 7 PhD are allocated in DC. During the year of 2021-2025 out of 224 PhD provisions 150 PhD allocated in Bangladesh, 66 PhD for TWC and only 8 PhD in DC (Table 5.1 & Fig. 8). It is mentioned that out of total 694 PhD provisions 439 are allocated in Bangladesh, whereas 226 PhD would be placed in TWC and 29 PhD would be placed in DC in the field of molecular biology, molecular bio-information, molecular marker, tissue culture, biotechnology, physiology, vaccine development, etc.

5.6.5.2 Post Doctoral programs: In case of Post Doctoral fellowship there are provisions of 42 post doctoral fellows in the year 2009-2015 and would be placed in TWC of 33 and 9 would be placed in DC. Where as in 2016-2020 there are provisions of 36 post doctoral fellowships, by which 28 to be placed in TWC and 8 in DC. In 2021-2025 there are provisions of 40 post doc., 30 would be placed in TWC and 7 in DC. It is clear that about 80% of post doc provisions are kept for TWC and 20% would be in DC (Table 5.2).

5.6.5.3 Non-degree training in abroad: The placement of short term training in TWC for about 481 scientists and only 23 scientists to be placed in DC during 2009-2015, whereas during 2016-2020 the placement of short term training in TWC will be for 445 scientists and 10 scientists will be in DC and during 2021-2025 plan period 433 scientists will be placed in TWC and 10 scientists in DC. The placement of total short term training participants would be 1359 (97%) in TWC and 64 (3%) in DC (Table 5.3). This plan is prepared for retention of scientists in NARS institutes.

5.6.5.4 Study tour/ seminar/ workshop/ meeting in abroad

Participation of scientists in the international study tour/ seminar/ workshop helps a lot in improving their professionalism. The scientists can interact with the eminent scientists while participating in the international forum. During 2009-2015 plan period there are 228 provisions and out of which 222 scientists will be placed in TWC and only 6 in DC. During 2016-2020 plan period there are provisions of 185 scientists to be participated the above mentioned programs in TWC and none in DC. Whereas during 2021-2025 plan period there are provisions of 186 scientists' participation, in which 182 scientists are allocated in TWC and only 4 in DC. In total study visit, seminar, workshop, etc. 656 scientists will placed in TWC which is about 98% and rest 10 (2%) will be placed in developed countries (Table 5.4).

5.6.6 Budgetary requirements

Assessment of budget for different training in different countries is very essential for preparation of a project. On the other hand without proper guidelines it is very difficult to prepare proper budget for training programs in home and abroad. Previous experiences indicate that it is very difficult to implement the training programs properly without proper homogenous budget. Thus there is requirement of budget guidelines for preparation of uniform budget to NARS. On that basis a training budget guideline and the budget requirements for PhD at home and abroad, Post Doctoral in abroad, Short term training in abroad and study visit/seminar/workshop in abroad is placed in Table 5.5 and budget preparation guideline is placed in Table 5.6.

The estimated budget requirement for NARS is prepared on the basis of training plan and budgetary guidelines. The summary budget requirement for NARS scientific manpower development for the period from 2009-2015 is about US\$ 15.27 million. Whereas, during 2016-2020 the budget requirement would be US\$ 12.42 million and during 2021-2025 will be US\$ 12.45 million for implementation of training provisions. The detailed budgetary requirement of each of the institutes in various countries is shown in Table 5.6.

On the other hand the budget requirement for different fields of local training, seminar/workshop for scientists, officers and supporting staff is placed in Table 5.7. In the budget there are provisions of 1620

persons in various national trainings, where requirements of fund will be Tk. 438.00 lacs and for seminars and workshops fund requirement will be Tk. 60.00 lacs during 2009-2015. Whereas during 2016-2020 the fund requirements will be Tk. 365.50 lacs for 1280 scientists' participation in various training programs and Tk. 70.00 lacs for participation in seminars /workshops. In the years 2021-2025 the cost involvement of Tk. 365.50 lacs will be necessary for 1280 persons' participation in various trainings and Tk. 80.00 lacs will be necessary for 4000 persons participation in national seminars workshops.

5.6.7 Measures to ensure return, utilization and retention of scientists in profession

The limitations of HRD program are not only the problems in arranging funds for training scientists abroad, very often, the scientists sent for training linger their stay beyond stipulated time, for one reason or others. They often find job abroad, manage work visa and express unwillingness to come back. Those who come back are often not properly utilized as per acquired skills. Besides many do not stay in their profession and leave the institute. To overcome these problems, measures suggested to bring back the scholars trained outside, utilize them properly as per acquired skills and introduce an attractive incentive packages, motivational program and create research-friendly environment for the trained scholars to stay in the profession.

5.6.7.1 Return of scientists trained abroad: It may be mentioned that in the HRD plan more than 90% are allocated for placement in TWC to ensure return of scholars upon training from abroad. The scholar shall sign a bond of agreement stating his return after completion of training.

Bond of agreement: All selected and admitted candidates shall sign a bond of agreement in a non-judicial stamp worth Tk. 150/- countersigned by an advocate and a first class magistrate (annex-iii).

Passport: All foreign trainees will be under official/gratis passport. Validation of passport will be for the period, not exceeding 3 (three) months beyond the training period.

Administrative measures: Disciplinary action including dismissal/forfeitures of service benefits, etc. shall be taken

Legal Notices: Serve legal notices and take legal actions to bring back the trained scientist as per agreement bond. The matters of violation of any articles of bond of agreement will be taken up in the court of law for legal actions against the candidate for non-return.

5.6.7.2 Utilization of trained scientists

Deployment of the scientist will be made to work in appropriate areas for which he/she would be trained to acquire the skills. The trained scientists would be required to submit a work plan detailing the skills acquired and the way of utilizing the skills to perform the jobs effectively. Required support

services, regular monitoring, performance appraisal, delegation of responsibility and accountability, proper attention and due recognition and honour including the benefits of the incentive packages would be provided to keep the motivation of the trained scientists. BARC will monitor the proper deployment of the scientists, after training, and ensure proper utilization and evaluate their performance as per prescribed format.

5.6.7.3 Retention of scientists in profession

There are some bonafied reasons that encourage the qualified scientists to search jobs elsewhere such as absence of motivational work, atmosphere for professional activities, limited opportunities for promotion of activities and advancement of career, posting of highly trained scientists in a remote research centre/substations, where the facilities are absent to utilize the acquired skills and educate their children, lack of required attention to the problems of highly motivated scientists/technicians. Therefore, the human resource management system will ensure to properly recognize their necessity, assign the jobs for which they were trained to acquire the skills and deploy them in appropriate place.

For proper management of NARS human resources, the consultant has suggested that a unified Service Rules to be developed for NARS and also established an independent Scientists Recruitment Division at BARC. In the service rules in addition to other rules the following points to be incorporated for better performance of the organizations

- i) Advanced increment to candidate obtaining for each first class or equivalent cumulative grade point in the academic degrees at the entry point.
- ii) For PhD degree holder five advanced increments to be given.
- iii) Ensured regular and timely promotion (The hurdle regarding promotion needs to be removed immediately through person post up gradation on in situ promotion).
- iv) Special incentive to be given for the outstanding performance (Special pay/ advanced increment *like PARC research allowance*).
- v) After 20 years of service 25% CSO/Director is to be given selection grade on basis of seniority and outstanding performance.
- vi) Provision of Scientist Emeritus. [It is a reiteration of recommendation given by Hasanuzzaman (2000) who recommended that the last pay should be his retirement pay. So that a talented scientist may be retained without any extra cost provided the scientist wants to continue his research for progress and benefit of his nation.]
- vii) Provision of National Agricultural Scientist Award in recognition of outstanding contribution. [It is a reiteration of a suggestion given by Shaikh (2000) in the line of National Professor.]
- viii) National Awards/ Honour and Honorarium for some 10-15 outstanding scientists of every year. The each national award would include a certificate and cash Tk. 2,00,000/- only. [It is a reiteration of a suggestion given by Shahjahan (2006).]
- ix) Provision for RARS, sub-station allowance for the scientists.
- x) Retiring age to be raised to 65 years.
- xi) Benefit of intellectual property right to be ensured for the scientists.
- xii) The working environment should be made free from pollution of all sorts of conflicts and interest groups.

Table 5.1 Placement of NARS PhD program at home and abroad for the year 2009-2025

Organization	2009-2015				2016-2020				2021-2025				Grand Total		
	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC
BARI	42	34	6	82	47	27	3	77	65	34	2	101	154	95	11
BIRRI	29	18	2	49	18	15	1	34	20	11	1	32	67	44	4
BJRI	13	9	1	23	14	8	0	22	10	7	1	18	37	24	2
BINA	5	6	1	12	7	6	1	14	10	5	1	16	22	17	3
BSRI	13	3	3	19	10	2	2	14	12	3	2	17	35	8	7
BFRI (Forest)	7	8	0	15	9	4	0	13	5	0	0	5	21	12	0
BTRI	3	2	0	5	6	0	0	6	3	1	0	4	12	3	0
BFRI (Fish)	10	4	1	15	8	3	0	11	10	2	1	13	28	9	2
BLRI	7	3	0	10	10	1	0	11	6	0	0	6	23	4	0
SRDI	17	4	0	21	14	1	0	15	9	1	0	10	40	6	0
BARC	0	0	0	0	0	2	0	2	0	2	0	2	0	4	0
Total:	146	91	14	251	143	69	7	219	150	66	8	224	439	226	29

NB: BD=Bangladesh, TWC=Third World Country, DC=Developed Country. Projection is made incase of PhD 70% is kept for BD, 25% TWC and 5% in DC. The PhD candidates in Bangladesh may be placed appropriate universities abroad for a period of three months for attending course work, chemical analysis if needed including collection of literature and also discussion with his/her thesis relevant professor/scientists.

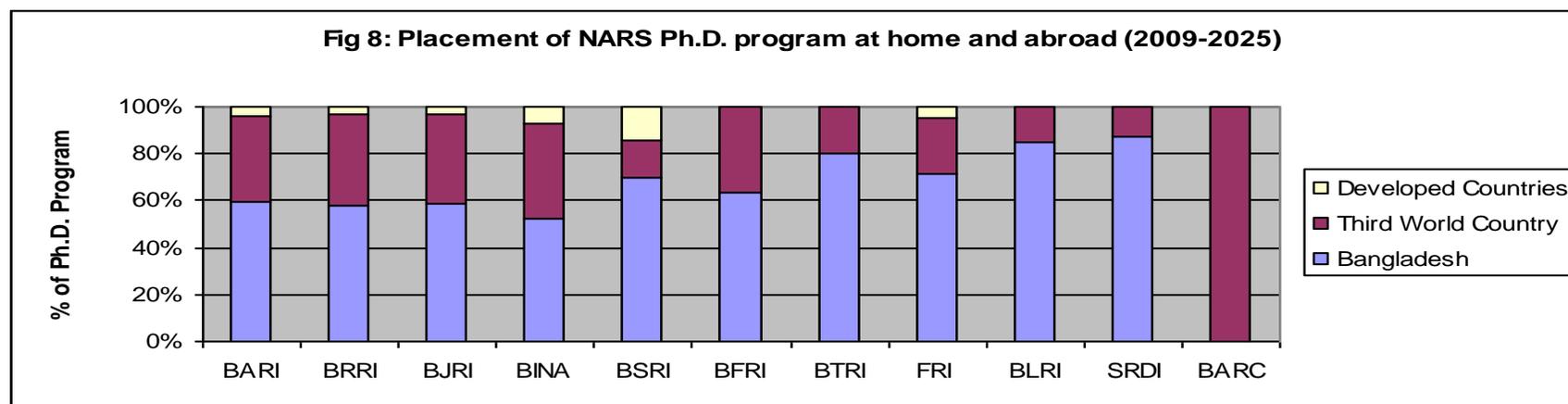


Table 5.2 Placement of NARS scientists for post doctoral programs in abroad for the years 2009-2025

Period Organization	2009-2015				2016-2020				2021-2025				Grand Total		
	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC
BARI	0	9	1	10	0	11	0	11	0	11	1	12	0	33	2
BARRI	0	8	1	9	0	3	1	4	0	5	1	6	0	16	3
BJRI	0	0	2	2	0	1	1	2	0	2	0	2	0	0	6
BINA	0	2	0	2	0	1	0	1	0	1	1	2	0	4	1
BSRI	0	2	1	3	0	1	1	2	0	3	1	4	0	5	4
BFRI (Forest)	0	1	1	2	0	1	1	2	0	0	1	0	0	2	2
BTRI	0	1	0	1	0	1	0	1	0	1	0	1	0	3	0
BFRI (Fish)	0	2	1	3	0	2	1	3	0	3	0	3	0	7	2
BLRI	0	3	0	3	0	3	0	3	0	3	0	3	0	9	0
SRDI	0	2	0	2	0	2	0	2	0	2	0	2	0	6	0
BARC	0	3	2	5	0	3	2	4	0	2	2	3	0	6	6
Total	0	33	9	42	0	29	7	35	0	33	7	38	0	91	26

NB: BD=Bangladesh, TWC=Third World Country, DC=Developed Country, Post D.=Post Doctoral. The placement of Post Doc. in TWC will be 95% and rest in DC.

Table 5.3 Placement of NARS scientists for short term training program in abroad for the years 2009-2025

Period Organization	2009-2015				2016-2020				2021-2025				Grand Total		
	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC
BARI	0	150	20	170	0	117	10	127	0	110	8	118	0	377	38
BARRI	0	46	0	46	0	42	0	42	0	38	0	38	0	126	0
BJRI	0	25	0	25	0	40	0	40	0	42	0	42	0	107	0
BINA	0	21	0	21	0	29	0	29	0	31	0	31	0	81	0
BSRI	0	41	3	44	0	28	0	28	0	43	2	45	0	112	5
BFRI (Forest)	0	34	0	34	0	30	0	30	0	32	0	32	0	96	0
BTRI	0	10	0	10	0	14	0	14	0	12	0	12	0	36	0
BFRI (Fish)	0	28	0	28	0	27	0	27	0	21	0	21	0	76	0
BLRI	0	20	0	20	0	20	0	20	0	13	0	13	0	53	0
SRDI	0	91	0	91	0	83	0	83	0	73	0	73	0	247	0
BARC	0	15	0	15	0	15	0	15	0	18	0	18	0	48	0
Total	0	481	23	504	0	445	10	455	0	433	10	443	0	1359	43

NB: BD=Bangladesh, TWC=Third World Country, DC=Developed Country, Short T.=Short Training, . Projection is made incase of Short Training would be 90% in TWC and 10% in DC.

Table 5.4 Placement of NARS scientists/ officers for study tour/seminar/workshop program in abroad for the year 2009-2025

Period Organization	2009-2015				2016-2020				2021-2025				Grand Total		
	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC
BARI	0	56	6	62	0	40	0	40	0	32	3	35	0	128	9
BRRI	0	25	0	25	0	23	0	23	0	21	0	21	0	67	0
BJRI	0	10	0	10	0	16	0	16	0	17	0	17	0	43	0
BINA	0	7	0	7	0	9	0	9	0	14	0	14	0	30	0
BSRI	0	22	0	22	0	10	0	10	0	17	0	17	0	49	0
BFRI (Forest)	0	26	0	26	0	12	0	12	0	16	1	17	0	54	1
BTRI	0	5	0	5	0	8	0	8	0	6	0	6	0	19	0
BFRI (Fish)	0	16	0	16	0	17	0	17	0	14	0	14	0	47	0
BLRI	0	10	0	10	0	10	0	10	0	7	0	7	0	27	0
SRDI	0	22	0	22	0	19	0	19	0	18	0	18	0	59	0
BARC	0	23	0	23	0	21	0	21	0	20	0	20	0	64	0
Total	0	222	6	228	0	185	0	185	0	182	4	186	0	587	10

NB: BD=Bangladesh, TWC=Third World Country, DC=Developed Country, Sty/S/W=Study tour / Seminar / Workshop. Projection is made incase of Study tour / Seminar / Workshop @ 95% in TWC and 5% in DC.

Table 5.5 Estimated budget requirements for NARS manpower development plan for the year 2009-2025

(000 US \$)

Period Type of Training	2009-2015				2016-2020				2021-2025				Grand Total			
	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total	BD	TWC	DC	Total
PhD	(146) 1752.00	(91) 5460.00	(14) 1400.00	(251) 8480.00	(143) 1716.00	(69) 4140.00	(7) 700.00	(219) 6556.00	(150) 1800.00	(66) 3960.00	(8) 800.00	(224) 6560.00	(439) 5268.00	(226) 13560.00	(29) 2900.00	(694) 21728.00
Post D	(0) 00.00	(33) 1155.00	(9) 360.00	(42) 1515.00	(0) 00.00	(28) 980.00	(8) 320.00	(36) 1300.00	(0) 00.00	(33) 1155.00	(7) 280.00	(40) 1435.00	(0) 00.00	(94) 3290.00	(24) 960.00	(118) 4250.00
Short T.	(0) 00.00	(481) 3848.00	(23) 276.00	(504) 4124.00	(0) 00.00	(445) 3560.00	(10) 120.00	(455) 3680.00	(0) 00.00	(433) 3464.00	(10) 120.00	(443) 3584.00	(0) 00.00	(1359) 10872.00	(43) 516.00	(1402) 11388
Sty/S/W	(0) 00.00	(222) 1110.00	(6) 36.00	(228) 1146.00	(0) 00.00	(185) 925.00	(0) 00.00	(185) 925.00	(0) 00.00	(182) 910.00	(4) 24.00	(186) 934.00	(0) 00.00	(589) 2945.00	(10) 60.00	(599) 3005.00
Total	(146) 1752.00	(827) 11573.00	(52) 2072.00	(1025) 15265.00	(143) 1716.00	(726) 9605.00	(25) 1140.00	(895) 12461.00	(150) 1800.00	(714) 9489.00	(29) 1224.00	(893) 12513.00	(439) 5268.00	(2268) 30667.00	(106) 4436.00	(2813) 40371.00

Table 5.6 Guidelines for budget preparation for PhD post doctoral, Short- term Training, etc. at home and abroad

Sl. No.	Items	TWC (India, Thailand, Philippines, Malaysia, Indonesia, etc.)	DC (USA, Canada, Japan, etc.)	DC (Europe)	Australia, New Zealand	Africa	Remarks
A.	PhD/MS.						
1.	Application form fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
2.	Registration fee	-Do-	-Do-	-Do-	-Do-	-Do-	
3.	Tuition fee	-Do-	-Do-	-Do-	-Do-	-Do-	
4.	Foreign Student fee	-Do-	-Do-	-Do-	-Do-	-Do-	Philip & Malays
5.	Monthly scholarship	US\$ 800.00	US\$ 1200.00	US\$ 1000.00	US\$ 900.00	US\$ 800.00	
6.	Settlement allowance (One time)	US\$ 450.00	US\$ 600.00	US\$ 600.00	US\$ 600.00	US\$ 500.00	
7.	Book allowance (One time)	US\$ 500.00	US\$ 500.00	US\$ 500.00	US\$ 500.00	US\$ 500.00	
8.	Small equipments	US\$ 1500.00	US\$ 1500.00	US\$ 1500.00	US\$ 1500.00	US\$ 1500.00	
9.	Research cost for TWC	US\$ 8000.00	-	-	US\$ 10,000.00	US\$ 8000.00	Maximum
10.	Thesis preparation cost	US\$ 600.00	US\$ 600.00	US\$ 600.00	US\$ 500.00	US\$ 500.00	
11.	Health insurance	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
12.	Shipment	US\$ 300.00	US\$ 400.00	US\$ 400.00	US\$ 400.00	US\$ 400.00	
13.	Round trip air fare	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
B.	Post Doctoral/Sabbatical						
1.	Application form fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
2.	Course fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
3.	Monthly living cost	US\$1500.00	US\$ 2000.00	US\$ 2000.00	US\$ 1800.00	US\$ 1500.00	
4.	Health insurance	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
5.	Shipment	US\$ 200.00	US\$ 300.00	US\$ 300.00	US\$ 300.00	US\$ 300.00	
6.	Round trip air fare	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
C.	Short Training (Up to 8 weeks)						
1.	Application form fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
2.	Course fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
3.	Monthly scholarship	US\$ 1200.00	US\$ 1500.00	US\$ 1500.00	US\$ 1400.00	US\$ 1200.00	
4.	Health insurance	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
5.	Shipment	US\$ 100.00	US\$ 150.00	US\$ 150.00	US\$ 150.00	US\$ 150.00	
6.	Round trip air fare	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
D.	Short Training (9-52 weeks)						
1.	Application form fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
2.	Course fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
3.	Monthly scholarship	US\$ 1000.00	US\$ 1300.00	US\$ 1200.00	US\$ 1100.00	US\$ 1000.00	
4.	Health insurance	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
5.	Shipment	US\$ 200.00	US\$ 300.00	US\$ 300.00	US\$ 300.00	US\$ 300.00	
6.	Round trip air fare	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
E.	Study tour/Seminar/Workshop						
1.	Registration fee	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
2.	Daily allowance	GOB Rate	GOB Rate	GOB Rate	GOB Rate	GOB Rate	
3.	Health insurance	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	
4.	Round trip air fare	As per requirement	As per requirement	As per requirement	As per requirement	As per requirement	

NB: TWC=Third World Countries, DC=Developed Countries, where estimated budget requirement for PhD in TWC, Africa, and Middle East US\$ 60,000.00 to 70,000.00, DC US\$ 100,000.00 and in Australia US\$ 80,000.00 for a duration of 42 months with inflation of scholarship @ 5% annually. In Bangladesh the total estimated budget requirement of US\$ 12,000.00 with monthly scholarship of Tk. 10,000.00 including research cost Taka 200,000.00. In case of post doctoral for a duration one year US\$ 35,000.00 per scholar for TWC and US\$ 40,000.00 for DC, whereas short term training in TWC US\$ 8,000.00 will be needed for two months training and US\$12,000.00 for DC and study visit/seminar/workshop per recipients cost will be US\$ 5,000.00 in TWC and US\$ 6,000.00 for DC.

Table 5.7 BARC's local manpower development plan for NARS personnel for the year 2009-2025

(Tk. in 000.00)

Sl. No.	Type of Training Training Course	PhD (2009-2015)	Short-term training (2009-2015)	Seminar/workshop /meeting (2009-2015)	PhD (2016-2020)	Short-term training needed (2016-2020)	Seminar/workshop /meeting (2016-2020)	PhD needed (2021-2025)	Short-term training (2021-2025)	Seminar/workshop / meeting (2021-2025)	Total PhD (2009-2025)	Total Short-term training (2009-2025)	Total Seminar/workshop/ meeting (2009-2025)
1.	PhD	(146) 0	0	0	(143) 0	0	0	(150) 0	0	0	(571) 0	0	0
2.	Foundation Training	0	(240) 3,0000.00	0	0	(200) 2,5000.00	0	0	(200) 2,5000.00	0	0	(640) 8,0000.00	0
3.	Research methodology	0	(180) 3600.00	0	0	(150) 3000.00	0	0	(150) 3000.00	0	0	(480) 9600.00	0
4.	Administration and financial management	0	(180) 3600.00	0	0	(150) 3000.00	0	0	(150) 3000.00	0	0	(480) 9600.00	0
5.	Procurement	0	(180) 900.00	0	0	(150) 750.00	0	0	(150) 750.00	0	0	(480) 2400	0
6.	Financial management	0	(180) 900.00	0	0	(150) 750.00	0	0	(150) 750.00	0	0	(480) 2400	0
7.	Monitoring and evaluation	0	(180) 900.00	0	0	(150) 750.00	0	0	(150) 750.00	0	0	(480) 2400	0
8.	Research management	0	(210) 2100.00	0	0	(120) 1200.00	0	0	(120) 1200.00	0	0	(450) 4500.00	0
9.	Personnel management	0	(210) 2100.00	0	0	(180) 1800.00	0	0	(180) 1800.00	0	0	(570) 5700.00	0
10.	ICT/MIS	0	(60) 600.00	0	0	(30) 300.00	0	0	(30) 300.00	0	0	(120) 1200.00	0
11.	Local Seminar, Workshop, Seminar, Meeting,. Field days, etc	0	0	(3000) 6000.00	0	0	(3500) 7000.00	0	0	(4000) 8000.00	0	0	(10500) 2,1000.00
	Total:	(146) 0	(1620) 4,3800.00	(3000) 6000.00	(143) 0	(1280) 3,6550.00	(3500) 7000.00	(150) 0	(1280) 3,6550.00	(4000) 8000.00	(571) 0	(4180) 11,7800.00	(10500) 2,1000.00

6.0 Monitoring and Evaluation

The term monitoring has been defined as a continuous or periodic review of the implementation activities to ensure that input deliveries, work schedules, targeted outputs and other required actions are proceeding according to plan. Whereas, evaluation has been defined as a process for determining systematically and objectively the relevance, efficiency, effectiveness and impacts in the light of their objectives (Bary Nestle, ISNAR Working Paper No. 22, March 1989). Both monitoring and evaluation are necessary for keeping the track of progress and effectiveness of the HRD programs.

One of the effective procedures of monitoring is the use of a checklist program activity. The checklist provide simple but effectively comparing the targets with the achievements for each component of a program. Items to be monitored at quarterly and annual intervals shall include, among other the following:

- A. Program attributes:
 - 1. Number of programs/ projects under implementation
 - 2. Types and number of personnel (Management staff, scientists, technicians, support staff, etc.)
 - 3. Levels and number of training (Post Doc. PhD Non degree training, Study tour/ Seminar/ Workshop, etc.)
 - 4. Commodities and disciplines
 - 5. Institutions
 - 6. Gender balance

- B. Facilities and resources:
 - 7. Funding position and timely fund availability
 - 8. Foreign assistance
 - 9. Physical facilities for different training programs
 - 10. Availability of trainers, counselors
 - 11. Training materials
 - 12. Working environment
 - 13. Other logistic support if any

- C. Trainees:
 - 14. Selection of trainees
 - 15. Pre-training preparation
 - 16. Process for training
 - 17. Training completion reports from program coordinators (achievements of each trainees including different pre and post test reports)
 - 18. Training evaluation reports from trainees

- D. Other information:
 - 19. New recruitment made
 - 20. Retirements resignation and deaths
 - 21. Promotion, award, and special achievements
 - 22. Disciplinary action and punishment

Overall evaluations of programs besides the immediate evaluation of the specific training are needed at the following levels:

- A. Immediate evaluation of a training program
- B. By institute yearly evaluation by the own division or through a committee composed of HRD personnel and other members from other institutes
- C. External evaluation at 3-4 yearly intervals

The immediate evaluation at the end of the each training course should be a part of periodic monitoring. The immediate evaluation of each training, study tour/ seminar/ workshop in a format stated below:

Self Evaluation format

For training, study tour/ seminar/ workshop

1. Title of the course/topics:
2. Duration: from to
3. Venue: Country
4. Objectives:
5. Methodology:

	Very good	Good	Average	Poor
a. Class room lecture				
b. Group discussion				
c. Exercise				
d. Field visit				
e. Visual materials				
f. Overall facilities				
6. Contents and materials:

	Very good	Good	Average	Poor
a. Contents of course/topic				
b. Information provided				
c. Instructors knowledge				
d. Delivery/presentation				
7. Do you have any idea for more improvement?
 - a.
 - b.
 - c.
8. Do you think the course is useful? Please indicate:
 - a.
 - b.
 - c.
9. Do you have computer facility for course and E-mail purpose?
10. Recommendations:

In the evaluation process, training output in terms of skill development of the trainees will be assessed. Post activity evaluation will also be considered as indicators of the training success.

7.0 Conclusion

Human Resources is the vital force of national development. A nation is developed in accordance with the development of its human resources. As already stated, Bangladesh is a resource-poor country, and its economy mainly depends on agriculture. For this reason its agricultural manpower development is essential, and more emphasis needs to be placed on training of research scientists. On the other hand, the country is the most densely populated country in the world, and it is no more possible to horizontally expand the land, thus attempts must be made to increase its agricultural production vertically without destroying environmental resources. To increase yield vertically to feed the over growing population in country, it is essential to develop research scientists in such a way that they can face the future research challenges in all sectors of agriculture. The NARS human resource development plan is, therefore, undertaken with the aim upgrading the knowledge and skill of the research scientists as well as of the support. This will help exploit the working potentials, which much benefit in all sectors of agricultural research and development in Bangladesh. The human capital can be improved by improving the knowledge and skill level through the acquisition of formal training. In other words, this development of human resources through education, skills, health, etc. is a prerequisite for overall national development. For proper development of human resources in the NARS it is essential to have proper planning, implementation, regular monitoring and periodical appraisal and to make necessary adjustments and corrections.

8.0 Recommendations

1. Regular updating of management information systems (MIS) for the proper management of scientists in their respective institutes.
2. Manpower development in the institutes in a way that should ensure stronger coordination and development of leaders in both technical and non-technical levels. This will make for proper management of research activities in a research institutes for its development.
3. In-country academic training leading to a PhD should be strengthened in a way such that more than 70% of the PhD degrees can be provided locally with the help of specialized scientists.
4. The syllabi of all agriculture colleges and universities are to be updated. It is also necessary to open some new departments such biotechnology, physiology, information technology, anthropology, etc. Biotechnology and physiology may be opened in the fields of agriculture crops, livestock, and fisheries. This will also require the training of teachers accordingly.
5. Some special fields such as biotechnology, physiology, tissue culture, molecular biology, sociology, agricultural policy, special courses in plant protection, etc. mainly PhD programs- and course work for a duration of 2 years may be arranged in a suitable foreign universities, especially in developed countries. In these fields, research work could be done in Bangladesh with the

attachment of a local supervisor from a local university. The head of the research division in discussion with a local supervisor, shall select the thesis problem from the relevant institute's research master plan. In this case the foreign university or local university will award the degree.

6. The PhD holders working in the NARS should guide at least one PhD scholar to get a PhD degree. For such work he/she should be allowed 10 points for his promotion. Any PSO who does not participate regularly in seminars and workshop will get the minimum points in ACR, which will be shortcoming in his/her promotion.
7. All scientific officers must participate in a 4 month-long foundation course. Successful candidates should be allowed 5 points for his/her senior scientific officer promotion.
8. Degree and short-term training abroad should be continued in specialized fields, if where such types of training are not possible in the country as yet.
9. More emphasis should be given to upgrade the existing laboratory and library facilities to promote the scientists knowledge for quality output.
10. Creation of increased facilities for NARS scientists to provide timely promotion with a change of on-the post-oriented promotion system to a pay scale system. Also, make life insurance coverage for his/her life safety including treatments.
11. Annual evaluation of scientists and promotion criteria based on not only seniority but also on merit.
12. Trained scientists should be placed in a proper posting and given appropriate opportunities for utilizing his/her knowledge and skills in the research field.
13. Upon completion of training, scientists or trainees must submit their completion reports in the prescribed format and must provide their suggestions and recommendations. The concerned training division/ section should verify these suggestions/recommendations in consultation with the research division, and find suitable suggestions, which may be used to promote their research institutes. These new suggestions for the promotion of research should be placed during their institutional research review programs for incorporating the new ideas in their future research programs.
14. Development of comprehensive HRD program by each NARS in consultation with the coordination organization of BARC.

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Bangladesh Agricultural Research Council

NARS Scientists Personal Data Format for preparation of HRD Plan up to 2025

(To be filled by individual scientists)

1. Name of Institute :
2. Name of Candidate :
3. Mother's Name :
4. Father's Name :
5. Sex : Male : Female :
6. Date of Birth :
- : *DD* *MM* *YYYY*

7. Permanent Address : Village :
Upazila :
District :

8. Educational Qualification (Start from last)

Name of institutions	Degree/ Certificate	Division/Class/ Grade	Year	Major subjects
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Note: PhD to SSC including Diploma

9. a. Designation :
- b. Date of First Joining in Service :
- : *DD* *MM* *YYYY*
- c. Pay Scale :
- d. Basic Salary :
- e. Job Description (start from current) :

- I. _____
- II. _____
- III. _____
- IV. _____
- V. _____

10. Length of Service : Year(s) Month(s)

11. Service Record(s) [Start from last position]

Designation	From	To	Place of posting	Organization	Discipline

12. Number of Publications (Please enclose list):

- A. Journal publication: National: International:
- B. Other publication: Books: Bulletin/ Proceeding
- C. Patent registered

13. Trainings Information [Start from last]:

A. Local Training:

Title	From	To	Training venue	Sponsoring Agency	Remarks

B. Local Seminar/ Workshop:

Title	From	To	Venue	Sponsoring Agency	Remarks

C. Foreign Training:

Title	From	To	Venue	Country	Sponsoring Agency	Remarks

D. Foreign Seminar/ Workshop/Study visit:

Title	From	To	Venue	Country	Sponsoring Agency	Remarks

14. Field of Specialization : _____

15. Experience : a. Research: (List of research program/project developed, research program/ project executed as Program Leader/ Project Investigator/Co-Project Investigator/Team Member)

Number of research programs developed	Number of research programs executed	Number of research projects developed	Number of research projects executed	Remarks

b. Management/Planning /Training

Number of programs developed	Number of programs executed	Number of projects developed	Number of projects executed	Remarks

16. Other relevant experience(s):

17. Research Achievements (List of technology developed/patent registered and disseminated) :

Number of technology developed	Number of technology disseminated	Number of patents registered	Number of patents disseminated	Remarks

18. Academic/research award if any :

19. Membership of Professional Societies:

20. Future training needs (Post Doc/PhD/MS /Short-term training etc.):

Field of Training	Up to 2015	Up to 2020	Up to 2025

Candidate's Signature

Date:

Signature

Head of Division / Department

Date:

Note: Use separate sheet whenever necessary

Bangladesh Agricultural Research Council
Statement of NARS Institute's Division/Discipline -wise Manpower for
Human Resource Development Planning up to 2025

(To be filled by the Heads of Division/Unit/ Discipline)

9. Name of the Institute:

10. Division/Unit/ Discipline:

11. Status of Manpower:

Sl. No.	Posts	Status of Manpower			Future training needs	Justification of training needs	Retirement Status					
		Provision	Present position	Vacant position			2009-2015		2016-2020		2021-2025	
							PhD	MS	PhD	MS	PhD	MS
	Director											
	CSO											
	PSO											
	SSO											
	SO											
	Administration*											
	Finance*											
	Procurement*											

Note: * Please mention grades.

12. Past Research Achievements:

13. Current Research Activities:

14. Future Research Priority Areas:

15. Logistic Support for Priority Research Areas:

9. Proposal for new dimension of research (if any):

10. Future training needs on the basis future priority research areas (Post Doc/PhD /MS/ Short-term training etc.):

Field of Training	Up to 2015	Up to 2020	Up to 2025

Signature

Head of the Organization:

Date:

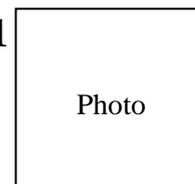
Signature

Head of Division/Department

Date:

Note: Use separate sheet whenever necessary

National Agricultural Technology Project: Phase-1
Project Implementation Unit (PIU)
Bangladesh Agricultural Research Council
New Airport Road, Farmgate, Dhaka-1215



Application form for selection of PhD In country Abroad

Field of Study:

Instruction: please furnish the following information correctly and completely. Type or in ink. Read carefully and follow all directions. If you need more space, attach additional pages of the same size. Be sure to sign and date this form. Application form must accompany clearance certificate from the employer. The applicant must be a citizen of Bangladesh.									
1. Full name (Block letters):									
2. Permanent address:									
3. Mailing address:									
4. (a) Date of birth:					(b) Place of birth				
5. Marital status:					Single		Married		Others
6. Language	READ			WRITE			SPEAK		
	Excellent	Good	Fair	Excellent	Good	Fair	Excellent	Good	Fair
English									
TOEFL/ IELTS Score with year									

7. Qualifications: (please attach copies of certificate/documents)						
(a) Academic:						
High School/ College/ University, Name & Place (start from the last)	Years attended		Certificate/Degree obtained			Major Subjects
	From	To	Year	Class /Division	GPA	
	Year	Year	Year	Class /Division	GPA	
Annexure-a						
(b) Professional:						
(i) Training: (a) Foundation Training: Batch.....Year.....Venue						
(b) Other Training:						
(ii) Participation in national/ international seminars, workshops etc. (Please attach separate sheet)						
(iii) Others profession, if any;						
8. Evidence of contribution in technology generation with scale of adoption or academic/research contribution award, if any;						

9. Membership of professional societies :

Annexure-b

10. Employment Records:

Title of positions	Place of posting	Period	Remarks

11. List of scientific publications (please attach your publication list as indicated with the scoring sheet)
12. State other relevant facts, if any;

I certify that the statements made by me are true and correct to the best of my knowledge and belief. I understand that any false statements or any required information withheld from this form may provide grounds for the withdrawal or any offer of fellowship or cancellation.

Date: _____

Candidate's Signature:

Annexure-c (For official use only)

13. Annual Confidential Report (ACR):

Last 5 years annual evaluation records to be indicated with tick mark by your Head of Division/Organization.

<i>Evaluation Year</i>	Extra Ordinary	Very Good	Good

Head of the Division /Organization Signature:

Name

Date

Seal

A. Self Score Sheet of the Candidate for Higher Degree Leading to MS/PhD In-country/Abroad

1. Name of the candidate (Block Letter) :
2. Present Position :
3. Organization :
4. Application for the field of :
- PhD (in country), PhD (Abroad), MS (in country), M.S.(Abroad)

Sl. No.	Criteria	Full Score	Score by the Candidate	Score by the Office
1.	Academic records	24		
2.	Service Length	10		
3.	Age	10		
4.	Publications	25		
5.	Foundation Training	05		
6.	ACR (Official use)	20		
7.	Selection Committee (Official use)	06		
	Total	100		

I certify that the statements made by me are true and correct to the best of my knowledge and belief. I understand that any false statements or any required information withheld from this form may provide grounds for the withdrawal of my offer of fellowship or cancellation.

(Candidate's Signature)

Recommendation by the concerned Head of the Division:

(Signature)

Nomination by the Head of the Organization:

(Signature)

(Note: Please score with the help of procedure provided overleaf)

B. Procedure of Scoring of Candidates for Selection of Higher Degree Leading to MS/PhD of NARS

In country, Abroad

Sl. No.	Criteria	Full Score
8.	Academic records	24
9.	Service Length	10
10.	Age	10
11.	Publications	25
12.	Foundation Training	05
13.	ACR (Official use)	20
14.	Selection Committee (Official use)	06
	Total	100

1. Academic Records : Full points-24

For PhD Applicant:

Class/Grade	SSC		HSC		B.S.		M.S.	
	Old	New	Old	New	Old	New	Old	New
1 st * / A+	5	5	5	5	8	8	6	6
1 st / A	4	4	4	4	-	7.5	-	5.6
A-	-	3.5	-	3.5	-	7	-	5.25
B+	-	-	-	-	-	6.5	-	4.88
2 nd / B	3	3	3	3	6	6	4.5	4.5

For MS Applicant:

Class/Grade	SSC		HSC		B.Sc.	
	Old	New	Old	New	Old	New
1 st * / A+	7	7	7	7	10	10
1 st / A	4	4	4	4	-	7.5
A-	-	3.5	-	3.5	-	7
B+	-	-	-	-	-	6.5
2 nd / B	3	3	3	3	6	6

1st* Class only applicable for SSC & HSC

(Note: For M.S. candidates scores will be counted up to Bachelor Degree and for PhD candidates up to Master Degree. The best score will be counted for one Master Degree in case of candidates having more than one Bachelor or Master Degree).

2. Service Length: Full Points-10 (1 point/year)

(Note: Duration of six months and above may be given full point of the year)

3. Age: Full Point-10

- (a) Upto-30 years-06 points (d) 36.1-39 years-08 points
 (b) 30.1-33 years-08 points (e) 39.1-42 years-06 points
 (c) 33.1-36 years-10 points (f) 42.1-45 years-04 points

(Note: For abroad up to 40 years and local up to 45 years may be considered)

4. Annual Confidential Report (ACR): Full Points 20 (Past 5 years)

- (a) Extra ordinary- 4 points/years (c) Good (B-Grade) – 2 points/years
 (b) Very good (A-grade)- 3 points/years (d) Average (C-Grade)-1 point/years

5. Publications: Full Points-25

- (a) Full Paper in Periodicals: (b) Scientific Note, Technical Paper in
 Principal Author – 3.00 points/paper Workshop, Seminar etc.
 Associate Author- 2.00 points/paper Principal Author – 2.00 points/paper
 Associate Author- 1.00 points/paper

6 & 7. Not to be filled by the candidate.

(Note: Only published article may be considered, abstract and letter of acceptance of any article may not be considered).

National Agricultural Technology Project: Phase – 1
Project Implementation Unit
Bangladesh Agricultural Research Council
Bond for In-country Scholarship/ Foreign Scholarship

I.....Father's Name:

Mother's Name: Designation:

Name of Institute with address:

Permanent address:and Own
guardian / responsible person (full name):.....

Father's Name:.....Mother's Name:.....

Present address:.....

Permanent address:.....

Name of Course:.....Duration:.....

Name of the Educational Institution and address:.....

I do hereby commit that as a candidate of higher education:

1. I would complete the above course successfully within 42 (forty two) months.
2. I must return home within deputation period after completion of my Ph. D. course abroad.
3. I must resume my duties in my own institute immediately after return from abroad and the deputation period otherwise don't provide any order of Bangladesh Agricultural Research Council / Ministry of Agriculture.
4. In any circumstances I will not apply for any change of my course or extension of course duration beyond my deputation period.
5. I must abide by the rules and regulation of the Educational Institutions during my studies and must do work without any hesitation related to my Ph. D. course and also do not take part in any activity subversive to the state or of discipline.
6. I must serve the institute for a period of 4 (Four) years after successful completion of my Ph. D. course, otherwise, I or my guardian / responsible person must refund Tk. 2,00,000/- (Two lac)/ Tk. 6,00,000/- (Six lac) for In-country/ Foreign country only in favour of the Executive Chairman, Bangladesh Agricultural Research Council, Farmgate, Dhaka.

7. If I resign from my job after 2 years of bond period of service or join in other place, then I must refund one year's salary and plus money as mentioned in my bond in favour of the Executive Chairman, Bangladesh Agricultural Research Council, Farmgate, Dhaka.
8. If overcome the above 2 years but in bond period, I will like to resign from the job, then I or my guarantor must refund the money proportionally adjusting with the bond period.
9. If I failed to achieve the Ph. D. degree, then I must serve the institute as mentioned in the bond period and myself or my guarantor must refund the compensation as mentioned in my bond.
10. I must submit 6 monthly progress reports through my supervisor in favour of sponsored organization and my own institute during my Ph. D. course.
11. I must submit a copy of my Ph. D dissertation to the Training Unit of BARC and to my own Institute.
12. In addition I must abide by the rules and regulations as mentioned in my award letter.

We the undersigned certify that we read the terms and conditions of the bond and realized the actual meaning signed the bond without any persecution in front of 1st Class Magistrate.

.....
Signature of Parent / Responsible Person	Signature of applicant

Witness:

1. Name:	2. Name:
Father's Name:	Father's Name:
Full Address:	Full Address:

.....

Signature and Seal of Fast Class Magistrate

National Agricultural Technology Project: Phase – 1
Project Implementation Unit
Bangladesh Agricultural Research Council

Research budget preparation for In-country PhD scholar

Name: Father's Name:
 Mother's Name: Designation:
 Name of Institute with address:
 Name of Course:.....Duration.....
 Name of the Educational Institution and address:

(In taka)

Sl. No.	Name of item	1 st Year	2 nd Year	3 rd Year	Total (Taka)	Remarks
1.	Research Cost					
a)	Small equipment purchase (Maximum – Tk. 14,500/-)					
b)	Book & reference materials allowance Tk. 10,000/- maximum					
c)	Hiring enumerators/skilled labour					
d)	Research inputs (depending on research undertaking) Labour, Fertilizer materials, Chemicals, Seeds, Pesticide, Irrigation/ water management Feed/ Fodder etc.					
e)	Travel and transportation including researcher/supervisor					
f)	Thesis Preparation Cost (Maximum – Tk. 40,000/-) i) Data analysis ii) Photography iii) Stationeries iv) Composing v) Printing vi) Binding					
g)	Miscellaneous (Not exceeding 5% of total research cost)					
	Total:					

(Taka in word-)

Signature of Candidate

Submitted for approval

Recommended by Supervisor

Approved by Head of the Department

Annexure-vi

List of different foreign universities for probable placement of PhD, post doctoral fellowships, short term training, seminar, study tour etc.

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
AGRICULTURAL CHEMISTRY	College of Agriculture	University of the Philippines Los Baños	Los Baños, Laguna, Philippines	http://ca.uplb.edu.ph +63 049 536 3546 uplbcado@yahoo.com
	Graduate School (Agricultural Chemistry)	Tokyo University of Agriculture	Tokyo, Japan	http://www.nodai.ac.jp/english/graduate/index.html
	Faculty of Agriculture	Chiang Mai University	Thailand	http://www.cmu.ac.th/main_Eng.htm
	Faculty of Agriculture	Bogor Agricultural University	Bogor, Indonesia	http://www.ipb.ac.id/en/ +62 251 622642 rector@ipb.ac.id
	PhD Soil Science and Agricultural Chemistry	Kerala Agricultural University	Kerala, India	http://www.keralauniversity.edu/ +91 471 306422 kuinform@eth.net
	Department of Agricultural Chemistry, Faculty of Agriculture	Bangladesh Agricultural University	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
	Soil Science and Agricultural Chemistry, Center for Soil and Crop Management Studies	Tamil Nadu Agricultural University	India	http://www.tnau.ac.in/tnaudept.html Tel: 0422 6611210 deanagri@tnau.ac.in
	Department of Agricultural	Jawalharlal Nehru	Jabalpur,	http://www.jnkvv.nic.in/

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Chemistry and Soil Science, College of Agriculture	Krishi Vishwavidyalaya Agriculture University	Madhya Pradesh, India	Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com
	Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture	Chandra Shekhar Azad University of Agriculture and Technology	Kanpur, Uttar Pradesh, India	http://www.csauk.ac.in/index.html +91 2534156-60 Ext. 158 info@csauk.ac.in
	Department of Agricultural Chemistry, Faculty of Nutrition Sciences	NWFP Agricultural University Peshawar	Pakistan	http://www.aup.edu.pk/ +92 091 9216572-79 ayazjan@hotmail.com
AGRICULTURAL ECONOMICS	Department of Agricultural Economics, College of Economics and Management	University of the Philippines Los Baños	Los Baños, Laguna, Philippines	http://uplb.edu.ph/cem/ +63 049 536 2715 cem@uplb.edu.ph
	Department of Agricultural Economics	Kansas State University	Manhattan, USA	http://www.agronomy.k- state.edu/DesktopDefault.aspx agec@k-state.edu
	Faculty of Agriculture	Bogor Agricultural University	Bogor, Indonesia	http://www.ipb.ac.id/en/?p=9 +62 251 629354 faperta@ipb.ac.id
	Agricultural Economics Program, Course of Agriculture	Obihiro University of Agriculture and Veterinary Medicine	Japan	http://www.obihiro.ac.jp/english +81 155 49 5216 soumu@obihiro.ac.jp
	College of Agriculture	Purdue University	West Lafayette, Indiana	http://www.purdue.edu/ (765) 494 8470

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
				goinag@purdue.edu
	Department of Agricultural Economics, Faculty of Agricultural Economics and Rural Economy	Bangladesh Agricultural University	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
	Faculty of Agriculture	Tokyo University of Agriculture and Technology	Tokyo, Japan	http://www.tuat.ac.jp/index-e.html
	Department of Agricultural Economics, College of Agriculture	Ferdowsi University of Mashhad	Iran	http://www.um.ac.ir/Faculty-schools-id-41.html
	Department of Agricultural Business and Economics	Pampanga Agricultural College	Philippines	http://www.instanet.com.ph/pac/ +63 045 866 0800 pac_info@yahoo.com
	Department of Agricultural Economics, College of Agriculture	Xavier University – Ateneo de Cagayan	Philippines	http://www.xu.edu.ph +63 8822 723116 Loc. 3100 aggies@xu.edu.ph
	Department of Agricultural Economics, Faculty of Agriculture	Akdeniz University	Antalya, Turkey	http://www.akdeniz.edu.tr/english/international/ +90 242 310 15 75 +90 242 310 66 40 international@akdeniz.edu.tr
	Department of Agricultural Economics, College of Agriculture	CCS Haryana Agricultural University	Hisar, India	http://hau.ernet.in/ Tel: 01662 284308 dcoag@hau.emet.in
	Department of Agricultural	Jawaharlal Nehru	Jabalpur,	http://www.jnkvv.nic.in/

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Economics and Farm Management, College of Agriculture	Krishi Vishwavidyalaya Agriculture University	Madhya Pradesh, India	Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com
AGRICULTURAL ENGINEERING	Faculty of Agriculture	Tokyo University of Agriculture and Technology	Tokyo, Japan	http://www.tuat.ac.jp/index-e.html
	Department of Agricultural Engineering	Pampanga Agricultural College	Philippines	http://www.instanet.com.ph/pac/ +63 045 866 0800 pac_info@yahoo.com
	Department of Agricultural Engineering, College of Agriculture	Xavier University – Ateneo de Cagayan	Philippines	http://www.xu.edu.ph +63 8822 723116 Loc. 3100 aggies@xu.edu.ph
	College of Agricultural Engineering	Punjab Agricultural University	Ludhiana, India	http://web.pau.edu/ +91 161 2401960 79 Ext. 213 registrar@pau.edu
	Degree Program of Agricultural Engineering	Allahabad Agricultural Institute Deemed University	India	http://www.aaidu.org/ +91 532 2684281 registrar@aaidu.org
	Department of Agricultural Engineering, College of Agriculture	Jawaharlal Nehru Krishi Vishwavidyalaya Agriculture University	Jabalpur, Madhya Pradesh, India	http://www.jnkvv.nic.in/ Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com
	Faculty of Agricultural	Sindh Agriculture	Pakistan	http://www.sau.edu.pk

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Engineering	University		+92 22 2765870 info@sau.edu.pk
	College of Agricultural Engineering	Gorgan University of Agriculture and Natural Resources	Iran	http://www.gau.ac.ir/en.php +98 171 2240028 support@gau.ac.ir
AGRICULTURAL PROCESSING	Department of Food and Agricultural Process and Engineering, Agricultural Engineering College and Research Institute	Tamil Nadu Agricultural University	India	http://www.tnau.ac.in/tnaudept.html Tel: 0422 6611210 deanagri@tnau.ac.in
	Agro-industrial Technology, Faculty of Agricultural Technology	Bogor Agricultural University	Indonesia	http://www.ipb.ac.id/en/?p=9 +62 251 629354 faperta@ipb.ac.id
	Department of Agricultural Technology and Processing Engineering, College of Agriculture	Jawaharlal Nehru Krishi Vishwavidyalaya Agriculture University	Jabalpur, Madhya Pradesh, India	http://www.jnkvv.nic.in/ Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com
AGRICULTURAL STATISTICS	PhD Agricultural Statistics	Birsa Agricultural University	Jharkhand, India	http://www.baujharkhand.org/ Tel: 06512450708
	Department of Agricultural Statistics, Faculty of Agricultural Economics and Rural Economy	Bangladesh Agricultural University	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
AGRONOMY	PhD Agronomy	Kerala Agricultural University	India	http://www.keralauniversity.edu/ +91 471 306422

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
				kuinform@eth.net
	Department of Agronomy	Purdue University	West Lafayette, Indiana	http://www.purdue.edu/ (765) 494 8470 agronomy@purdue.edu
	Department of Agronomy	Orissa University of Agriculture and Technology	Orissa, India	http://ouat.ac.in/ Fax: +91 674 2397780 ouatmain@hotmail.com
	Department of Agronomy, College of Agriculture	University of the Philippines, Los Baños	Los Baños, Laguna, Philippines	http://ca.uplb.edu.ph +63 049 536 3546 uplbcado@yahoo.com
	Faculty of Agriculture	Universiti Putra Malaysia	Malaysia	http://www.upm.edu.my/ +603 8946 4169 dekan@agri.upm.edu.my
	College of Agriculture and Forestry	Mariano Marcos State University	Philippines	http://www.mmsu.edu.ph +63 792 2660/2563 caf@mmsu.edu.ph
	Faculty of Agronomy	Hanoi Agricultural University	Vietnam	http://www.hua.edu.vn/en/ +84 4 8276473 agronomy@hua.edu.vn
	Department of Agronomy, Faculty of Agriculture	Bangladesh Agricultural University	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
	College of Agronomy and Biotechnology, Office of International Relations	China Agricultural University	China	http://www.cau.edu.cn/cie/en/ +86 10 62732736 cauie@cau.edu.cn

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Department of Agronomy, College of Agriculture	Ferdowsi University of Mashhad	Iran	http://www.um.ac.ir/Faculty-schools-id-41.html
	Department of Agricultural Sciences	Pampanga Agricultural College	Philippines	http://www.instanet.com.ph/pac/ +63 045 866 0800 pac_info@yahoo.com
	Department of Agronomy, Faculty of Agricultural Production	Maejo University	Chiang Mai, Thailand	http://www.mju.ac.th/about/2009/about_Eng.html
	College of Agriculture	Punjab Agricultural University	Ludhiana, India	http://web.pau.edu/ +91 161 2401960 79 Ext. 213 registrar@pau.edu
	Department of Agronomy, College of Agriculture	CCS Haryana Agricultural University	Hisar, India	http://hau.ernet.in/ Tel: 01662 284308 dcoag@hau.emet.in
	Center for Soil and Crop Management Studies	Tamil Nadu Agricultural University	India	http://www.tnau.ac.in/tnaudept.html Tel: 0422 6611210 deanagri@tnau.ac.in
	Department of Agronomy, College of Agriculture	Jawaharlal Nehru Krishi Vishwavidyalaya Agriculture University	Jabalpur, Madhya Pradesh, India	http://www.jnkvv.nic.in/ Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com
	College of Agronomy	Inner Mongolia Agricultural University	Mongolia, China	http://www1.imau.edu.cn/ Tel: 0086 471 4309331 Tel: 0086 471 4306360

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
				iecimau@imau.edu.cn
	Department of Agronomy, Faculty of Agriculture	Chandra Shekhar Azad University of Agriculture and Technology	Kanpur, India	http://www.csauk.ac.in/ +91 2534156-60 Ext 158 info@csauk.ac.in
	Department of Agronomy, Faculty of Crop Production Sciences	NWFP Agricultural University Peshawar	Pakistan	http://www.aup.edu.pk/ +92 091 9216572-79 ayazjan@hotmail.com
ANIMAL BREEDING	Institute of Animal Breeding and Genetics	University of Veterinary Medicine	Vienna, Austria	http://www.vu-wien.ac.at/en/ +43 1 25077 5600 gottfried.brem@vu-wien.ac.at
	Department of Animal Science	Cornell University	Ithaca, New York	http://www.cornell.edu/ Tel: (607) 254 4636 info@cornell.edu
		Universiti Putra Malaysia	Malaysia	http://www.upm.edu.my/ +603 8946 4169 dekan@agri.upm.edu.my
	Animal Genetics and Breeding, Faculty of Animal and Aquaculture	Hanoi Agricultural University	Vietnam	http://www.hua.edu.vn/en/ +84 827 6346 webmaster@hau1.edu.vn
	College of Veterinary Medicine	University of the Philippines Los Baños	Los Baños, Laguna, Philippines	http://www.uplb.edu.ph/index.php/veterinary- medicine +63 049 536 2730 cvm@uplb.edu.ph
	Department of Animal	CCS Haryana	Hisar, India	http://hau.ernet.in/

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Breeding and Genetics, College of Animal Science	Agricultural University		Tel: 01662 284308 dcoag@hau.emet.in
	College of Animal Science	Gorgan University of Agriculture and Natural Resources	Iran	http://www.gau.ac.ir/en.php?id=6 +98 171 4425655 support@gau.ac.ir
	Department of Animal Breeding and Genetics, Faculty of Animal Husbandry and Veterinary Sciences	NWFP Agricultural University	Peshawar, Pakistan	http://www.aup.edu.pk/ +92 091 9216572-79 ayazjan@hotmail.com
BIOCHEMISTRY	Department of Biochemistry	University of Madras	Chennai, India	http://www.unom.ac.in +91 44 25361055 registrar@unom.ac.in
	Department of Biotechnology, Faculty of Science	Mahidol University	Thailand	http://www.sc.mahidol.ac.th/scbc/ +66 2 201 5600 1 scmpl@mahidol.ac.th
	College of Agriculture	Purdue University	West Lafayette, Indiana	http://www.purdue.edu/ (765) 494 8470 goinag@purdue.edu
	Department of Biochemistry, Faculty of Agriculture	Bangladesh Agricultural University	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
	Applied Molecular Biology and Biochemistry, Faculty of Agriculture	Tokyo University of Agriculture and Technology	Japan	http://www.tuat.ac.jp/index-e.html wwwadm@cc.tuat.ac.jp
	Center for Plant Molecular	Tamil Nadu	India	http://www.tnau.ac.in/tnaudept.html

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Biology	Agricultural University		Tel: 0422 6611210 deanagri@tnau.ac.in
	Department of Agricultural Biochemistry, Faculty of Agriculture	Chandra Shekhar Azad University of Agriculture and Technology	Kanpur, Uttar Pradesh, India	http://www.csauk.ac.in/ Tel: 0512 2533906 (O) deanag@csauk.ac.in
BIOTECHNOLOGY		Biotechnology and Nuclear Agriculture Research Institute (BNARI)	Lhegon, Ghana	http://www.bnari.org/ +233 21402286 director@bnari.org
	National Institute of Molecular Biology and Biotechnology	University of the Philippines Los Baños	Philippines	http://uplb.edu.ph/ +63 049 536 3604 opr@uplb.edu.ph
	Department of Chemical Engineering and Biotechnology, School of Technology	University of Cambridge	UK	http://www.ceb.cam.ac.uk/ webmaster@ceb.cam.ac.uk
	Division of Biotechnology	Nagasaki University	Japan	http://www.nagasaki-u.ac.jp/index_en.html +81 95 819 2435 yosimoto@nagasaki-u.ac.jp
	Faculty of Biotechnology and Biomolecular Sciences	Universiti Putra Malaysia	Malaysia	http://www.biotech.upm.edu.my/ +603 8946 4169 dekan@agri.upm.edu.my
	Department of Biotechnology	Kasetsart University	Bangkok, Thailand	http://biot.agro.ku.ac.th/ Tel: 0 2562 5074

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	College of Agronomy and Biotechnology, Office of International Relations	China Agricultural University	China	http://cab.cau.edu.cn/ +86 10 62732736 cauie@cau.edu.cn
	Crop Biotechnology and Breeding, Department of Animal Science, College of Agriculture	Ferdowsi University of Mashhad	Iran	http://www.um.ac.ir/Faculty-schools-id-41.html
	Biotechnology, Center for Plant Molecular Biology	Tamil Nadu Agricultural University	India	http://www.tnau.ac.in/cpmb/cpmb/bt.html +91 422 6611353 biotech@tnau.ac.in
	Biotechnology, College of Bioengineering	Inner Mongolia Agricultural University	Mongolia, China	http://www1.imau.edu.cn/lxsh/ Tel: 0086 471 4309331 Tel: 0086 471 4306360 iecimau@imau.edu.cn
	Institute for Biotechnology Research	Jomo Kenyatta University of Agriculture and Technology	Naoribi, Kenya	http://www.jkuat.ac.ke/academics.php?id=9 +254 06752711 pro@jkuat.ac.ke
	Department of Agriculture Biotechnology, Faculty of Agriculture	Chandra Shekhar Azad University of Agriculture and Technology	Kanpur, Uttar Pradesh, India	http://www.csauk.ac.in/index.html +91 2534156-60 Ext. 158 info@csauk.ac.in
ENTOMOLOGY	College of Agriculture	Purdue University	West Lafayette, Indiana	http://www.purdue.edu/ (765) 494 8470 goinag@purdue.edu

COURSE OFFERED	FACULTY/DEPARTMENT	UNIVERSITY	COUNTRY	CONTACT DETAILS
	Department of Entomology, College of Agriculture	University of Kentucky	Lexington, Kentucky	http://www.ca.uky.edu/entomology/entomology.php Tel: 859 257 7450 John.obrycki@uky.edu
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	College of Agriculture	Agricultural University		Tel: 01662 284308 dcoag@hau.emet.in
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	College of Resources and Environment	Huazhong Agricultural University		http://www.hzau.edu.cn/en/ +86 027 87282027 fao@mail.hzau.edu.cn
GENETIC ENGINEERING		International Center for Genetic Engineering and	Trieste, Italy	http://www.icgeb.trieste.it/home.html +39 040 3757345 decio@icgeb.org

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	Faculty of Agriculture	Universiti Putra Malaysia	Malaysia	http://www.upm.edu.my/ +603 8946 4169 dekan@agri.upm.edu.my
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	Department of Agricultural Sciences	Pampanga Agricultural College	Philippines	http://www.instanet.com.ph/pac/ +63 045 866 0800
	Department of Horticulture, Faculty of Agricultural Production	Maejo University	Chiang Mai, Thailand	http://www.mju.ac.th/about/2009/about_Eng.html
	Department of Horticulture, Faculty of Agriculture	Akdeniz University	Turkey	http://www.akdeniz.edu.tr/english/international/ +90 242 310 1575 international@akdeniz.edu.tr
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		University		
	College of Agronomy	Inner Mongolia Agricultural University	Mongolia, China	http://www1.imau.edu.cn/ Tel: 0086 471 4309331 Tel: 0086 471 4306360 iecimau@imau.edu.cn
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NUCLEAR AGRICULTURE		Bangladesh Institute of Nuclear Agriculture (BINA)	Bangladesh	http:// www.bau.edu.bd/ (091) 54729 agribau@mymensingh.net
	Institute of Nuclear-Agricultural Sciences	Zhejiang University	Hangzhou, China	http://www.zju.edu.cn/english/zupo@zju.edu.cn
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	Department of Plant Pathology, College of Agriculture	Ferdowsi University of Mashhad	Iran	http://www.um.ac.ir/Faculty-schools-id-41.html
	Department of Plant Pathology, College of Agriculture	Jawaharlal Nehru Krishi Vishwavidyalaya Agricultural University	Jabalpur, India	http://www.jnkvv.nic.in/ Tel: 0761 2680771/2681773 akrai_jnau@yahoo.com

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	Department of Soils and Environmental Science, Faculty of Agricultural Production	Maejo University	Chiang Mai, Thailand	http://www.mju.ac.th/about/2009/about_Eng.html
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