भाकृअनुप
ICAR

Quinquennial Review Team Report

(1st April, 2012 to 31st March, 2017)

ICAR Research Complex for Eastern Region

ICAR Parisar, P.O.: Bihar Veterinary College
Patna - 800 014 (Bihar)

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Acknowledgements

The Eastern region of India is blessed with rich natural resources and has diverse agro-climatic conditions, which offers inimitable opportunities for cultivation of various crops, rearing of livestock and aquaculture activities, and providing livelihood opportunities to millions of people. In spite of having rich natural resources and agricultural productivity potential, the development in the region has remained lower than several other states. There is vast potential for increasing agricultural production in the region so as to impact food security even at the national level. This region is also experiencing frequent flood and drought like situation. Fragmented landholdings, lack of quality seed and planting materials, inaccessibility to the credit facilities, lowest per capita income, large BPL population, poor extension mechanism and delivery services, energy crisis in the agricultural sector, soil acidity etc. apart from lack of location specific production technologies, dissemination of scientific knowledge to farmers are hampering agriculture and allied sector development in the Eastern states.

Keeping in view the above mentioned facts, the ICAR Research Complex for Eastern Region (ICAR-RCER), Patna came into existence (February 22, 2001) with an objective to address diverse issues relating to land and water resources management, crop husbandry, horticulture, agroforestry, aquatic crops, fishery, livestock and poultry, agro-processing and socio-economic aspect for achieving food self sufficiency in the Eastern region.

During the assessment period (2012-2017), the Institute has made significant contributions in research and extension in different agri-horti crops, livestock & fisheries, agroforestry, aquatic crops, and water management besides socio-economic aspects through different institutional and externally funded projects. I compliment the Director and his team for taking initiatives in conducting several stakeholders meeting at Patna, Ranchi and Kolkata encompassing all the seven States. Many important issues and suggestions were derived in those meetings. Institute also has taken good initiatives towards 2nd Green Revolution and bringing out a policy document on 'Second Green Revolution in Eastern India: Issues and Initiatives' for agricultural development in the region.

I wish to express my sincere thanks and gratitude to all the members of QRT namely Dr. V.V. Sadamate, Dr P.K. Mahapatra, Dr. Kusumakar Sharma and Dr K.K. Satapathy for their valuable suggestions and support in the evaluation process. My sincere thanks are also due to Director, ICAR Research Complex for Eastern Region, Patna, all Heads of the Divisions, Incharge KVKs and their team for extending help and support during these periods of reviewing and finalizing the 3rd QRT report of the Institute for the period from April 1, 2012 to March 31, 2017.

(**A.N. Mukhopadhyay**)
Chairman, QRT

Contents

Executive Summary

The Quinquennial Review Team (QRT) was constituted by the Secretary DARE & Director General, ICAR vide ICAR F. No. NRM/18-14/2018-IA-II dated 24.07.2019 to review the work done by the ICAR Research Complex for Eastern Region (ICAR-RCER), Patna and its two Research Centres and KVKs for the period from April, 2012 to March, 2017. The terms of reference encompassed review of research achievements, impact, research relevance, budget allocation, collaboration with state agricultural universities, linkages with stakeholders, end-users and to recommend changes in the organization and programmes, if required. The scope also included to examine constraints hindering the Institute in achieving its objectives and to recommend ways of minimizing or eliminating them. The QRT held five meetings, which included review meetings at Patna, Ranchi and Kolkata, visits to field experiments & laboratories, interaction with scientists and other staff and stakeholders, besides a virtual meeting to discuss and finalize the report.

ICAR Research Complex for Eastern Region was established towards the end of IX Plan on February 22, 2001 headquartered at Patna with its regional stations at Darbhanga, Bihar and Ranchi, Jharkhand, besides two attached KVKs at Buxar and Ramgarh in the state of Bihar and Jharkhand, respectively. Since its establishment, the Institute has contributed significantly in the areas of land and water resources management, agri-horti crops, fishery, livestock & poultry, and agro-processing for agricultural development. The Institute published 433 research papers, 21 books and 60 technical bulletins, besides 74 book chapters, 134 popular articles and 4 policy papers during the review period. A total of 53% papers were published in high impact national/international journals.

The mandate and objectives of the Institute are clearly defined and have been reviewed periodically as per the requirement. To meet the mandate, the research programmes have been developed appropriately in consultation with the Research Advisory Committee/Institute Research Committee under the able guidance of ADG (AAF&CC), DDG (NRM) and DG, ICAR. The research activities are well organized under six thematic research areas, supported by 96 research projects for development of integrated farming and cropping systems, natural resource management and climate resilient agriculture to help usher much awaited Green Revolution in the Eastern region, with notable impact in the states of Bihar and Jharkhand.

The Institute has developed and transferred location specific technologies during the period across the production systems. These technologies have been released for use by the stakeholders. The varieties for several commodities *(vegeta-*

bles, makhana, rice) were developed and released. These varieties brought substantial improvement (~1.5-2.4 folds) in productivity. The Institute also developed and released 14 vegetable varieties resistant for bacterial wilt for improving productivity, especially in the Eastern Hill and Plateau region. The studies on long-term impacts of conservation agriculture, scientific management of rice-fallow, diversification of rice-wheat cropping systems, integrated farming system models, carbon sequestration potential of different cropping systems are appreciable.

The Institute has made notable progress in the areas of quality seed andplanting material for production of important fruits and vegetables, high density orcharding of mango and guava including rejuvenation of unproductive mango orchards, fertigation in important vegetable crops, collection/conservation and domestication of potential wild edibles including tuber crops, and the work on insect-pest dynamics in mango. Further, the technology developed on cropping system mode of makhana cultivation witnessed reduction in drudgery associated with collection of makhana seeds from ponds to a great extent, besides productivity improvement of aquatic bodies through diversification of aquatic production system.

Commendable work has been carried out in livestock and fisheries sectors, particularly for characterization of native breeds, genetic improvement in *diara* buffalo, soil-plant-animal continuum based mineral mixture formulation, development of fish-based integrated farming system models, conservation and characterization of indigenous duck strains, low input poultry production, etc., which may significantly help resource poor farmers of the region.

Both the KVKs *(Buxar in Bihar and Ramgarh in Jharkhand)* of the Institute have strong presence in their domain area, and are making the farmers aware of the improved technologies through FLDs, OFTs, trainings, field visits, and print & electronic media.

The QRT is of the view that flood and flood-prone ecologies of the region may be targeted for improving the productivity. Likewise, it will be desirable to aim rice-fallow areas for pulse and oilseed production. The Institute needs to diversify the existing horticultural production systems for Hill and Plateau region and undertake a focused programme on mechanization in makhana cultivation for the benefit of resource poor farmers. Since goat farming is popular in the region, RCER needs to identify the breeding tract of Black Bengal goat where pure germplasm is available including identification of high prolific gene and its introgression into low prolific animals. Linkages with line departments need to be strengthened, may be piloting through systematically attempted Block Extension Plans (BEP), pooling public and private extension resources for popularization and adoption of the technologies on a wide scale.

The research laboratories are fully supported by ARIS Cell, ITMU, animal and agriculture farms, and library. The Institute has ATIC and Kisan Call Centre to cater to the needs of the farmers. The extension activities undertaken by the Centre include *camps*, *gosthies* and *kisan melas*. The available human resource is well trained, but absence of desired technical and administrative staff needs urgent attention of the Council. The equipments are being maintained properly at large and are in running condition. The laboratories can be strengthened further by providing few sophisticated equipments. The QRT is satisfied with the year wise expenditure made by the Institute and feels that the budgetary allocations may be increased considering the likely expenditure on salaries and inflation. The future research programmes have been designed concurrent to the upcoming needs and vision of the Institute.

The QRT has analyzed different components and relevant recommendations have been given in section 6 of the report.

1. Introduction

1.1 Constitution and Composition of the QRT

The Council constituted the 3rd QRT vide F.No. NRM/18-14/2018-IA-II dated 24.07.2019 to review the work of ICAR Research Complex for Eastern Region (ICAR-RCER), Patna and its two Research Centres and KVKs for the period 01.04.2012 to 31.03.2017. The composition of QRT is as follows:

Sl. No.	Name	Designation
1.	Dr. A.N. Mukhopadhyay Former VC, AAU, Jorhat, 'Sangini', 151 Akanksha, Udyan II, Raibareilly Road, Lucknow - 226 025, U.P. E mail: amar.mukhopadhyay@gmail.com (M) 9793200333	Chairman
2.	Dr. V.V. Sadamate Former Adviser, Agriculture Planning Commission, GOI C-309, Kendriya Vihar Sector 56, Gurgaon - 122 011 Delhi NCR, E mail: sadamatevv@gmail.com, (M) 9599557696	Member
3.	Dr. P.K. Mahapatra Former Dean, College of Agriculture, OUAT, Bhubaneswar Plot No 1046/1, Jagmohan Nagar, Right Lane-5, Near ITER Engg. College, Khandagiri, Bhubaneswar - 751 030, Odisha E mail: pkmahapatra20@gmail.com, (M) 9437114786	Member
4.	Dr. Kusumakar Sharma Former ADG (HRD), ICAR Flat No. 05073, ATS Greens Paradiso, Tower 05, 7th Floor, Sector Chi-4, Greater Noida - 201 310, U.P. E mail: ksharma52@gmail.com (M) 9650125552, Res. 11125846034	Member
5.	Dr. K.K. Satapathy Former Director, NIRJAFT, Kolkata A-1, 2/10 Chhayanat, Calcutta Greens, 1050/2 Survey Park, Kolkata - 700 075 E mail: kks1046@gmail.com, (M) 9432012466	Member
6.	Dr. Kamal Sarma Principal Scientist, ICAR RCER, Patna E mail: kamalsarma6@rediffmail.com (M) 9678844751, 9430809552	Member Secretary

1.2 Terms of Reference

Institute/Unit

I. Research achievements and their impact

- To examine and identify the research achievements of the Institute, Projects/KVKs its regional Stations, AICRPs operated by them vis-a-vis sectoral programmes since the previous QR and critically evaluate them. Commensurate with the objectives, mandates and resources of the organization, the socio-economic impact of research on farmers/beneficiaries and transferability of results to farmers through extension should be critically reviewed.
- The research and its impact should be brought out in quantifiable benchmarks wherever possible.
- To know the value for money, QRT should assess and bring out the physical outputs and outcomes vis-a-vis the budget spent during the period under report. If the likely outcomes are going to take considerable time, the projected outcomes should be indicated.
- The socio-economic impact of research on farmers/beneficiaries and transferability of results to farmers being an important aspect of research outcome the transferability should be mandatory for major research projects.

II. Research relevance and budget allocation

To examine the objectives, scope and relevance of the research programmes and budget of the Institute for the next 5 years in relation to overall/state/ regional national plans, policies and long and short-term priorities. The Committee may also draw its attention to the EFC/SFC Memo in relation to recommendations of the previous QRT and also the Perspective Plan and Vision 2030 document of the Institution.

III. Relationship/collaboration with SAUs and other stakeholders

To printout whether the research programmes of the past and proposal for future are in harmony with the Vision of ICAR (HQ) and the programme of related centres of research and Agricultural Universities, state government, private sector, and IARCs.

IV. Linkages with clients/end users

To examine the kinds of linkage established with the clients and end-users of research results, i.e., farmers /fishermen and the extent of interest displayed in conducting "on-farm research", on farmers' fields and in organizing demonstrations/training courses for the transfer of technology to extension agencies and KVKs of the ICAR.

V. Proposed changes in organization, programmes and budget

To examine whether any changes in the organizational setup are called for manpower and funds allocation. The decentralization in day-to-day working and the transparency should be highlighted. Further, the committee may also examine the resource generation efforts and implementation of Project-based Budgeting.

VI. Constraints

To examine constraints hindering the Institute in achievement of its objectives and implementation of its programme and goals and to recommend ways and means of minimizing or eliminating them.

VII. Looking forward

To look into any other points considered relevant by the Committee or referred to it by the ICAR, the Institute Director or the Management Committee, in respect of future project development, research prioritization and management changes.

The above terms of reference may be modified at the suggestion of Director of Institute/Project/Management Committee of Institute/Project/ICAR Headquarters/ GB keeping in mind any specific problems of the Institute.

KVK

- To examine the functioning of KVK sanctioned by the ICAR under ICAR-RCER, Patna.
- To assess the performance of the KVK against assigned task and responsibilities.
- To undertake critical review of the research-extension linkages at the district, block and panchayat level and suggest remedial measures for focusing extension services for women farmers and agricultural development projects.
- To obtain and analyze responses from the beneficiaries about the impact of the KVKs on agricultural production, productivity and socio-economic upliftment of the identified areas/sections under the KVK.
- To examine problems/constraints, if any, requiring policy decisions, legal, institutional or administrative actions of the KVK.

2. Process

The preliminary meeting of Chairman, QRT with DDG (NRM) was held at ICAR, New Delhi on 17.06.2019. As per the guidelines of the QRT, the Institute provided the detailed write up on the background information including the mandate and mission of the Institute, research programmes, recommendations of earlier QRT (2006-12), RAC, IMC and IRC, annual reports and other relevant documents to the QRT members before planning its first meeting.

The first meeting of the QRT was held during September 10-11, 2019 at the main campus of ICAR-RCER, Patna. During the planning meeting, the research progress of the Institute was reviewed. The summarised overall achievement of the Institute including technologies and infrastructures/facilities developed, scientific publications, impacts, new initiatives taken, financial and administrative set up, staff position, etc., was presented by the Director, and subsequently the salient achievements of different divisions, regional centres and KVKs were presented by the respective HODs and PCs. During the QRT review process, members visited different field experiments, laboratories and farm facilities at main campus Patna; FSRCHPR Ranchi; Research Centre for Makhana, Darbhanga; KVK Ramgarh and KVK Buxar; and interacted with the scientists and staff of the respective centres and gave valuable suggestions to improve the performance in research and extension related activities for the overall betterment of the Institute.

Meetings/ visits	Date	Place	Remark
Preliminary meeting of QRT	17.06.2019	ICAR, New Delhi	The preliminary meeting was held with DDG (NRM) alongwith other officials of SMD
1st QRT meeting	10.09.2019 to 11.09. 2019	ICAR-RCER, Patna	Presentations, discussions, and field & lab visits
2nd QRT meeting	4.11. 2019 to 6.11.2019	ICAR-FSRCHPR, Ranchi and KVK Ramgarh	Interaction meeting with the staff, entrepreneurs, farmers and stakeholders from Jharkhand, Odisha and Chhattisgarh
3rd QRT meeting	7.11.2019	ICAR RCER, Patna	Stakeholders meeting encompassing Bihar and Eastern UP
Visit	27.12.2019	RCM, Darbhanga	Field visit and discussion with the staff
Visit	28.12.2019	KVK Buxar	Field visit and discussion with the staff
4th QRT meeting	28.01.2020	ATARI Kolkata	Stakeholders meeting encompassing Assam and West Bengal

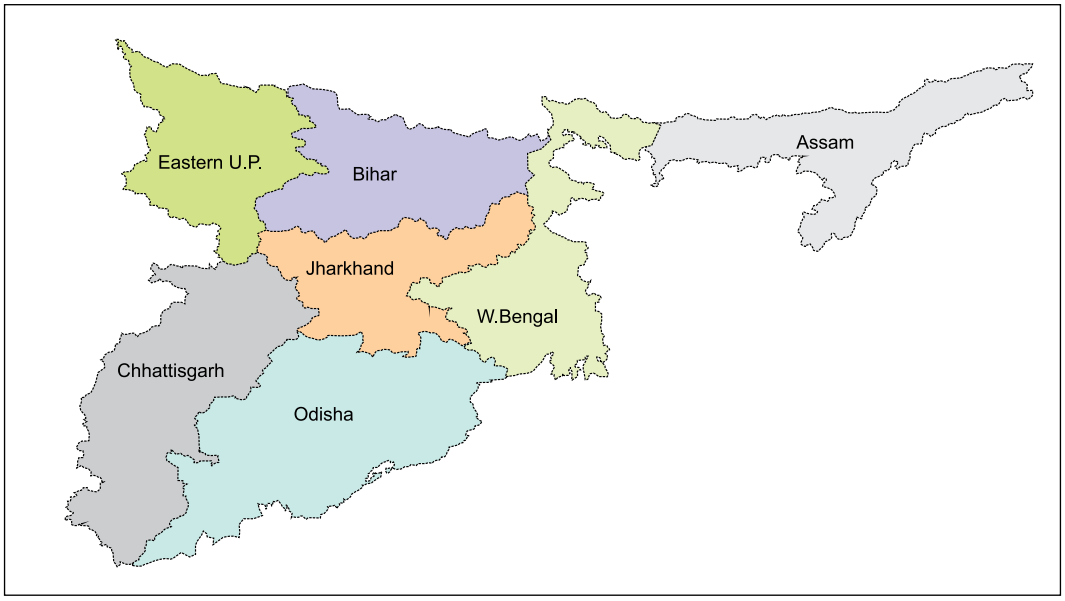
The QRT members also participated in the stakeholders meetings conducted at FSRCHPR, Ranchi; ICAR-RCER, Patna; KVKs (Buxar & Ramgarh) and at AT-ARI, Kolkata. The stakeholders meetings were organized to fine tune the research and development activities in the context of changing climatic conditions so that the developed technologies could bring resilience to the agricultural systems of the region and to develop a road map for further research and development in the Eastern India. The Vice Chancellors and Directors of the SAUs/CAU, Directors and scientists of the ICAR institutes, representatives from State Departments of Agriculture and other related agencies, NGOs and progressive farmers of the region participated in the stakeholder meetings.

The Chairman QRT and members interacted virtually on August 5 & 18, 2020, with the Director, Member Secretary, Divisional Heads & Scientists of the Institute to finalize the draft QRT report and submitted the QRT report to the Secretary, DARE and DG, ICAR in the month of August, 2020 after discussing and finalizing it with the members of the review team.

3. ICAR-RCER Background Information

3.1 Brief History

Eastern India comprising of Assam, Bihar, Chhattisgarh, Eastern UP, Jharkhand, Odisha and West Bengal is inhabited by about 34% of the total human population of the country. The region occupies about 21.85% of the country's geographical area. In general, the region can be divided into 3 distinct physiographical units namely (i) plains of Eastern UP, Bihar, West Bengal, and Assam; (ii) hilly and plateau regions in Eastern UP, Bihar, Jharkhand, West Bengal, Odisha, Chhattisgarh, and Assam; and (iii) coastal plains of West Bengal and Odisha.



Geographical spread of Eastern states

As elsewhere, agriculture is the mainstay of economy in Eastern India and 82% population lives in rural areas. It is also inhabited by resource poor people with small land: human ratio. The region is bestowed with rich natural resources and has great potential for intensive and diversified crop production besides livestock and fisheries development. The climate of the region is tropical, hot and humid except in hilly areas with high rainfall. Agriculture in this region is, by and large, complex, diverse and risk prone with vast area being rainfed, facing various constraints with respect to resources, infrastructure, technology outreach and institutional mechanisms. Though major amount of rainfall (about 80%) is received during *kharif*, it has large spatial and temporal variation which leads to immense uncertainty and instability in agricultural productivity and production.

Occurrence of long drought spells during critical growth periods of crops are quite common in the region. Further, heavy spells of rains lead to water congestion and flooding, making crop cultivation almost impossible, even during the *kharif* season. Even though the region receives substantially high precipitation, surface and ground water resources are utilized to a minimum level and large proportion of the cultivated area does not receive any irrigation water. The farmers still depend on the vagaries of the monsoon for crop production. In view of above mentioned scenario and production, productivity gaps of different enterprises besides the potential of this region could not be exploited and therefore, on the initiation of the Govt. of India, ICAR decided to establish ICAR Research Complex for Eastern Region (ICAR-RCER) with its Hqs. at Patna.

ICAR-RCER was established on the February 22, 2001 having the merger of Directorate of Water Management, Patna with the Complex. On April 1, 2001, Central Horticultural Experimental Station, Ranchi was also merged in the complex. Since its establishment persisting constraints of facilities, infrastructure and manpower could not allow to create its visible impact in all the seven states falling under the Eastern region. The ICAR-RCER, Patna has basically a broad-based approach to address diverse agricultural issues related to water and land resource management, crop husbandry, horticulture and agroforestry, livestock and fisheries management, aquatic crops, socio-economic and extension research and development programmes in a holistic and integrated manner for promoting research capability in order to enhance production and productivity potential.

The Complex has broad-based mandate in view of emerging opportunities of research in frontier areas, initiatives for regional cooperation, globalization, and cost competitiveness. In order to achieve 4% growth rate in agriculture, emphasis is being given on multi-disciplinary research in a program matrix. A network and consortium approach is envisaged to achieve mission of the Complex through partnership and collaboration with SAUs, ICAR institutes and NGOs. The Complex is comprised of four divisions, two research centres and two KVKs as depicted below:

1. Division of Land and Water Management (DLWM), Patna
2. Division of Crop Research (DCR), Patna
3. Division of Livestock and Fisheries Management (DLFM), Patna
4. Division of Socio-economic and Extension (DSEE), Patna
5. ICAR-RCER Farming System Research Centre for Hill & Plateau Region, Ranchi, Jharkhand
6. ICAR-RCER Research Centre for Makhana, Darbhanga, Bihar
7. Krishi Vigyan Kendra, Buxar, Bihar
8. Krishi Vigyan Kendra, Ramgarh, Jharkhand

Vision

The vision is to pre-position the Institute with desired competitiveness for developing the kind of technologies needed to address the multiple vulnerabilities confronting agriculture and allied fields today and likely to confront tomorrow and thereby contribute towards production, profitability and sustainability in agriculture, particularly in view of "Act East Policy" of Govt. of India, for ensuring food security in the country.

Mission

- Transforming ***Low Productivity-High Potential*** Eastern region into high productivity region for food, nutritional and livelihood security in a manner that is environmentally sustainable, socially acceptable and monetarily profitable.
- Utilization of vast seasonally waterlogged and perennial water bodies for multiple uses of water and aquatic crops besides, poverty alleviation and women empowerment through employment generating activities.
- Promote network and consortia research in the Eastern region.

Mandate of the Institute

- Strategic and adaptive research for efficient integrated management of natural resources to enhance productivity of agricultural production systems in Eastern region.
- Transform low productivity-high potential Eastern region into high productivity region for food, nutritional and livelihood security.
- Utilization of seasonally waterlogged and perennial water bodies for multiple uses of water.
- Promote network and consortia research in the Eastern region.

Modalities to achieve the Mandate are

- Facilitate and promote coordination and dissemination of appropriate agricultural technologies through network/consortia approach involving ICAR institutes, SAUs and other agencies for generating location-specific agricultural production technologies through sustainable use of natural resources.
- Provide credible scientific support and to act as a centre for vocational as well as advanced training to promote agricultural production technologies.
- Act as repository of available information and its dissemination on all aspects of agricultural production systems.
- Collaborate with relevant national and international agencies in liaison with state and central government departments for technology dissemination.

- Provide need-based consultancy and advisory support for promoting agriculture, horticulture, livestock and fisheries in the region.
- Socio-economic evaluation and impact assessment of agricultural technologies.

3.2 Research Programmes

To achieve the mandate as stated above, the Institute has following six major programmes :

(a) **Farming System Research including Climate Resilient Agriculture:** The objectives of this programme are; (i) development/refinement of integrated farming system and cropping system for Eastern region, (ii) popularization of resource conservation technologies, and (iii) climate resilient agriculture in the Eastern region.

(b) **Genetic Resource Management and Improvement of Field, Horticultural and Aquatic crops:** Sharp focus on management of genetic resources and varietal development of field, horticultural and aquatic crops.

(c) **Improved Production and Protection Technologies for Agri-Horti Crops:** The objectives of this programme are; (i) to develop technologies, package of practices for enhancing the production and productivity, and (ii) development of protection technologies against insect pests & diseases.

(d) **Integrated Land & Water Management:** Centre of attention on land & water management to improve their use efficiency.

(e) **Livestock & Fisheries Management:** Linchpin on livestock, avian and fisheries management for the benefit of resource poor and landless stakeholders.

(f) **Socio-Economics, Extension and Policy Research:** This programme deals with socio-economics, extension and policy research with focus on evolving extension strategies, linkages with development departments and adoption/ upscaling of the technologies.

3.3 Location

(a) **ICAR-RCER Headquarters:** The Institute is situated at 25°35′30″ N latitude and 85°05′03″ E longitude. It has 03 research farms in Patna. Main campus of the institute is spread over 65 acres. The other research farm of 42.57 acres, located at Sabajpura, is 8 km from the main campus. Institute also has 11 acres of farm land at WALMI, Phulwari Sharif, which is 10 km away from the main campus.

(b) **ICAR-RCER Farming System Research Centre for Hill & Plateau Region, Ranchi:** The Centre is situated at 23°34′54″ N latitude and

85°37′56″ E longitude. It has 190.26 acres of farm land located at Plandu, Ranchi and 236.54 acres of research farm at Churu, Ranchi, Jharkhand.

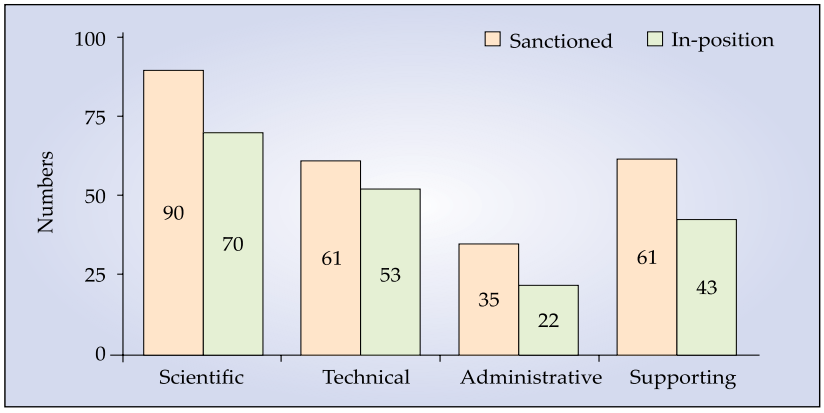
(c) **ICAR-RCER Research Centre for Makhana, Darbhanga, Bihar:** The Centre is situated at 26°10′15″ N latitude and 85°53′46″ E longitude. It has 25 acres of research farm located at Basudeopur, Darbhanga, Bihar.

(d) **ICAR-RCER Krishi Vigyan Kendra, Buxar, Bihar:** The Krishi Vigyan Kendra under the jurisdiction of the Institute has 25.64 acres of farm land located at Lalganj, Buxar (25°54′76″ N latitude and 83°99′25″ E longitude), Bihar.

(e) **ICAR-RCER Krishi Vigyan Kendra, Ramgarh, Jharkhand:** This Krishi Vigyan Kendras under the jurisdiction of the Institute has 19.04 acre area of farm land located at Ramgarh (23°48′42″ N latitude and 85°28′6″ E longitude), Jharkhand.

3.4 Manpower

(a) Category-wise cadre strength of ICAR-RCER

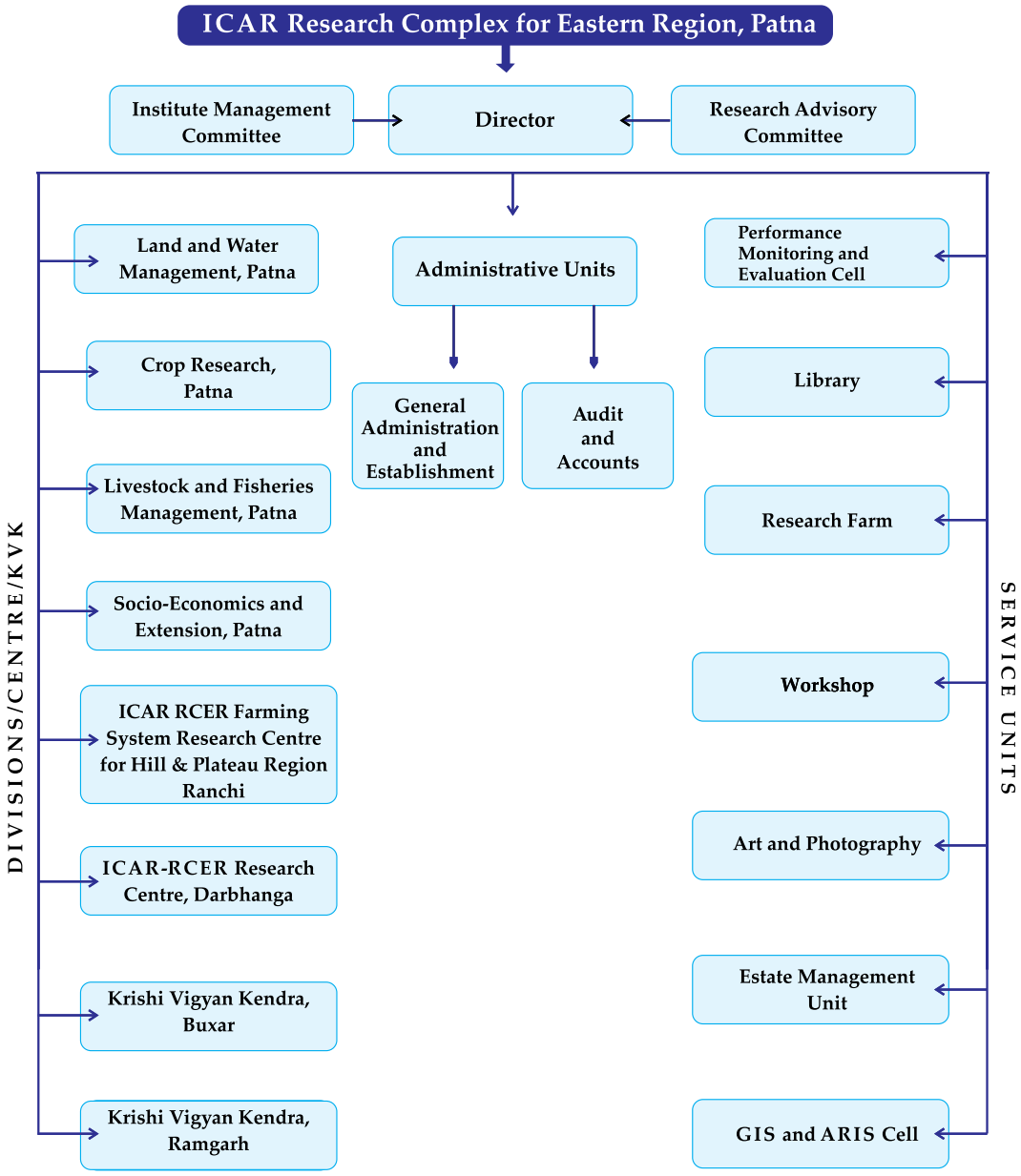


Category-wise cadre strength of ICAR-RCER

(b) Category-wise cadre strength of ICAR-RCER KVKs

Sl. No.	Category	KVK, Buxar		KVK, Ramgarh	
		Sanctioned	In position	Sanctioned	In position
1.	Scientific (PC)	1	0	1	0
2.	SMS (T6)	6	4	6	3
3.	Technical	3	3	3	1
4.	Administrative	4	4	4	1
5.	Supporting	2	0	2	0
	Total	16	11	16	5

Organogram


ICAR Research Complex for Eastern Region, Patna
Institute Management Committee
Director
Research Advisory Committee
Land and Water Management, Patna
Crop Research, Patna
Livestock and Fisheries Management, Patna
Socio-Economics and Extension, Patna
ICAR RCER Farming System Research Centre for Hill & Plateau Region Ranchi
ICAR-RCER Research Centre, Darbhanga
Krishi Vigyan Kendra, Buxar
Krishi Vigyan Kendra, Ramgarh
DIVISIONS/CENTRE/KVK
Administrative Units
General Administration and Establishment
Audit and Accounts
Performance Monitoring and Evaluation Cell
Library
Research Farm
Workshop
Art and Photography
Estate Management Unit
GIS and ARIS Cell
SERVICE UNITS

3.5 Infrastructure

3.5.1 General Infrastructure

Sl. No.	Particulars	ICAR-RCER, Patna	FSRCHPR, Ranchi	Research Centre for Makhana, Darbhanga	KVK, Buxar	KVK, Ram-garh
1.	Land (acre)	118.57	425.83	25.0	25.64	19.04
2.	Administrative building	1	1	1	1	1
3.	Workshop	1	–	–	–	–
4.	Laboratories	10	5	2	–	–
5.	Seminar and conference hall	2	2	1	1	–
6.	Godown near thrashing floor	1	1	–	–	–
7.	Heifer & Dry cow shed	4	–	–	–	–
8.	Poultry shed	2	–	–	–	–
9.	Feed mill and feed and fodder store room	2	–	–	–	–
10.	Bi-cycle stand at Sabajpura farm	1	–	–	–	–
11.	Vehicle parking shed	2	1	–	–	–
12.	Goat shed	2	–	–	–	–
13.	Small livestock shed	1	–	–	–	–
14.	Sale counter	1	–	–	–	–
15.	Poultry hatchery shed	1	–	–	–	–
16.	ARIS Cell	1	1	–	–	–
17.	Library	1	1	–	–	–
18.	Vehicles: • Four wheeler small vehicle • Bus • Motorcycle	 1 – 2	 – 1 3	 – – –	 – –	 1 – –
19.	Implements: • Tractor • Power tiller • Thrasher	 3 3 3	 4 3 –	 1 – –	 1 – –	 1 – –
20.	Irrigation facilities: • Tube well • Pump set • Reservoir/pond	 9 4 7	 3 10 4	 1 1 4	 1 – –	 1 – 4

3.5.2 Equipments purchased (> 1 Lakh)

Sl. No.	Name of the Instrument	Quantity
1.	Up Gradation of LAN System	1 No.
2.	Automatic Weather Station	7 Set
3.	Tractor (Model : Framtrac- 70DX)	1 No.
4.	3200 Poultry Eggs Capacity Fully Automatic and Digitally Controlled Shelter Cum Hatchery and Essential Spare	1 Set
5.	Distillation Unit	1 Set
6.	Neo Post Digital Franking Machine	1 No.
7.	Escorts Tractor, (Engg. No. E2300852) (NAIP)	1 No.
8.	VST Shakati 13 HP Powertiller	1 No.
9.	Server IBM, Portable Hand Held Scanner Dell TFT Monitar (NAIP)	1 Set
10.	Kirloskar Green Brand Diesel Generator 200KVA (NAIP)	1 No.
11.	PCR Machine Gel Electrophoresis (DBT Project)	1 No.
12.	PCR System with laptop	1 No.
13.	Harpended Anthorpometer	1 No.
14.	Eutech Make PCD 650	1 No.
15.	Spectrophotometer based water analyzer (NASPAD)	1 No.
16.	Micro/mini spinclor system (CRP on Water)	1 Set

3.5.3 Library Facilities

A total of 1331 books have been purchased during the period under report.

Sl. No.	Year	Total books purchased	*On line access to E journals	Journal subscribed	
				Foreign	Indian
1.	2012-13	565	Through CERA	17	14
2.	2013-14	666	Through CERA	–	–
3.	2014-15	32	Through CERA	–	–
4.	2015-16	28	Through CERA	–	–
5.	2016-17	40	Through CERA	–	–

3.6 Frequency of IMC, RAC and IRC Meetings

The meetings of all the committees (IMC, RAC and IRC) were organized as per norms of ICAR. During the period under review sincere efforts have been made by the Institute to take suitable actions on recommendations of these committees. The year-wise frequency of different meetings is as follows:

Year	IMC Meeting	RAC Meeting	IRC Meeting
2012	June 30, 2012	Dec. 17-19, 2012	Dec. 22, 2012
2013	June 17, 2013	Oct. 30 to Nov. 1, 2013	July 29-30, 2013
2014	July 7, 2014	Sept. 22-25, 2014	June 23-24, 2014
2015	Feb. 9, 2015	June 16-17, 2015	July 9-10, 2015
2016	–	June 22-23, 2016	July 21-22, 2016

In addition to this, there are several committees like Institute joint staff council, Women grievance cell, Institute staff welfare committee (Recreation club) and HRD committee.

3.7 Human Resource Development

(a) Trainings, Winter/Summer Schools organized

Short-term trainings

(i) ICAR Short course on *Recent Advances in Livestock Fish Integrated Farming System* during February 10-19, 2016.

(ii) Capacity building programme on *General Administration and Management* during December 14-16, 2016.

(iii) Training programme on *Improved Agricultural Implements and Machinery for Skill Up-gradation under CRP on FM* during December 22-24, 2016.

Winter/Summer Schools

(i) Summer School on *Horticulture based Diversification Options for Livelihood Security in Tribal Areas* from May 21 to June 10, 2013.

(ii) Winter School on *Recent Advances in Enhancing Water Productivity in Hill and Plateau region* from Sept. 25 to October 15, 2015.

(iii) Winter School on *Optimization of Production Efficiency of Fish-Livestock Integrated Farming* from Nov. 17 to Dec. 7, 2016.

Trainings, FLDs and OFTs programme organized for the farmers and entrepreneurs

A total of 714 nos. of training programmes have been conducted by the Institute on different areas of agriculture and allied sectors benefiting a total of 18996 stakeholders. Besides, 128 nos. of FLDs and 75 nos. of OFTs were conducted during 2012-17.

Capacity Building	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Training	158	183	168	83	122	714
FLDs	25	25	32	26	20	128
OFTs	6	13	20	10	26	75

(b) Trainings, Winter/Summer Schools attended by the ICAR-RCER Staff

2016-17

- Dr. M.K. Dhakar attended the summer school training on "*Canopy Architecture Management in Fruit Trees for Conservation and Utilization of Natural Resources in Changing Climate*", organized at ICAR-NRC, Litchi, Muzaffarpur during July 11-31, 2016.
- Mr. P.K. Sarkar attended summer school on "*Livelihood and Climate Change Mitigation and Adaptation through Agroforestry*", organized at ICAR-CAZRI, Jodhpur, Rajasthan, during August 3-23, 2016.
- Mr. Dharamjit Kherwar attended short course on "*Principles and Production Techniques of Hybrid Seeds in Vegetables*", organized at ICAR-IIVR, Varanasi during September 27 to October 8, 2016.
- Mrs. R. Shinde attended CAFT training on "*Soil, Air and Water Pollution and Mitigation Strategies*", organized at PAU, Ludhiana during November 2-22, 2016.
- Dr. S.S. Mali attended winter school on "*Assessing Natural Resource Management, Climate Risk and Environmental Sustainability Using Simulation Models*", organized at ICAR-IISS, Bhopal during November 8-28, 2016.
- Mr. Dharamjit Kherwar attended training-cum-workshop on "*Micro Irrigation for Improving Water Use Efficiency and Productivity*", organized at BAU, Ranchi during January 18-20, 2017.
- Mr. Indrajeet attended training-cum-workshop on "*Production and Application of Bio-fertilizer for Sustainable Agriculture*", organized at BAU, Ranchi during February 6-7, 2017.
- Miss Snatashree Mohanty attended winter school on "*Current Trends in Molecular Diagnosis for Better Health Management in Aquaculture*", organized at ICAR-CIFA, Bhubaneswar, Odisha, during Febraury 15 to March 7, 2017.

2015-16

- Dr. Sharad Kumar Dwivedi attended short course on "*Advanced Technique for Bioremediation and Management of Salt Affected Soils*", organized at ICAR-CSSRI regional Research Station Lucknow, during September 15-24, 2015.
- Drs. S.J. Pandian, Reena Kumari Kamal and Santosh Kumar Gupta attended 02 days training on "*HPLC Analysis*", organized at Mahavir Cancer Hospital, Patna during December 1-2, 2015.
- Mr. Ved Prakash attended winter school on "*Multiple Crop Modeling to Improve Resource Use Efficiency in Agriculture under Changing Climatic Conditions*", organized at PJTSAU, Hyderabad during Dececember 3-23, 2015.
- Dr. Dushyant Raghav workshop on "*Cluster Demonstration Programme on Oil Seed and Pulse Crops*", organized at Kalyani, Nadiya by ICAR-ATARI, Zone II, Kolkata during December 8-9, 2015.
- Dr. Tarkeshwar Kumar attended the training programme on "*Competency Development for Human Resource Development Nodal Officers of ICAR*", organized at ICAR-NAARM, Hyderabad during February 10-12, 2016.
- Dr. Ujjwal Kumar attended 03 days training on "*Competency Development of HRD Nodal Officers*", organized at ICAR-NAARM, Hyderabad during February 10-12, 2016.

2014-15

- Dr. Sanjeev Kumar attended international training programme on "*Basic Experimental Design and Data analysis*", organized by IRRI, Philippines during February 2-7, 2014.
- Miss Snatashree Mohanty attended professional attachment training at ICAR-CIFA, Bhubaneswar, during May 12 to August 18, 2014.
- Dr. Sridhar Gutam visited Bioversity International, Rome, Italy to work on a proposal entitled "*Securing Food and Nutritional Security through Subtropical Fruits in India*" during September 3-19, 2014.
- Dr. Tarakeshwar Kumar attended professional attachment training at ICAR-CIFA, Bhubaneswar, during November 17, 2014 to Feb. 16, 2015.
- Dr. Tshering Lhamu Bhutia attended professional attachment training at ICAR-NBPGR, New Delhi, during November 19, 2014 to Feb. 18, 2015.

2013-14

- Dr. S.K. Barari attended a training programme on "*Database Management System*", organized at ICAR-IASRI, New Delhi during April 8-12, 2013.
- Mr. Sarfaraj Ahmad attended "*Orientation Programme of Programme Assistant (Computer) of KVKs*", organized by Bihar Agriculture University, Sabour, Bhagalpur, Bihar during July 8-11, 2013.

- Dr. Santosh Kumar participated in a foreign training cum-workshop on "*Characterization of Rice Growing Environments for Dissemination of Stress Tolerant Varieties in South Asia*", held at Kathmandu, Nepal during July 24-26, 2013.
- Dr. Ramakrishna Roy attended training-cum-sensitization workshop on "*National Initiative on Fodder Technology Demontration*", organized at ICAR-IGFRI, Jhansi during September 22-23, 2013.
- Dr. Shanker Dayal attended advanced training programme on "*Transcritome Profiling of Adipogenic Progenitor Cell of Cattle*", organized by Washington State University, Pullman, USA during September 30 to December 28, 2013.
- Dr. Mandhata Singh participated in a foreign training on "*Rice, Post Production to Market*", held at International Rice Research institute (IRRI) Philippines during October 28 to November 8, 2013.
- Dr. Reena Kumari Kamal has undergone professional attachment training in Hatchery Unit of Bihar Veterinary College, Patna during November 19, 2013 to February 18, 2014.
- Dr. R.C. Bharati attended training programme under NAIP subproject entitled "*Developing, Commissioning, Operating, and Managing an Online System for NET/ARS-Prelim Examination in ASRB, ICAR*", organized by ASRB New Delhi during November 21-22, 2013.
- Mr. Sarfaraj Ahmad attended training programme under the NAIP sub-project entitled "*Developing, Commissioning, Operating and Managing an Online System for NET/ARS-Prelim in ASRB*", organized by ASRB, New Delhi during November 21-22, 2013.
- Dr. A. Chakrabarti attended a training programme on "*Fundamentals of Livestock Meteorology*", organized by Kerala Veterinary and Animal Sciences University, Mannuthy during December 2- 22, 2013.

2012-13

- Dr. R.C. Bharati attended a training programme on "*Developing Agricultural Commodity Outlook Models for Policy Analysis*", held at ICAR-NCAP, New Delhi during March 15-24, 2012.
- Dr. Santosh Kumar participated in a foreign workshop-cum- training on "*Marker Assisted Breeding for Drought Tolerance*", held at International Rice Research Institute (IRRI), Los Banos, Philippines during September 2-9, 2012.
- Dr. A.K. Singh attended NAIP sponsored training programme on "*Intellectual Property Rights and Biotechnology*", held at ICAR-NAARM, Hyderabad during September 21-25, 2012.
- Dr. K.M. Singh participated in "*Management Development Programme on Leadership Development* (*A Pre-RMP Programme*)", held at ICAR-NAARM, Hyderabad during October 8-19, 2012.

- Dr. Santosh Kumar participated in an ICAR sponsored winter school on "*Molecular Breeding Approaches for Genetic Enhancement in Oilseeds Research*", held at Directorate of Oilseeds Research (DOR), Hyderabad during December 1-21, 2012.

Participation of the Scientists in Conferences/Seminars/Symposia etc.

Scientists are being encouraged to participate in the national/ International Conferences/ Seminars/ Symposia/Workshops relevant to their area of specialization, subject to contribution of a good quality paper in the event.

3.8 Budget

Head wise expenditure of ICAR RCER

(Rs. in Lakh)

Heads	2012-13		2013-14		2014-15		2015-16		2016-17	
	Plan	Non Plan	Plan	Non Plan	Plan	Non Plan	Plan	Non Plan	Plan	Non Plan
Equipment	57.70	7.00	6.42	6.00	2.80	7.72	8.98	15.02	32.77	7.99
Works	202.87	0.00	12.90	0.00	57.87	0.00	153.35	0.00	66.50	0.00
Furniture	4.96	0.00	0.00	4.49	3.34	11.00	0.00	4.60	0.64	3.00
Vehicles	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Livestock	0.00	2.00	0.00	1.50	0.00	1.50	16.59	2.00	0.00	1.96
Library	54.44	0.00	30.65	2.00	17.40	1.00	6.07	2.00	0.08	2.00
Sub Total	**319.97**	**9.00**	**49.97**	**13.99**	**81.41**	**21.22**	**184.99**	**23.62**	**99.99**	**14.95**
Estt.Charges	0.00	1374.09	0.00	1437.71	0.00	1558.21	0.00	1670.25	0.00	1729.08
TA	21.69	8.00	24.55	9.99	23.40	9.00	18.54	11.00	18.50	10.75
HRD	1.21	0.00	1.01	0.00	5.11	0.00	2.27	0.00	3.15	0.00
Contingencies	107.10	543.70	149.42	488.53	116.50	660.30	228.02	707.15	318.34	525.38
Sub Total	**130.00**	**1925.79**	**174.98**	**1936.23**	**145.01**	**2227.51**	**248.83**	**2388.40**	**339.99**	**2265.21**
Grand Total	**449.97**	**1934.79**	**224.95**	**1950.22**	**226.42**	**2248.73**	**433.82**	**2412.02**	**439.98**	**2280.16**
BE	450.00	1935.00	225.00	2032.56	245.00	2310.25	436.00	2498.66	440.00	2281.29
% Expenditure	**99.99**	**99.99**	**99.98**	**95.95**	**92.42**	**97.34**	**99.50**	**96.53**	**100.00**	**99.95**

3.9 Linkages

Besides having linkages with leading ICAR Institutions, SAUs and State Govt. of various Eastern states, the details of other linkages is depicted below:

International

Research areas	Collaborating Institutes
• Conservation Agriculture	CIMMYT
• Climate Resilient Cropping Systems	
• Improving Water Use for Dry Season Agriculture	
• Sustainable and Resilient Farming System Intensification for EIGP	
• Development of Submergence Tolerance Rice Varieties for Flood Plain and Flood Prone Areas of Eastern region	IRRI
• Development of Drought Tolerance Rice Varieties for Eastern region	
• Restoration of Degraded Lands, Water Congested Areas and Carbon Sequestration	World Agroforestry Centre
• Developing Suitable Pulse Varieties of Lentil, Grass pea and Pigeonpea for Drought Tolerance in Eastern States	ICARDA
• Small Ruminants Improvement and Production System	ILRI

National

Research areas	Collaborating Institutes/ Regional Centres
• Integrated Farming System	• IVRI RC, Kolkata; CSWCRTI, Koraput; IARI RS, Pusa (Bihar); CIFRI; CPRS RS, Patna, IIFSR, Modipuram and NBSS&LUP
• Tribal Farming System	• CSWCRTI, Koraput, Odisha, and NBSS&LUP
• Quality Brood Management, Fish Seed, Enclosure Culture and Wetland Rehabilitation	• CIFA; CIFRI; CRRI; NRC (Pig); AAU and CTCRI

• Livestock & Avian Production System	• IVRI; NRC (Pig); NDRI; AAU; UBKV; BAU (Bihar); BAU (Ranchi) and CARI, Bareilly
• Seed Production of Agri-horti Crops including Production Technology	• DSR, Mau; IARI RS, Pusa; BISA (CIMMYT) Pusa; CRRI; BAU (Bihar & Ranchi); RAU, Pusa; IIVR; CTCRI; CHES; NRC, Litchi; CSISA; DMR; CPRS-RS, Patna & UBKV, Cooch Behar
• Ph.D Programme in Forestry	• State Forest Productivity Council (ICFRE), Ranchi
• Ph.D Programme in Agroforestry, Horticulture and Soil Science	• Birsa Agricultural University, Ranchi, Jharkhand
• Ph.D Programme in Horticulture	• Bihar Agricultural University, Sabour, Bhagalpur

3.10 Research Achievements

Varieties Developed and Released

- The Institute has developed the varieties of makhana (Swarna Vaidehi), rice (Swarna Shreya), and brinjal (Swarna Mohit and HABR-21), which have been released by the CVRC for different States. Similarly, 12 vegetable varieties consisting of tomato (Swarna Anmol for protected cultivation, Swarna Kanchan for processing type and Swarna Ratan for open field condition), chilli (Swarna Praphulya for table purpose and Swarna Tejashwi for pickle purpose), sweet pepper (Swarna Atulya), bottle gourd (Swarna Sneha), bitter gourd (Swarna Yamini), satputia (Swarna Sawani), lima/ butter bean (Swarna Poshan), leaf amaranth (Swarna Raktim) and faba bean (Swarna Safal) were released by the SVRC for cultivation in Eastern Hill and Plateau region. The Institute has also developed and released 02 varieties of faba bean (Swarna Gaurav for irrigated and Swarna Suraksha for rainfed ecologies of Eastern India) through SVRC.

Technologies/Models Developed

- In the upland ecologies of EIGP, rice-wheat cropping system could be successfully diversified with millets (sorghum, pearl millet, ragi, foxtail millet, etc) and soybean during *Kharif* season. Similarly, diversification of rainfed upland rice system with vegetables, pulses and millets was found to be more profitable in Eastern Hill and Plateau region.

- Long-term conservation agriculture (CA) experiments in rice-based systems revealed that rice mealybug may become a potential threat to rice in rice-mustard-maize system, necessitating tillage operation after 6-7 years of continuous ZT. Rice-wheat-mungbean under CA was, however, the most productive and profitable system with improvement in soil quality as compared to conventional system.
- In rice-fallows of EIGP, direct-seeding of short duration rice varieties viz., Lalat and Naveen, and 30% rice crop residue retention followed by ZT sowing of lentil, chickpea, linseed and safflower has been found productive and profitable. *Utera* cropping (broadcasting of seeds in the standing crop of rice 12-15 days before harvest) of lathyrus and lentil with seed priming and foliar application of nutrients has also been found promising in transplanted rice-fallows.
- Drip irrigation with black polythene mulching in tomato and brinjal increased the productivity, reduced weed infestation and 50-75% saving of irrigation water as compared to surface irrigation without mulching. Plant geometry and growth stage based fertigation requirement for chilli, tomato, broccoli and sweet corn were standardized for the hot sub-humid region.
- Collected, evaluated and characterized 256 cultivars of tuber crops from Eastern India. Sweet potato line ACC-161 (8.25 t/ha), Colocasia line ACC-60 (748.50 g/plant), Elephant foot yam line ACC-136 (2.63 kg/plant), Tapioca line ACC-139 (19.75 t/ha) and Greater yam line ACC-34 (42.77 t/ha) were found promising for yield, nutritional, anti-oxidant and biotic stress traits. Also collected & evaluated 70 nos. of potential wild leafy vegetables and species like *Celosia argentea*, *Leucas plukenetii* and *Bacopa monnieri* were found promising for anti-oxidant properties. High mineral content was found in *Hygrophila auricalata*, *Leucas cephalotes* and *Commelina caroliniana*.
- Characterized the indigenous breeds of cattle *viz.*, *Bachaur, Purnea* & *Gangatirti; Diara* buffalo, and *Ghungroo* breed of pig in their home tracts. Also collected and characterized the indigenous duck strains of Eastern region. Based on these studies, recently '*Purnea* cattle' and '*Maithili* duck' have been registered as new varieties.
- Standardized breeding and culture practices of *Clarias batrachus* (*Magur*), *Labeo bata* (*Bata*) and *Puntius japonicas* (*Puthi*) for diversification in aquaculture production systems.
- Based on soil-plant-animal continuum, area specific mineral mixture (Swarna Min) has been developed for livestock of Bihar. Supplementation of this mixture has resulted in milk yield increase of 14.1% as compared to 4.8% by commercially available mineral mixtures.

- Developed and replicated 06 nos. of fish-based integrated farming models for water surplus ecologies of Eastern India. The highest fish production (5.05 t/ha) was achieved in cattle-fish integration, followed by pig-fish and buffalo-fish (3.57 t/ha) integrations. Pasture-goat-fish model was also developed for improving productivity in waterlogged areas.
- Developed the technology for makhana cultivation in cropping system mode, which was able to improve upon the net monetary income of Rs. 15,930/- per acre compared to traditional method of makhana cultivation. Makhana based integrated farming system model, developed for water surplus ecologies of Bihar, provided net monetary income of Rs. 35,560/- per acre.
- Integrated farming system models have been developed for irrigated, rain-fed and Hill & Plateau region. One acre IFS model comprising agri-horti crops (3500 m^2) + goat (20+1 nos.) + poultry (200 birds/cycle of 35-40 days) and mushroom could generate a net annual income of Rs. 89,413 with an initial investment of Rs.1,02,220/- under irrigated medium land, while the two acre IFS model integrating agri-horti crops (6500 m^2) + livestock (2 cows + 2 calves) + fish/duck (1000 m^2), with an initial investment of Rs.2,05,500/-, could give a net annual income of Rs. 1,42,244/- under the lowland situation.
- Diversity of fruit flies (Tephritidae: Diptera) and their Host Plant Determination was completed for the Eastern region. Fruit fly species *viz.*, *Bactrocera dorsalis*, *B. correcta* and *B. zonata* have been found dominant in the region. Sequencing of mitochondrial DNA of mango fruit fly was also completed. Temperature-based phenology model was developed for *Bactrocera zonata* (Diptera: Tephritidae), a potential pest of mango.
- Future scenario (2020, 2050 and 2080) of different fruit fly species of mango in India was developed, using MarkSim Model.
- Developed a solar operated groundwater pumping and pressured irrigation for the Eastern region. With this model, ground water of 104-120 m^3 per day can be extracted between the months of Dec. to Jan., and between 140-170 m^3 per day in the remaining months in the Eastern Indo-Gangetic Plains. The system can irrigate 0.25-0.30 ha cropped area per day by surface method. The system offers pressure head of 1.4- 1.6 kg/cm^2 for pressured irrigation.
- Developed technology for Instant Makhana Kheer Mix and Dry Instant Soup Mix of button mushroom.

Germplasm and Gene Sequence Conserved

- Thirteen germplasm of different vegetables were deposited in NBPGR {Tomato (3), Capsicum (1), Bottle gourd (1), Brinjal (3), Amaranth (1), Chilli (2), Bitter gourd (1) and Ridge gourd (1)}.

- Promising litchi (04), early vegetable type jackfruit (06), jamun (02), red flesh guava (12) and custard apple (03) germplasm were identified. An early vegetable type jackfruit selection from Baradari, Ranchi was registered with NBPGR (IC-0625182).
- Eight gene sequences registered at National Centre for Biotechnology Information (NCBI), USA on growth and prolificacy genes of goat.
- Registered 14 varieties of different vegetables (tomato, brinjal, field pea & cowpea) with PPV&FRA besides 02 farmers' varieties (litchi & cucumber).

MoUs for Technology Commercialization

- KGVK Rukka, Ranchi for parental lines of tomato hybrid- Swarna Sampada.
- Dynamic Tarang Private Limited, Ranchi for open pollinated vegetable varieties.
- Natural Resources Integrated Development Foundation, Maudhapara, Raipur Chhattisgarh for instant swarna mushroom mix.
- TATA Steel Authority, Jamshedpur for application of basic slag in agriculture.
- Sabujshakti Agrotech Revolution, Kolkata for large scale production and sale of open pollinated and hybrid vegetable varieties.
- Gram Bharti, Beej Gram-Golhaiya, Giridih (Jharkhand) for large scale seed production of open pollinated vegetable varieties.
- Green Gold Farming Swalambi Sahkari Samitee Ltd., Dharti Dhan Bhawan, Ranchi for large scale seed production of open pollinated vegetable varieties.
- Director, National Horticulture Mission, Govt. of Jharkhand for cultivation of high valued exotic vegetables in Ranchi, Jharkhand on turnkey basis-a maiden attempt in India.
- Director, National Horticulture Mission, Govt. of Chhattisgarh for capacity building of the stakeholders, rejuvenation of declining orchards, ensuring supplying of quality, seed and planting materials.
- Director, National Horticulture Mission, Govt. of Jharkhand for adopting advanced and latest technologies for holistic development of the state.

General Achievements

- A new Krishi Vigyan Kendra (KVK), ICAR-RCER, Ramgarh (Jharkhand) has been established and started functioning from July, 2014 with the mandate of technology assessment, refinement and demonstration.

- Two Pulse Seed Hubs (Patna and Buxar) were established for increasing pulse production.
- During the review period, thirty seven villages of six districts of Bihar and Jharkhand were covered under *Mera Gaon Mera Gaurav*, and 3125 farmers were directly benefitted through various activities like training, demonstration, supply of quality planting materials, etc.
- A farm machinery resource centre was established at ICAR RCER Patna and a Custom Hiring Centre for farm machinery and implements at KVK Buxar.
- Produced the quality seeds and planting material of:

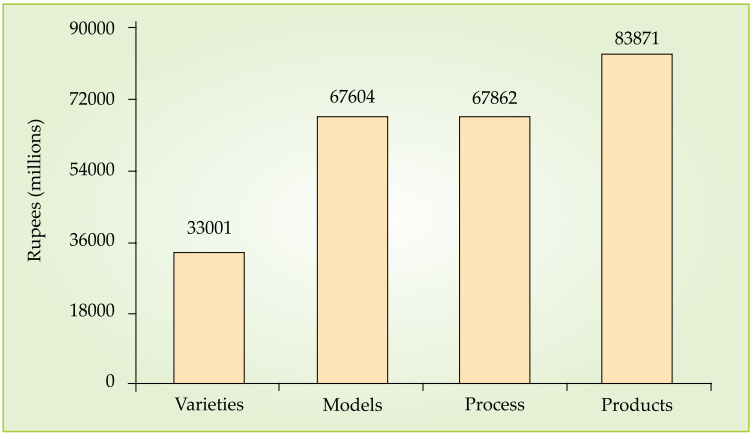
1.	Rice (Swarna Shreya)	5.0 t
2.	Lentil, chickpea, field pea & mungbean	30.0 t
3.	Truthfully levelled vegetable	21.0 t
4.	Makhana	1.5 t
5.	Quality planting materials of fruit trees	0.31 million
6.	Seedlings of MPTs	0.15 million
7.	Mushroom spawn	27.0 t

3.11 Impact

Based on the presentations made by different divisions at Hqrs. and also the Regional Stations and KVKs including the visits made in the farmers' fields and the feedback received from the stakeholders, the Committee feels that the Institute has made the visible impact through technology generation and transfer. The Institute released varieties have been found instrumental in improving economic and nutritional security of the farmers due to wide scale adoption. The Committee has also gone through the success stories published by the Institute and observed that :

- Adoption of integrated aquaculture by group farming for improving productivity of *Chaur* in Bihar (https://icar.org.in/node/301) and multiple water use for income generation in *Chaur* of Eastern India (https://icar.org.in/node/8081), has enhanced the aquaculture expansion in more than 40 ha of *Chaur* area with annual fish production of 200 tonnes and net monetary income of Rs. 15 millions (approximately).
- Notified new vegetable varieties (https://icar.org.in/node/6167) occupied an area of more than 5000 ha in the states of Jharkhand, Bihar, Odisha, West Bengal, Chhattisgarh, Eastern UP, Maharashtra, Assam, Nagaland and Karnataka, and contributed to the net monetary gains of nearly Rs. 900 millions.

- For adoption of the technologies, the Institute has also entered into MoUs with :
  (i) State Horticulture Mission, Raipur, Chhattisgarh for the production of quality planting material and capacity development of stakeholders in the field of horticultural development (Annexure I),
  (ii) National Horticulture Mission, Jharkhand for protected cultivation of Dendrobium orchid (Annexure II),
  (iii) TATA Steel Authority, Jamshedpur, Jharkhand for application of basic slag in agriculture (Annexure III), and
  (iv) Production of round the year button mushroom (Annexure IV).
- The integrated farming system models, developed by the Institute for small holders, have been well appreciated by the Govt. of Bihar and accordingly sanctioned a provision of a subsidy of Rs. 10,000/- per acre for adoption of system mode of food production (Annexure V).
- The Institute has also commercialized other technologies by signing MoUs with six different organizations as evidenced from the section 3.10(d) of the report.
- The overall economic impact assessed, using partial budgeting technique and economic surplus approach by the Institute, has been accounted for Rs. 252338 millions, which is appreciable.



Economic impact (Rs. in millions)

However, the Committee suggests that environmental impact should also be assessed of a particular system/ technology over and above the socio-economic impact.

3.12 Publications

During the period under report, the research publications made by the Institute are given below. For details of some quality publications, please see Annexure VI.

Publications	2012-13	2013-13	2014-15	2015-16	2016-17	Total
Research Papers	81	82	65	88	117	433
Books	8	5	-	5	3	21
Book Chapters	9	9	8	13	35	74
Bulletins	9	7	8	26	10	60
Training Manuals	2	2	3	-	2	9
Popular Articles	36	31	28	20	19	134
Policy Documents	-	-	1	1	2	4

3.13 Awards and Recognitions

The Institute received fellowships (3 nos.), associateships (2 nos.), national awards (6 nos.), best research paper awards (6 nos.), recognitions (2 nos.), team leader award (1 no.), young scientist award (1 no.) and gold medal (1 no.) during the period under report and details of the same is depicted in Annexure VII.

3.14 Important Events Organized

The details of the important events organized by the Institute during the period under report are depicted below:

Date	Programme conducted
April 12, 2012	Interface meeting with the Veterinary Officers of Bihar for Monitoring Livestock Diseases
May 14, 2012	Brainstorming Session on Water use Potential in Flood Affected and Drought Prone Areas of Eastern India
May 15, 2012	Organized Farmers' Innovation Day
May 17, 2012	Travelling Seminar on Conservation Agriculture
July 25, 2012	Regional Chapter Meeting on "Strategies for Agricultural Development in Hill & Plateau region
July 28, 2012	ICAR-Industry Meet Organized at BIA Premises, Patna
August 17, 2012	Stakeholder Workshop on Quality Fish Seed Production in Bihar
September 21-22, 2012	XXI regional Committee Meeting of the ICAR regional Committee No-IV held at Patna

October 11-13, 2012	Agri-Expo 2012- A Step Towards 2nd Green Revolution
November 22, 2012	Stakeholder's Meeting on "Strategies for Fodder Production in Bihar
April 8-9, 2013	Agri-Summit 2013- A Step Towards 2nd Green Revolution
May 10, 2013	Stakeholder Meeting on Improving Rural Livelihood through Access to Water, Energy and Market (IWMI)
May 10, 2013	Interaction Meeting with Nancy J. Powell, US Ambassador, New Delhi
August 13, 2013	Contingency Planning Meeting for Bihar and Jharkhand
November 19, 2013	Brainstorming Workshop on Precision Agriculture in Nutrient Management Present Status and Future Need in Eastern India
December 6-7, 2013	Technology Showcasing Meet 2013 in Collaboration with DKMA and NAIP
December 24-25, 2013	Farmers' Fair and Animal Health Camp Organized at Katihar, Bihar
February 26, 2014	Interaction Meeting with the Stakeholders for Technology Dissemination
February 27-28, 2014	Eastern region Chapter Meet on IPR in Agriculture
May 28, 2014	Regional Workshop on Research Priorities and Reconciliation
June 9-11, 2014	Regional Workshop on Strengthening Partnerships and Refined Methodology for On-station Experiments of AICRP on IFS
June 26, 2014	ICAR-DAC Meeting on Operationalization of District Level Contingency Plans in Bihar
July 25, 2014	Brainstorming Session on Improving Dairy Animal's Productivity through Efficient Feed and Fodder Interventions in Bihar
October 7-8, 2014	Brainstorming Session on Water in Agriculture held at ICAR Research Complex for NEH Region, Umiam, Meghalaya
April 20-25, 2015	Regional Programme on Planning for Promotion of Integrated Farming for Sustainable Development, Sponsored by NIRD
July 25-26, 2015	ICAR Foundation Day & 9th KVK National Conference, held at SKM Hall, Patna

August 10, 2015	Reducing Post Harvest Losses of Small Farm Holders of Bihar and Project Launching Ceremony at BVC, Patna
September 17, 2015	Stakeholders Meeting of NRC on Integrated Farming
October 7, 2015	Workshop for Identifying the Production and Technological Gaps in Middle Gangetic Plains region
December 25, 2015	Jai Kisan Jai Vigyan Week and Scientists- Farmers' Interaction- cum – Exhibition, Organized at Motihari
March 29-30, 2016	Pashu Mela-cum-Farmers-Scientist Interaction, Organized at Kotwa, East Champaran
June 7, 2016	State Coordination Committee Meeting of Second Green Revolution held at Ranchi
June 8, 2016	Interaction Meeting on Application of Basic Slag in Agriculture held at Ranchi
June 27, 2016	First Steering Committee Meeting of Second Green Revolution (SGR)
June 28, 2016	Academia-Industry Interaction Meet for Eastern region
July 12, 2016	State Coordination Committee Meeting of SGR held in Odisha
July 14, 2016	State Coordination Committee Meeting of SGR held in West Bengal
July 27, 2016	State Coordination Committee Meeting of Second Green Revolution (SGR) held in Eastern UP
August 2, 2016	State Coordination Committee Meeting of SGR held in Assam
August 4, 2016	State Coordination Committee Meeting of Second Green Revolution (SGR) held in Patna
August 5, 2016	State Coordination Committee Meeting of SGR held in Chhattisgarh
August 26-27, 2016	XXIII Meeting of the ICAR regional Committee No-IV held at Patna
September 26-30, 2016	Mid-Term Review Meeting of Improving Water Use for Dry Season Agriculture by Marginal and Tenant Farmers in EGP
December 19, 2016	Interface Meeting on Documentation of Technologies and Development of Road Map for Livestock and Poultry Sector in Eastern region
March 23, 2017	Bihar State Coordination Committee Meeting for Doubling Farmers' Income by 2022

4. Issues and Strategies

Eastern region has about 163 million underprivileged people compared to 360 million at the national level. Similarly, the region has about 37 million scheduled tribe (ST) population, which needs special attention for livelihood options. Present agricultural system is multifaceted and multidimensional and, therefore, requires holistic management approach to create conducive environment for land, water, crops, biomass, horticultural, livestock, fishery and human resources for achieving overall sustainable agricultural development. Some notable challenges include population pressure on land, small and fragmented landholdings, land degradation, imbalance use of water and nutrients, low fertilizer consumption, low productivity, low level of mechanization, climate change impact, non-remunerative prices and post-harvest losses. In order to meet out the aforementioned challenges, technology integration, scaling up and framing of demand driven productivity enhancing research agenda in a network mode, using both conventional and frontier technologies ensuring scientific management of natural resources and sustainable intensification are required.

4.1 Challenges in Agriculture

The modern agriculture has many complex challenges. However, the major challenge is to produce more from dwindling natural resources for growing population in a sustainable manner to ensure food security. There are increasing pressures from climate change, soil erosion and biodiversity loss and from consumers' preference and choice of food and concerns about how safely it is produced. Although science led agriculture provides a large number of solutions, the outcome is not always the same because each farm is unique with different landscapes, soils, available technology and potential yields. Therefore, it will be imperative for farmers, researchers and other stakeholders to deal with many problems including how to:

- Cope with climate change, depleting soil-water resources and biodiversity loss,
- Satisfy consumers' changing tastes and expectations for more food of higher quality,
- Generate, transfer, learn and adopt new technologies,
- Invest in farm productivity with provision of incentives including promotion of private investments in agriculture,
- Strengthen institutional framework, infrastructure and value chain from farm to fork,
- Unlock the growth potential of agriculture in Eastern region.

4.2 Specific Issues

Productivity gap of various commodities is very high in the region. As such, following are the issues, which lead to low agricultural productivity:

- Resource poor farmers with the lowest per capita land availability and income, and small and fragmented land holdings,
- Frequent occurrence of floods, droughts, cyclones and other natural calamities in plains of Eastern region, especially Bihar, Odisha, Assam and West Bengal,
- More than 10 million ha area under rice-fallow and, thereby, predominance of mono-cropping system,
- Low productivity and poor health management in livestock and fisheries,
- Untapped potential of flood and flood-prone ecosystems for fisheries and aquatic crops production,
- Inadequate extension and other service delivery mechanisms (ICTs), and
- Absence of effective value chain management, especially in case of horticultural crops.

4.3 Strategies

Following strategies are suggested/promoted for increasing the farm income, assuring food and nutritional security and enhancing agricultural growth in the Eastern region:

- New promising area-specific varieties for major crops,
- Strengthen institutional base for quality seed and planting material production,
- Holistic and sustainable development of rainfed areas based on watershed approach,
- Promoting conjunctive use of surface and groundwater resources in canal commands by expanding shallow tubewell programme,
- Market orientation of horticultural produce along with post-harvest processing, product development and value addition, storage, etc.,
- Genetic improvements in indigenous goats, cattle and buffalo,
- Productivity enhancement of ponds and tanks through scientific management of fish culture including popularization of fish based integrated farming system models for improving livelihood options, and
- Organic farming in Hill and Plateau region, and to ensure supply of organic seeds, bio-pesticides and bio-fertilizers to the stakeholders.

4.4 Looking Forward

The approach for achieving food security in the Eastern region would be sustainability, crop diversity and community based management of natural resources with technological backup. The necessity to grow enough food, feed, fuel and fibres to meet requirements of the ever increasing population has put the soil, water and vegetation under severe stress. The problem of soil degradation through erosion, pollution and salinization is also growing and needs to be addressed. Since pressure on available limited soil resources will increase with time, effective and rational use of this resource will be the core strategy to increase future productivity on sustainable basis. Soil health and fertility must also draw immediate attention of all concerned, especially when organic matter content has gone as low (0.3 to 0.5%), and several micronutrient deficiencies are surfacing prominently. Thus, there is a strong need for conserving soil and land resources and preserving natural ecosystem so that short-term exploitative measures on soil resources do not jeopardize long-term sustenance of soil productivity and health. Similarly, biodynamic farming system consisting of crop, livestock, fish, poultry and agroforestry should be developed for achieving sustainable and climate resilient production systems for food, nutrition and environmental security. Following strategies will be adopted to achieve the goals and targets in the changing scenario:

- Availability of water for agriculture will be limited in future, hence water use efficiency needs to be improved. It is estimated that even after achieving the full irrigation potential, nearly 50 to 55% of the total cultivated area will remain rainfed.
- Issues relating to management of supplies to improve availability of water in time and space, management of demands through improvement in storage, transport, water allocation, scheduling and application technologies, and preservation of integrity of water dependent ecosystems through development of decision-support systems for disposal and reuse of waste water need to be addressed. Special efforts will have to be made to evolve technologies for prevention and amelioration of salinity in irrigation commands, which are based on harnessing synergy of hydraulics and plant biology. Also multiple use technologies that enhance water productivity without consumptive use such as fish production in irrigation storage and conveyance system will have to be planned. Research aimed at capturing technology-policy interactions in respect of water market, pricing, security for quality and dependability will have to be undertaken to develop water management options. Judicious use of ground water and rain water harvesting is also need of the hour.

- Resource conservation technologies (RCTs) would be given due importance in order to meet out emerging challenges of sustainability. Technologies are available for holistic development of land through integrated watershed management, particularly in the Hill and Plateau region. Precision farming is also an emerging area of research for resource conservation.
- New technologies on value addition, food safety and greenhouse gas mitigation need to be tested and replicated in the region. Agroforestry in the context of energy farming and carbon trading provides opportunities in the region, particularly in the Hill and Plateau region.
- Horticultural crops would play a major role in market driven diversification of the existing production systems. Hence, development of customized horticultural production system fitting the resource base of farmers with the objective of maximizing income and ensuring livelihood security of farming communities of Eastern region will be imperative.
- With land resources becoming scarce in time, protected cultivation of high value crops in multitier systems with its nutrition and crop management strategies will become high priority area. Since higher production from rainfed areas is a priority for sustainable food production, watershed based water management and budgeting will be taken up on priority basis.
- Second Green Revolution should focus on generation of employment for the small and marginal farmers and the landless, while enhancing agricultural production. Developing location-specific integrated farming system modules (IFS) having synergistic interaction of agri-horti crops, agro-forestry, fishery, livestock, poultry, beekeeping and mushroom need to be replicated to enhance the income of the stakeholders of the Eastern region. Organic farming zones should also be identified in the region, targeting the commodity and market.
- Livestock is an integral part of food and nutritional security and even landless farmers can derive livelihood through livestock farming. Agricultural biosecurity systems will be developed to prevent pandemics in avian and animal population.
- Secondary agriculture, promoting processing and value addition of agricultural commodities and horticultural produce is another thrust area for economic upliftment of predominantly agrarian economy of Eastern region.
- Weather-based forecast for land use planning is also required keeping in view of the vagaries of monsoon. Eastern region consists of very high percentage of small and marginal farmers and significant population below poverty line. Climate resilient crops, farming systems and enterprises are a major thrust area considering the changing climate scenario and agro ecological situations.

- Framing up forward looking research agenda on biotechnology and use of ICT in agriculture in the areas of innovative technology generation need to be focused for increase in food production.
- The strategies to meet the challenges will comprise of striving to harness the power of science for increasing productivity, enhancing input use efficiency, reducing cost and post-harvest losses, minimizing risks and improving quality of food commodities through conventional techniques as well as new science and tools.
- ICAR-RCER, Patna realizes the need to re-engineer the process to bring improvements in order to ensure a firm new mindset to transform the organization to excellence. Building a capable organization will obviously require competent people, building core competencies and competitive abilities, restructuring the organization and work with efficient and effective support system, which will result in development of committed leadership, effective communication and team building. Regional networking with SAUs, KVKs, NGOs, line departments and other social organizations will create the foundation to address the challenges.

4.5 Human Resource Requirement and Trainings

Overall growth of agricultural sector demands skilled and efficient human resources not only for the organizational needs but also to meet the requirements of R&D institutions for developing and evaluating newer technologies. Thus the qualities of trained technical and professional manpower in agriculture are critical factors. Therefore, the Institute would give emphasis to strengthen its HRD programme by incorporating newer and need based course curriculum.

- Tailor made training programmes on integrated farming system, water productivity improvement, multiple uses of water, conservation agriculture, livestock, poultry and fish diagnostic and prevention, integrated aquaculture, IPR, innovative extension delivery etc. with emphasis on hands on training would be developed.
- Promoting scientists to participate in seminars, workshops and training programmes organized by specific agencies, within and abroad, so as to develop expertise in relevant fields at national and international level.
- Technology delivery systems with the latest ICTs, mass communication tools and internet platforms should be developed and strengthened by developing linkages with SAUs, Govt. Departments, ATMAs, KVKs, NGOs, private R&D organizations and international agencies.
- Participatory approaches would be employed for refining and demonstration of technologies to the stakeholders. For quicker dissemination of information/ feedback, a common platform is required for the Eastern region through a cyber-based information exchange system.

4.6 Infrastructure Requirement

- Centralized laboratory unit at regional Centres of the Institute will need modern equipments for soil, water, feed and mineral analysis facilities like atomic absorption spectrophotometer, gas chromatography, LPLC, cooling centrifuge and ultra low freezer.
- Agriculture Mechanization and Development Centre (AMDC) should be established at main campus.
- State of the art facilities shall be established for disease diagnostic laboratory and planting material production.
- The laboratories are overcrowded by old and defunct equipments. Most of the costly equipments like AAS, Texture Analyzer (Malveri make), Soil Moisture Meter, Pressure Plate Apparatus, Guelph Permeameter, Orbital Shaker, Infrared Gas Analyser (IRGA), Leaf Area Meter, Refrigerated Centrifuge, Nikon Microscope, etc. have been purchased by the Institute long back and most of them are out of order. Even the spares are not available now in the market. The Committee strongly recommends that provision should be made to purchase these equipments for soil and plant analysis. Additionally, ICPAES, Nitrogen Analyzer, Soil Moisture Probe, NIR Feed Analyzer, Inverted Light Microscope, Nano Spectrophotometer and Automatic Water Analyzer should also be purchased based on the requirements of the work carried out by the scientists in different disciplines.
- A well-furnished farmers' hostel and guest house is required at Darbhanga Centre for farmers, visitors and scientists.
- Keeping in view the importance of precious germplasm of litchi and mango being maintained by Ranchi Centre, proper fencing is essentially required at Farm No. 2. Security services shall be provided at Ranchi Centre for safety of the valuable germplasm being maintained by the Centre.

5. Observations

- It was observed that Institute has only 118.57 acres of land at three different locations in Patna. However, keeping in view the programmes of the Institute like breeder seed production, varietal development, crop diversification, livestock and fisheries component, quality seed production, etc., the Institute requires at least 50 acres of additional land so as to take up these programmes in befitting manner.
- The Institute has developed location-specific integrated farming system models for small and marginal farmers. However, the quantitative advantages of the integrated farming system models developed by the Institute compared to other organizations/institutions should be clearly identified. There is an urgent need to transfer the visible components of the IFS models to the farmers of the Eastern region for large scale adoption and feedback for further refinement.
- It has been found that large area of the Eastern region remains fallow after rice. Institute should take leading role for development and sustainable utilization of these fallow areas. Site-specific and resource base technologies may be developed for the benefit of the people. Similarly, large area of the region also remains flood affected and under wetlands. Technologies for management of these ecologies need to be developed and disseminated.
- Institute should focus on strategic and adaptive research rather than basic research. The basic research should be taken up in collaboration with other institutes to save resources.
- The soil degradation, soil nutrient and micro-climatic map developed by NBSS&LUP, regional Centre, Kolkata shall be used for crop planning by ICAR-RCER in the degraded soils which constitute a large proportion of the Eastern region.
- It is very encouraging that the centre has developed first ever variety of makhana 'Swarna Vaidehi'. Its genetic purity be maintained by the Institute for the benefit of stakeholders. The collection and evaluation of other aquatic crops (Alocasia, sacred lotus, *Acorus calamus*, waterchestnut, etc.) may also be initiated at the Centre. Moreover, necessary initiatives may be taken up by the Centre to showcase the makhana at a national and international platform to popularize the makhana and makhana products.
- Collaborative research work may be initiated for the refinement in makhana popping machine and development of seed harvester from the ponds. Special attention should be given for achieving higher production efficiency and economics during the development.

- Eastern states though contribute the major share in vegetables, proper marketing system is missing. Farmer oriented marketing strategies of farm produce including value chain management should, therefore, be developed to help farmers in developing linkages with mandis.
- Members advised that farmers should be empowered through development of Farmers Interest Groups, Farmers Organizations, Farmer Producer Company, etc.
- The Institute released varieties and developed technologies be popularized at different platforms. The Institute is advised to prepare the success stories of progressive farmers in the form of videos, leaflets etc., for large scale percolation of technologies among the farmers.

The QRT reviewed the performance of the Institute, its research stations, farms/ facilities, the KVKs, outreach programmes and linkages in detail as per the ICAR guidelines during the period under report. The technology generation, production, protection, dissemination and publication parameters were analyzed through domain experts and later collectively as a team across the sectors. The QRT is highly satisfied with the overall achievements and grades the Institute's performance as "Excellent".

6. Recommendations of the QRT

The recommendations of the QRT are listed below:

6.1 General

- Members of QRT observed strong presence of the Institute in the State of Bihar and Jharkhand and suggested to strengthen its research and extension/outreach programmes, linkages and coordination with different institutes and development departments of the other catchment States like Chhattisgarh, Odisha, West Bengal, Eastern UP and Assam as per the mandate of the Institute. MoUs may be signed between premier institutes of the Eastern region with ICAR-RCER to carry out collaborative research/ extension projects. Tribal Development Agencies and Tribal Research Institutes in the catchment States may be approached for programmatic linkages and joint strategies.
- The Institute should continue the work on improvement of non-descript buffalos through development and supply of elite *Murrah* buffalo germplasm.
- Fodder is a major constraint for livestock development. Fodder based cropping and seed production systems should be developed and popularized.
- The technology of biofloc and recirculation systems of fish rearing should be disseminated among the stakeholders to achieve higher productivity and profitability.
- Environmental impact should be assessed of a particular system/technology over and above the socio-economic impact.
- It is imperative to strengthen the linkages with the development departments for wider up-scaling of the technologies developed by the Institute. Regular scientific & stakeholders meetings, and interactive sessions can be organized to understand the prevailing issues and share the knowledge generated thereof for further research. Focus should be on the development and promotion of farmer empowerment models (SHGs, CIGs, FOs, FPCs, PPPs, etc.), large scale ICT applications through IT Platforms, social media, print & electronic media, farmer and farm women knowledge groups, Apps for various value chain operations, etc. Further, extension innovations attempted by the private extension services in agriculture and allied sectors would need to be documented, assessed and learning integrated for mutual advantage.

6.2 Organization and Management

- The QRT observed that large number of positions remained vacant in the scientific, technical and administrative cadres at the Complex. For example, Research Centre for Makhana at present is having only few scientists and does not have any administrative and technical staff which requires urgent attention. Similarly, at present only three SMS posts have been filled up for the newly established KVK Ramgarh and about 69% posts are lying vacant. Similar is the case with KVK, Buxar. Manpower inadequacy at all levels became a major bottleneck for effective and efficient implementation of research and development programmes. Necessary processes may be initiated for redeployment/ recruitment of the staff at the Centres/KVKs, for smooth functioning of the research and outreach activities.
- Supporting manpower and security guards are not adequately available at regional Centres and KVKs of the Institute. The necessary arrangement should be made to deploy, especially the security guards to ensure the securities to the office, farm, farmers' hostel, demonstration units etc.

6.3 Research

- In conservation agriculture, microbial dynamics and their role under different tillage practices and carbon sequestration potential should be studied under long-term field experiments. The environmental impacts of different conservation agriculture practices should also be evaluated.
- Crop residue burning is becoming a major environmental problem in EIGP, especially in rice-wheat cropping system. Study needs to be initiated on residue management including role of microbes in faster decomposition of crop residues in soil.
- Research programmes on diversification of rice-based cropping systems with climate resilient nutri-cereals should be initiated in diverse ecologies of Eastern India.
- For evaluation of rice varieties for flood tolerance, efforts should be made to simulate the turbidity of flood water. For this, such trials need to be undertaken in farmers' fields itself.
- Eastern India faces a problem of terminal heat, which limits the wheat productivity and quality. Germplasm resistance to terminal heat stress should be evaluated in collaboration with ICAR-IIWBR, Karnal and CIMMYT.
- Bacterial wilt is a major problem for pulse and vegetable production, especially in acidic soils. The Institute should continue to develop bacterial wilt resistant varieties of vegetables and screen the suitable germplasm of pulses for bacterial wilt resistance. Seed treatment of vegetables and pulses with *Trichoderma* should be continued to check the wilt complex.

- Insect-pest and weeds are the major problems in the mango orchard. Integrated environment friendly practices should be developed to reduce chemical load and cost of cultivation.
- Research should be intensified on development of different fruit-based production systems for improving the productivity of rainfed uplands.
- Special emphasis should be given for the development of suitable agro-forestry models and popularization of bamboo plantations in the Hill and Plateau region. Rehabilitation of overburden areas in coal and other mining areas should be given due importance especially in the States of Odisha, Jharkhand and Chhatisgarh. Bio-drainage models may be developed for rehabilitation of wetlands.
- The Institute should take a lead to have a repository of farm tools and implements for demonstration/sale by establishment of Agricultural Mechanization Development Centre (AMDC)/Agro service with the support from state/central govt. In addition, indigenous tools/implements shall be refined in order to reduce the drudgery of women folk.
- A database on indigenous knowledge of farming practices owned by tribal farmers should be created for validation and replication.
- The Institute needs to assess the crop-livestock and water interactions and economic water productivity for milk, meat and egg besides fish based integrated farming system models.
- Inventory of aquatic resources needs to be prepared especially for the selection of potential candidate species for aquaculture as well as ornamental fish species.
- Organic farming models for Hill and Plateau region should be developed targeting the commodity and market.
- Impact assessment of different technologies and trainings need to be emphasized. Reasons for acceptance or rejection of a particular technology should be properly documented and internalize in the Institute outreach programmes.
- The Social Science Division/Institute KVKs may consider taking up a pilot at least in one block, each in Bihar and Jharkhand, for trying integrated extension delivery and its impact, in collaboration with public and private extension service providers, through systematically worked out Block Extension Plan (BEP). Additional funding support for such an innovative extension research pilot could be obtained through Council, ATMA and other Central/State agencies.

6.4 Finance

- The Complex was able to utilize 98.9% of its Plan and 97.9% of Non-Plan Budget during the period under report (2012-17). QRT recommends that the budget allocation for the Complex may be enhanced by at least 50% under Grant-in-Aid-Capital and Grant-in-Aid-General so that infrastructural and laboratory facilities of all the centers are adequately developed and furnished. Moreover, higher budgetary allocation can enhance mobility of the scientific, technical and other staff to different Eastern states. This additional fund allocation would also help in undertaking the research in consortia mode in the states like Chhattisgarh and Eastern UP.

6.5 Key Recommendations

- The Institute is mandated to take up the strategic and adaptive research in Eastern states. However, its visible impact is limited mainly to Bihar and Jharkhand and partly in other States due mainly to the fact that it has only two regional Stations, located in Jharkhand and Bihar. The Committee strongly recommends that the regional Centres of ICAR, operating in the States of Odisha, Assam and West Bengal should be immediately merged with ICAR-RCER, Patna so as to fulfill the mandate of the Institute. Similarly, in all the catchment States the Institute should take up the research and extension work in consortia mode with ICAR, SAUs and other relevant agencies. Requisite funding support should be inbuilt into the Institute's budget for this purpose.
- Eastern India has large area under rice-fallow. Focused programme should be taken up on rice-fallow management through second crop of oil seeds, pulses, vegetables and fodder crops by effective utilization of residual moisture and appropriate rainwater management/conservation technologies.
- Strategic research should be initiated for improving productivity of flood and flood-plain ecologies through suitable technological interventions in EIGP.
- Need-based location specific biodynamic integrated farming system (IFS) models should be developed and replicated in diverse agro-ecologies of Eastern India.
- The rainfed agriculture in Eastern India is highly vulnerable to the vagaries of climatic variability. The Institute should develop and systematically disseminate different climate resilient production systems for the region.

- In order to strengthen small farm mechanization in Eastern India, Institute should be a repository of farm tools and implements by establishing Agricultural Mechanization Development Centre (AMDC)/Agro service with the support from state/central Govt. In addition, indigenous farm tools/ implements should be refined in order to reduce the drudgery of women folk in agricultural operations.
- The Institute should strengthen extension/outreach, linkages/partnerships and technology up-scaling efforts in collaboration with Agriculture and allied Development Departments, ATMAs, ATARIs, SAMETIs, SAUs, Tribal Development Agencies and other ICAR Institutes in the region, in demonstrating and up-scaling technology dissemination and adoption in the region.

Annexure-I

राज्य बागवानी मिशन, छत्तीसगढ़

बैंक ऑफ इंडिया के ऊपर, तेलीबांधा रेल्वे क्रासिंग के पास, महासमुंद रोड, तेलीबांधा, रायपुर
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क्रं./उ./तक/एसएचएम/योजना/2012–13/ 5279 रायपुर, दिनांक : 22/8/12

प्रति,

संचालक
भारतीय कृषि अनुसंधान परिसर, कैम्पस
पोस्ट बी.व्ही. कालेज, पटना–800014

विषय – केन्द्रीय योजनाओं के अंतर्गत मानव संसाधन विकास मद के अंतर्गत राज्य के बाहर कृषकों के प्रशिक्षण एवं भ्रमण के संबंध में ।

संदर्भ – एम.ओ.यू. दिनांक 29.12.2011 एवं आपका प्रस्ताव क्र.5–1/2011–पीएस/1769 दिनांक 23.07.2012

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उपरोक्त विषयांतर्गत लेख है कि राष्ट्रीय बागवानी मिशन योजना तथा राष्ट्रीय कृषि विकास योजना वर्ष 2012–13 में मानव संसाधन विकास मद अंतर्गत राज्य के बाहर कृषकों का भ्रमण/प्रशिक्षण कार्यक्रम आयोजित करने हेतु आपको संदर्भित अनुबंध के शर्तों अधीन आदेशित किया जाता है । भ्रमण एवं प्रशिक्षण कार्यक्रम का लक्ष्य निम्नानुसार है :

राष्ट्रीय बागवानी मिशन :– *(भौतिक लक्ष्य संख्या में, वित्तीय लाख में)*

क्रं.	प्रशिक्षण का विववरण	भौतिक लक्ष्य
1	2	3
1	**Training of Farmers -**	
1.3	Outside the State (Rs. 1000.00/day per farmer excluding transport, 7 days training)	1500
2	**Exposure Visit of Farmers -**	
2.3	Outside the State (Rs. 600.00/day per farmer excluding transport, 7 days visit)	1525
3	**Training/Study Tour of Technical Staff/Field Functionaries -**	
3.2	Study tour to progressive States/Units (group of minimum 5 participants@ Rs. 650.00/ day per participants plus TA/DA, as admissible, 7 days tour)	49
राष्ट्रीय कृषि विकास योजना :–		
1	**Training of Farmers -**	
1.3	Outside the State (Rs. 1000.00/day per farmer excluding transport, 7 days training)	200
2	**Exposure Visit of Farmers -**	
2.3	Outside the State (Rs. 600.00/day per farmer excluding transport, 7 days visit)	200
3	**Training/Study Tour of Technical Staff/Field Functionaries -**	
3.2	Study tour to progressive States/Units (group of minimum 5 participants@ Rs. 650.00/ day per participants plus TA/DA, as admissible, 7 days tour)	40

कृपया उपरोक्तानुसार भ्रमण एवं प्रशिक्षण कार्यक्रम के कियान्वयन हेतु तिथिवार कार्ययोजना प्रेषित करना चाहेगें, जिससे कि जिला अधिकारियों को अवगत कराया जा सके । साथ ही आपको निर्देशित किया जाता है कि स्टडी टूर टू प्रोग्रैसिव स्टेट के अंतर्गत प्रावधानित राशि रू. 650.00 प्रशिक्षणार्थी ही प्रदाय की जावेगी । टी.ए./डी.ए. की राशि तकनीकी अधिकारियों को यात्रा देयक प्रस्तुत करने पर प्रदाय की जावेगी ।

मिशन संचालक
राज्य बागवानी मिशन
छत्तीसगढ़, रायपुर

Annexure-II

राष्ट्रीय बागवानी मिशन, झारखण्ड

(झारखण्ड राज्य बागवानी मिशन)

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फोन न. : 0651 2230789, फैक्स न. : 0651 2230793, E-mail : nhmjharkhand@rediffmail.com

National Horticulture Mission, Jharkhand

(Jharkhand State Horticulture Mission)

Krishi Bhawan Campus, Kanke Road, Ranchi - 834008

Tel : 0651 2230789, Fax : 0651 2230793, E-mail : nhmjharkhand@rediffmail.com

पत्रांक 1523 दिनांक 10-11-12

सेवा में,

डा0 बी0पी0 भट्ट,
निदेशक, आई0सी0ए0आर0 आर0सी0ए0आर0,
आई0सी0ए0आर0 परिसर, पोस्ट- बिहार भेटनरी कॉलेज,
पटना – 800014 (बिहार)

विषय : केन्द्र प्रायोजित राष्ट्रीय बागवानी मिशन योजना के तहत राज्य में डेन्ड्रोबियम परियोजना की कुल रूपये 228.27744 लाख (दो करोड़ अठईस लाख सताईस हजार सात सौ चोवालिस रूपये) मात्र की लागत पर कार्यान्वयन हेतु राशि विमुक्त करने के संबंध में।

प्रसंग : कृषि एवं गन्ना विकास विभाग, झारखण्ड सरकार का पत्रांक 86 दिनांक 29.10.12

महाशय,

उपरोक्त विषय एवं प्रसंगाधीन पत्र के संदर्भ में राष्ट्रीय बागवानी मिशन योजना के तहत राज्य में डेन्ड्रोबियम परियोजना के कार्यान्वयन हेतु आपके द्वारा समर्पित परियोजना लागत कुल रूपये 228.27744 लाख का 50 प्रतिशत राशि 114.13 लाख रूपये प्रथम चरण में आपको उपलब्ध कराया जाना है। जिस हेतु एम0ओ0यू0 के अनुरूप एक अलग बचत खाता राष्ट्रीयकृत बैंक में खोलकर बचत खाता संख्या अधोहस्ताक्षरी को यथाशीघ्र उपलब्ध कराने का कष्ट करें जिससे कि राशि उपलब्ध करायी जा सकें।

उक्त योजना का कार्यान्वयन कृषि एवं गन्ना विकास विभाग, झारखण्ड का पत्रांक 86 दिनांक 29.10.12 के आलोक में दिनांक 28.02.2013 तक निश्चित रूप से पूर्ण किया जाना है।

अनु0: कृषि एवं गन्ना विकास विभाग, झारखण्ड का पत्रांक 86 दिनांक 29.10.12

विश्वास भाजन,

10/11/12

(प्रभाकर सिंह)
स्टेट मिशन डायरेक्टर

Annexure-III

भारतीय कृषि अनुसंधान परिषद्
(शिक्षा विभाग)
कृषि अनुसंधान भवन–II, नई दिल्ली–110 012

Indian Council of Agricultural Research
(Education Division)
Krishi Anusandhan Bhavan-II, New Delhi –110012
Telefax No. 011-25848369
Email: adgswm@gmail.com

Dr. S. K. Chaudhari
Asstt. Director General (SWM)

File NO. NRM 1/30/2014-SW&DF **Dated: 4 July 2014**

To

Dr. B.P. Bhatt
Director
ICAR Research Complex for Eastern Region,
ICAR Parisar, P.O. Bihar Veterinary College,
Patna-800014, Bihar.

Subject: MoU with TATA Steel Ltd., Jamshedpur in connection with use of basic slag in agriculture for soil acidity amelioration – reg.

Dear Sir,

I am directed to refer to your letter no. 5-1/PS-2001/1015 dated 17.06.2014 on the subject cited above and to say that Dy. Director General (NRM) has agreed 'in principle' for the proposed MoU with M/s. TATA Steel Ltd. and suggested that the MoU may be revised as per guidelines of Johl Committee recommendations in consultation with the CPC of the Institute before execution.

Yours faithfully,
04/07/20
(S K Chaudhari)

Annexure-IV

THE MUSHROOM TUB

Shed no. 6, SIRTDO Industrial Area, BIT Mesra, Ranchi

Deals In : Pasteurised Compost, Button Mushroom and Spawn

M : 7903630126, 7549160009

Ref.No. MT/02/2015 Date: 25/10/2015

To whom it may concern

This is to certify that ICAR-RCER, Research Centre, Ranchi had extended technical support for establishment of our round year Button Mushroom Production Unit. 'The Mushroom Tub' was established during 2014-15. The support was mainly in the form of preparation of Detailed Project Report (DPR), providing technical guidance on procurement of machineries and initiation of production. At present, the unit produces nearly 70 tonnes of mushroom per year. The Head and Scientists of ICAR-RCER, RC, Ranchi are continuously providing technical support for successful operation of the unit.

I am thankful to the Head, ICAR-RCER, RC, Ranchi and entire team of Research Centre, Ranchi for their continuous support to our venture.

Shubham

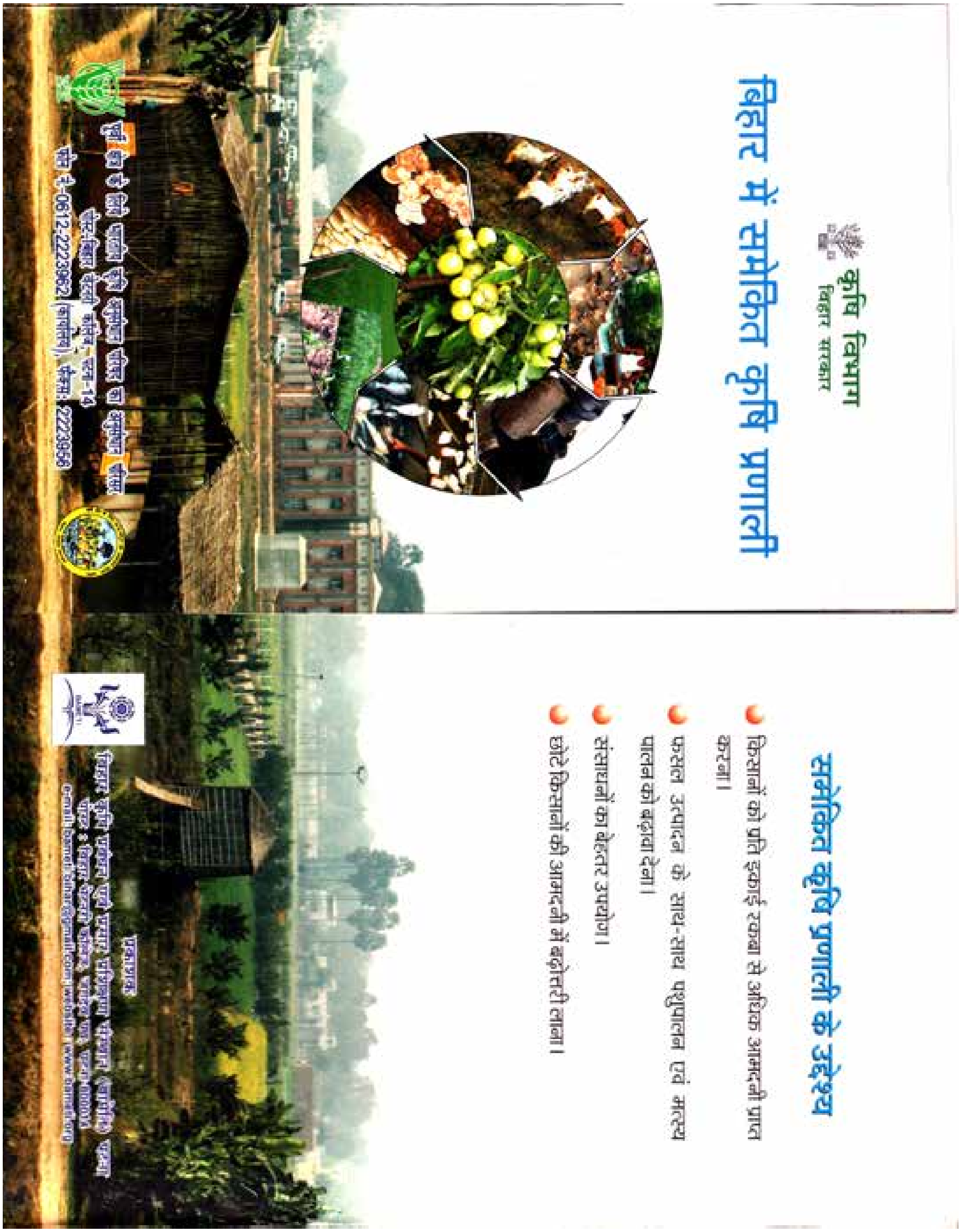
(Shubham Modi)

THE MUSHROOM TUB

Thanking you for your kind consideration, we look forward to your valued order.

In case you require any clarification, feel free to contact us.

Annexure-V



कृषि विभाग
बिहार सरकार
बिहार में समेकित कृषि प्रणाली
फोन नं.-0612-2223962 (कार्यालय), फैक्स: 2223956
समेकित कृषि प्रणाली के उद्देश्य
किसानों को प्रति इकाई रकबा से अधिक आमदनी प्राप्त करना।
फसल उत्पादन के साथ-साथ पशुपालन एवं मत्स्य पालन को बढ़ावा देना।
संसाधनों का बेहतर उपयोग।
छोटे किसानों की आमदनी में बढ़ोत्तरी लाना।
प्रकाशक

जाता है। इस वर्मी कम्पोस्ट को पुनः फसलों में डाला जाता है ताकि मिट्टी द्वारा पौधों को आवश्यक पोषक तत्व मिलें। इसी तरह बकरी पालन का भी फसल एवं सब्जियाँ तोड़ने के पश्चात कुछ मात्रा में पत्तें एवं डंठल चारे के रूप में बकरी को खिलाया जाता है जिसका वर्मी कम्पोस्ट के साथ सीधा सम्बन्ध है। बकरी के मल की कुछ मात्रा (लगभग 1 टन) वर्मी कम्पोस्ट बनाते समय पौधों के अवशिष्ट के साथ मिला दिया जाता है तथा शेष भाग की खाद बनाकर खेत में डाली जाती है। पौधे आवश्यक पोषक तत्व ग्रहण कर बढ़ोत्तरी अच्छी तरह विकसित होते हैं एवं उपज में भी बढ़ोत्तरी होती है। इस तरह समन्वित कृषि प्रणाली में सभी घटकों का आपस में परस्पर सम्बन्ध होता है तथा पुर्नचक्रण के कारण उत्पादन लागत भी कम प्राप्त होता है। समेकित कृषि प्रणाली अपनाने से रोजगार का भी सृजन होता है जिसे सारणी में दर्शाया गया है।

तालिका – विभिन्न फसल प्रणाली एवं समेकित कृषि प्रणाली के अन्तर्गत रोजगार का सृजन

फसल प्रणाली	फसल/ सब्जी	बकरी पालन	वर्मी कम्पोस्ट	कुल रोजगार (दिन)
धान – गेहूँ – मूंग	470	–	–	470
धान– आलू– मूंग	450	–	–	450
भिन्डी–आलू–प्याज	525	–	–	525
करेला–टमाटर–कद्दू	545	–	–	545
भिन्डी –धनिया–नेनुआ	525	–	–	525
बैंगन–गाजर–बोरो	539	–	–	539
धान–आलू–मूंग+सब्जी+बकरी	120+440	100	–	660
धान–आलू–मूंग+सब्जी+बकरी+ वर्मी कम्पोस्ट	560	100	30	690

समेकित कृषि प्रणाली : बिहार में बढ़ते कदम

समेकित कृषि के प्रसार एवं प्रचार के लिए बिहार सरकार काफी प्रयत्नशील है। सरकार की मंशा है कि छोटे एवं भूमिहीन किसान अपने छोटे आकार वाले जोत पर समेकित कृषि प्रणाली द्वारा चूँकि बिहार के 80 प्रतिशत कृषक छोटे एवं सीमान्त आकार वाले जोत के हैं, जिनकी आर्थिक दशा काफी विचारणीय है। बिहार सरकार इन कृषकों के जीविकोपार्जन में वृद्धि के लिए प्रयासरत है और इसका निदान समेकित कृषि प्रणाली के माध्यम से करने जा रही है। इस दिशा में पहल भी हो चुकी है और बिहार सरकार ने भा. कृ. अनु. प. द्वारा विकसित 1 एकड़ एवं 2 एकड़ मॉडल को छोटे किसानों के क्षेत्रों पर विकसित करने को ठानी है। इसके लिए बिहार के प्रत्येक ब्लॉकों से 2–2 मॉडल

किसान का चयन किया गया है, जिन्हें समेकित कृषि प्रणाली को अपने खेतों पर अन्तर्निहित करने के लिए आर्थक प्रोत्साहन दिया जा रहा है तथा सरकार ने बिहार के सभी कृषकों को विकल्प दिये हैं कि परम्परागत खेती के अलावा इस योजना में चयनित समेकित कृषि के किसी भी एक घटक को अपने खेती के साथ समायोजन करने पर रू. 10,000/– प्रोत्साहन राशि के रूप में उपलब्ध करायेगी जिनका उपयोग घटक को विकसित करने में ही किये जायेगें। सरकार द्वारा चयनिक घटकों/उद्यमों की सूची एवं अनुदान आदि का ब्योरा नीचे दिया जा रहा है :

समेकित कृषि प्रणाली में अपनाये जाने वाले कार्यघटक एवं अनुदान की राशि

(अ) प्राथमिक इन्टरप्राईजेज (उद्यम) : इस योजना के अंतर्गत फसल उत्पादन का कार्य मुख्य उद्यम के रूप में माना जायेगा।

(ब) सहायक इन्टरप्राईज (उद्यम) : समेकित कृषि प्रणाली के विकास की योजना के अंतर्गत निम्नांकित में से किसी एक उद्यम को सहायक उद्यम माना जायेगा।

1. उद्यान–फल उत्पादन/फूल उत्पादन/सब्जी उत्पादन, सब्जी बीज उत्पादन/ औषधीय एवं सुगंधित पौधा उत्पादन/मसाला की खेती/फल/सब्जी प्रसंस्करण/परिरक्षण कार्य, औषधीय/सुगंधित पौधे से आसवन कार्य।
2. पशुपालन एवं डेयरी–गाय या भैंस से दुग्ध उत्पादन/सूअर/बकरी/भेंड़ पालन, डेयरी के घरेलू उपकरण/यंत्र।
3. कुक्कुट पालन–अण्डा अथवा मांस के लिए कुक्कुट पालन ।
4. बत्तख पालन–अण्डा अथवा मांस के लिए बत्तख पालन।
5. मत्स्यपालन–निजी तालाब अथवा मौंन/चौर में मछली पालन (कार्प/देशी)।
6. वर्मी कम्पोस्ट–वर्मीकम्पोस्ट, बायोगैस उत्पादन।
7. मशरूम उत्पादन–बटन अथवा ओयस्टर मशरूम का उत्पादन/प्रसंस्करण।
8. मधुमक्खी पालन–मधुमक्खी पालन एवं बाटलिंग की व्यवस्था।

अनुदान की अनुमानरूता : कृषकों को सहायक उद्यम को अपनाने के लिए इस योजना में अनुदान का लाभ देय होगा। समेकित कृषि प्रणाली क विकास की योजनान्तर्गत फसलोत्पादन प्राथमिक उद्यम के रूप में अनुज्ञात है एवं एक से डेढ़ एकड़ भूमि – धारी सीमान्त कृषकों को सहायक इन्टरप्राइज के समन्वय स्थापित करने हेतु निम्नांकित विवरण के अनुरूप विभिन्न घटकों के लिए किये जाने वाले पूँजी निवेश पर अनुदान की राशि उपलब्ध होगी। अनुदान की राशि घटक के प्राक्कलित राशि का 50 प्रतिशत अधिकतम रूपये 10,000.00 (दस हजार रूपये) देय होगा। सहायक उद्यमों जिनके लिए अनुदान स्वीकृत किया जायेगा से संबंधित विवरण निम्न प्रकार है :

Annexure-VI

Some important publications of the Institute during the period under report (NAAS rating as on 01.01.2020)

Publication details	NAAS Rating
2017	
Bhatt, B.P.; Moanaro; Sapu, C. and Sarkar, B. (2017). Fuelwood characteristics of some firewood trees and shrubs of Eastern Himalaya India. *Energy Sources* Part-A: *Recovery, Utilization, and Environmental Effects*, **39**(1): 47-50.	6.89
Bhatt, B.P.; Moanaro and Sarkar, Bikash (2017). Fuelwood characteristics of some important trees and shrubs and emission of carbon dioxide in different states of Eastern India. *Energy Sources*, Part A: *Recovery, Utilization, and Environmental Effects*, **39**(4): 414-418.	6.89
Choudhary, J.S.; Rao, M.S.; Mali, S.S.; Das, B.; Kumari, A.; Mukherjee, D.; Singh, A.K. and Bhatt, B.P. (2017). Potential changes in number of generations of oriental fruit fly, *Bactrocera Dorsalis* (Diptera: Tephritidae) on mango in India in response to climate change scenarios. *Journal of Agrometeorology*, **19**(3): 200-206.	6.64
Das, Bikash; Dhakar, M.K.; Sarkar, P.K.; Kumar, S.K.; Nath, Vishal; Dey, P.; Singh, A.K. and Bhatt, B.P. (2017). Performance of mango (*Mangifera indica*) based agri-horticultural systems under rainfed plateau conditions of Eastern India. *Indian Journal of Agricultural Sciences*, **87**(4): 521-527.	6.25
Dwivedi, S.K; Arora, A. and Kumar, S. (2017). Paclobutrazol-induced alleviation of water-deficit damage in relation to photosynthetic characteristics and expression of stress markers in contrasting wheat genotypes. *Photosynthetica*, **55**(2): 351-359.	8.37
Dwivedi, S.K; Arora, A. Singh, V.P. and Singh, G.P. (2017). Induction of water deficit stress tolerance in wheat due to exogenous application of plant growth regulators: membrane stability, water relation and photosynthesis. *Photosynthetica*, DOI: 10.1007/s11099-017-0695-2.	8.37
Dwivedi, S.K.; Basu, Sahana; Kumar, Santosh; Kumar, Gautam; Ved, Prakash; Kumar, Sanjeev; Mishra, J.S.; Bhatt, B.P.; Malviya, N.; Singh, G.P. and Arora, A. (2017). Heat stress induced impairment of starch mobilisation regulates pollen viability and grain yield in wheat: Study in Eastern Indo-Gangetic Plains. *Field Crops Research*, **206**: 106-114.	9.87

Publication details	NAAS Rating
Dwivedi, S.K.; Kumar, Santosh; Bhakta, N.; Singh, S.K.; Rao, K.K.; Mishra, J.S. and Singh, A.K. (2017). Improvement of submergence tolerance in rice through efficient application of potassium under submergence-prone rainfed ecology of Indo-Gangetic Plain. *Functional Plant Biology,* **44**(9): 907-916.	8.33
Kumar, S.; Singh, S.S.; Dwivedi, S. K.; Idris, Md.; Sangle, U.R.; Singh, O.N.; Ram, T. and Kumar, A. (2017). Notification of rice variety Swarna Shreya (RCPR-8-IR84899-B-179-16- 1-1-1). *Indian Journal of Genetics and Plant Breeding,* **77**(2): 324-325.	6.41
Mali, S.S.; Jha, B.K.; Singh, R. and Meena, M. (2017). Bitter gourd response to surface and subsurface drip irrigation under different fertigation levels. *Irrigation and Drainage*, **66**: 615–625.	7.03
Mali, S.S.; Singh, D.K.; Sarangi, A. and Parihar, S.S. (2017). Crop water footprints with special focus on response formulation: the case of Gomti river basin (India). *Environmental Earth Sciences*. DOI: doi. org/10.1007/s12665-017-7121-8.	7.87
Naik, S.K. and Bhatt, B.P. (2017). Diagnostic leaf nutrient norms and identification of yield-limiting nutrients of mango in Eastern plateau and hill region of India. *Communications in Soil Science and Plant analysis*, **48**(13): 1574-1583.	6.69
Pandit, T.K.; Naik, S.K.; Patra, P.K.; Patra, P.K.; Dey, N.; Patra, P.K. and Das, D.K. (2017). Influence of organic manure and lime on cadmium mobility in soil and uptake by spinach (*Spinacia oleracea* L.). *Communications in Soil Science and Plant analysis*, **48**(4): 357-369.	6.69
Prakash, Ved; Mishra, J.S.; Kumar, Rakesh; Kumar, R.; Kumar, S.; Dwivedi, S.K.; Rao, K.K. and Bhatt, B.P. (2017). Thermal utilization and heat use efficiency of sorghum cultivars in middle Indo-Gangetic Plains. *Journal of Agrometeorology*, **19**(1): 29-33.	6.64
Samal, S.K.; Rao, K.K.; Poonia, S.P.; Kumar, Rakesh; Mishra, J.S.; Prakash, Ved; Mondal, S.; Dwivedi, S.K.; Bhatt, B.P.; Naik, Sushanta Kumar; Choubey, A.K.; Kumar, V.; Malik, R.K. and Mc Donald, Andrew (2017). Evaluation of long-term conservation agriculture and crop intensification in rice-wheat rotation of Indo-Gangetic Plains of South Asia: Carbon dynamics and productivity. *European Journal of Agronomy,* **90**: 198-208.	9.38
Srivastava, S.; Roy, Chowdhury A. and Maurya, S. (2017). Antimicrobial efficacy of methylated lac dye, an anthraquinone derivative. *Indian Journal of Microbiology*, **57**: 470-476.	7.53

Publication details	NAAS Rating

2016

Bhatt, B.P.; Rathore, S.S.; Lemtur, Monaro and Sarkar, B. (2016). Fuelwood energy pattern and biomass resources in Eastern Himalaya. *Renewable Energy,* **94**: 410-417. 11.44

Chatterjee, D.; Kumar, Rakesh; Kuotsu, R. and Deka, B.C. (2016). Validation of traditional weed control method through common salt application in the hill region of Nagaland. *Current Science,* **110**(8): 1159-1167. 6.76

Choudhary, J.S.; Naaz, N.; Prabhakar, C.S. and Moanaro (2016). Genetic analysis of oriental fruit fly, *Bactrocera dorsalis* (Diptera: Tephritidae) populations based on mitochondrial *cox1* and *nad1* gene sequences from India and other Asian countries. *Genetica,* **144**: 611–623. 7.23

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**RG Impact Factor 2019*

Annexure-VII

Awards and Recognitions

2016-17

- Plaque of Recognition conferred to Dr. B.P. Bhatt jointly by CIMMYT & BISA for significant contribution & continuous support to conservation agriculture in Eastern India.
- M. S. Swaminathan National Award conferred to Dr. B.P. Bhatt by ICAR Research Complex for NEH Region, Meghalaya for the outstanding contribution in the field of hill agriculture for the biennial 2015-17.
- Best Research Paper Award conferred to Dr. A.A. Haris, Dr. V. Chhabra, Dr. B.P. Bhatt and Dr. A.K. Sikka by Association of Agrometeorologists, Anand, Gujarat for the research paper entitled yield and duration of potato crop in Bihar under projected climate scenario, published in the *Journal of Agrometeorology* and appeared in Vol. 17, Issue 1.
- Dr. Rajendra Prasad Puraskar conferred to Dr. B.P. Bhatt for technical book writing in agricultural & allied sciences by ICAR New Delhi.
- Fakhruddin Ali Ahmad Award conferred to Dr. Rakesh Kumar for outstanding research in the field of tribal farming system research by ICAR, New Delhi.
- Dr. Biswajeet Choudhary Memorial Award conferred to Dr. A.K. Singh by Indian Society of Vegetable Sciences, Varanasi for significant contribution in the field of vegetable science.
- ISWS Gold Medal conferred to Dr. J.S. Mishra by Indian Society of Weed Science for significant contribution in the field of weed science.
- Best Research Paper Award conferred jointly to Dr. Asit Chakrabarti and Dr. Pankaj Kumar for the publication on incidence of foot diseases of cattle in Bihar, India, published by *International Journal of Agricultural Science and Research* and appeared in Vol. 6, Issue 1.
- ISEE Fellow Award conferred to Dr. Ujjwal Kumar for outstanding contributions in the fields of extension education by Indian Society of Extension Education at RVSK Vishwavidyalaya, Gwalior.
- Best Research Paper Award conferred to Dr. S.S. Mali by Indian Journal of Soil Conservation for 2016 in Conference on Farmers First for Conserving Soil and Water Resources in North Eastern Region (FFCSWR-2017) organized by IASWC, Deharadun.

2015-16

- Rajiv Gandhi National Award Scheme on Gyan Vigyan conferred to Dr. Sanjeev Kumar, Dr. Shivani and Dr. B.P. Bhatt for the book entitled *Samekit Krishi Pranali ek Vrihad Drishtikon* by the Ministry of Home Affairs, Govt. of India.

2014-15

- Fellow, NIE conferred to Dr. B.P. Bhatt by National Institute of Ecology, New Delhi
- Ganesh Shankar Vidyarthi Hindi Patrika Puraskar conferred to the Institute by ICAR, New Delhi
- Fellow, ISVS conferred to Dr. A.K. Singh by Indian Society of Vegetable Sciences for significant contribution in the field of vegetable science.
- Fakhrudddin Ali Ahmed Award conferred to Dr. Bikash Das, Dr. B.P. Bhatt, Dr. A.K. Singh and Dr. R.S. Pan for outstanding research in the field of tribal farming system research by ICAR, New Delhi.
- Young Scientist Award conferred to Dr. Santosh Kumar by the Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P) for his outstanding contribution in the field of plant breeding.
- ISA Associateship conferred to Dr. A.K. Singh by Indian Society of Agronomy during 20th National Conference held at PAU, Ludhiana.

2013-14

- NASS Associate conferred to Dr. A.K. Singh by National Academy of Agricultural Sciences, New Delhi.

2012-13

- Best Research Paper Award conferred to Dr. Joydeep Mukherjee by Association of Agrometeorologists, Anand, Gujarat.
- Certificate of Recognition conferred to Dr. A.K. Singh by Association of Plant Pathologist in the recognition for scientific contribution published in *Journal of Plant Disease Sciences*.
- M.J. Narshighum Merit Best Research Paper Award jointly conferred to Dr. J.P. Sharma and Dr. S. Kumar for the publication entitled management of *Ralstonia* wilt of tomato through microbes, plant extract and combination of cake and chemicals, published in *Indian Phytopathology* and appeared in Vol. 62, Issue 4.
- Team Leader Award conferred to Dr. A.K. Thakur by Indian Society of Agricultural Engineers for significant contribution for development of pomegranate aril extractor.

Glimpses of Meetings and Field Visits

1st Meeting of QRT held at Patna during September 10-11, 2019

2nd Meeting of QRT held at Ranchi during November 4-6, 2019

Visit to Experimental Farm and Farmers' Field at Ranchi

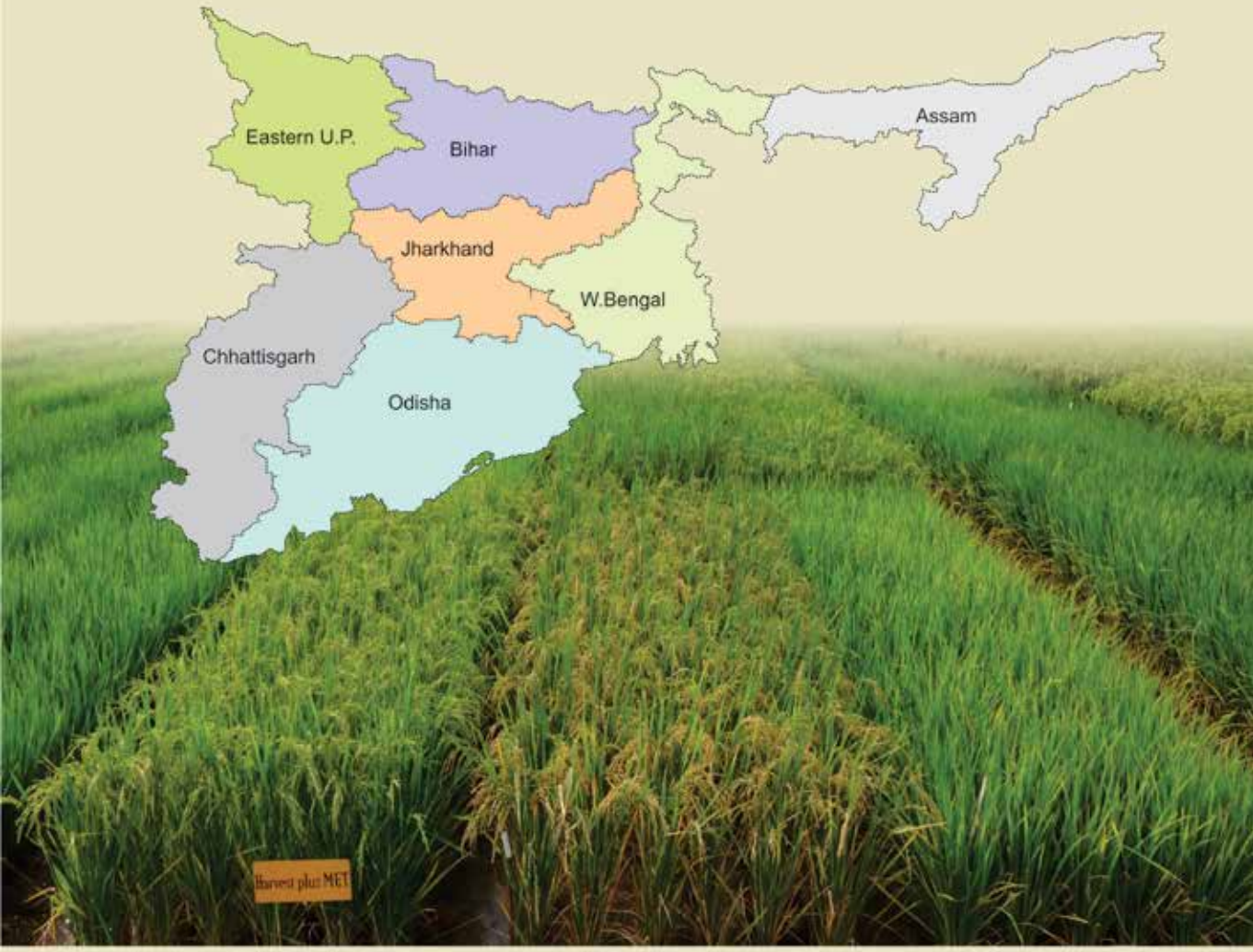



3rd Meeting of QRT held at Patna on November 7, 2019


Visit of QRT at RCM, Darbhanga on December 27, 2019


Visit of QRT at KVK, Buxar on December 28, 2019

4th Meeting of QRT held at Kolkata on January 28, 2020



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
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एक कदम स्वच्छता की ओर