

SECOND GREEN REVOLUTION IN EASTERN INDIA: ISSUES AND INITIATIVES



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राधा मोहन सिंह
RADHA MOHAN SINGH



कृषि एवं किसान कल्याण मंत्री
भारत सरकार
MINISTER OF AGRICULTURE
& FARMERS WELFARE
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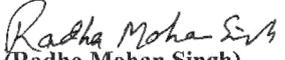
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Foreword

The Green Revolution began in mid-1960s through the introduction of new high yielding varieties of wheat and rice, turned India from 'Begging bowl' to 'Grain bowl'. The food grain production had increased from 82 million tonnes (mt) in 1960-61 to 264 mt by 2013-14. However, its benefits were mainly confined to north-western states of Haryana, Punjab and western Uttar Pradesh. It helped farmers of the region, having good irrigation network, and increased the farm productivity substantially over the years. However, the benefits of the first Green Revolution could not reach to the Eastern states and other rainfed areas of the country, which contribute about 60% of the country's total food grain production.

The Eastern region of India is rich in natural resources. However, its potential could not be harnessed in terms of improving agricultural productivity, poverty alleviation and livelihood improvement. It is rightfully thought that the Second Green Revolution (SGR) would be started in the Eastern region to ensure food security of the nation. To achieve this, the large untapped production reservoir should be judiciously utilized through an appropriate blend of technologies, services, input and output rising policies and above all farmer's participation. However, in Second Green Revolution, it is the need of the hour to shift from fertilizer and pesticide based conventional agricultural practices to natural and renewable resource based sustainable agriculture, which is cheap, environment friendly and emphasizes on the conservation of natural resources. While the first Green Revolution was to ensure food security as there was severe scarcity of food in the country, the Second Green Revolution should aim at creating sustainable livelihood security of resource poor farmers', poverty eradication by generating gainful employment through holistic development of all the components of agriculture.

I complement the Director and his team for successfully organizing the meetings of stakeholders at Patna and also in all the states of the Eastern region and bringing out this document on '*Second Green Revolution in Eastern India: Issues and Initiatives*' for agricultural development in the region. I am sure that the various line departments shall be benefited through this publication in order to make the roadmap for agricultural development in their respective states.


(Radha Mohan Singh)

Preface

The Eastern region comprising of Assam, Bihar, Chhattisgarh, Eastern Uttar Pradesh, Jharkhand, Odisha and West Bengal, holds promise for a Second Green Revolution (SGR), which can be accomplished through holistic management of land, water, crops, biomass, horticultural, livestock, fishery and human resources. The Eastern region is unique for its suitability to the production of many agricultural commodities. The region has fertile soils and ample water resources, the two most important natural resources required for higher productivity. The majority of the areas in these states have a length of growing period of 240 days or more, which is adequate to support double cropping. Annual rainfall in the region varies from 1000 mm to 2500 mm. Average rainfall during last 14 years was more than 2000 mm in the Lower Gangetic Plains and 1000 mm to 1250 mm in the Middle Gangetic Plains, and Plateau and Coastal regions.

The Eastern states accounts for 53 per cent of 154.71 BCM of total available ground water for future use. However, the ground water draft is much less than the ground water availability in most of the Eastern states except Eastern UP. Therefore, there is considerable scope for ground water development in the region with due care of the high arsenic content in certain areas. Rice is the major crop in the Eastern region. However, abiotic stress such as drought, flood, submergence and salinity is the major factor constraining the productivity of rice-based cropping systems. Of the total 11.6 million ha rice-fallow area in the country, 82% lies in the Eastern states. This offers an unique opportunity for enhancing the productivity through crop intensification. There is a great potential of organic farming in tribal dominated areas of Jharkhand, Odisha and Chhattisgarh, where organic farming by default is practiced. This region can be made sustainable with its orientation towards export market.

Though Eastern region is rich in natural resources, its potential could not be harnessed in terms of improving agricultural productivity, poverty alleviation and livelihood improvement. Keeping this fact in view, Ministry of Agriculture and Farmers' Welfare, Govt. of India has given due importance to hidden opportunities of agricultural development in the region and created Second Green Revolution (SGR) Cell with its headquarters' at ICAR-Research Complex for Eastern Region, Patna. Since ICAR RCER is mandated for undertaking multi-commodity and multi-disciplinary research and extension in Eastern states, the institute organized several sensitization workshops/policy workshops/seminars/symposia

to implement the SGR much ahead of creation of SGR Cell. Through this document, a humble attempt has been made to incorporate the various issues pertaining to research, development and policy in different Eastern states, and suggestions. This will provide an overall understanding of agriculture in Eastern region with respect to identification of gaps, formulation of research projects and developmental policies. We believe that this publication will be useful to the researchers, policy makers and other stakeholders.

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Authors

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Introduction

The Eastern states comprising of Assam, Bihar, Chhattisgarh, Eastern Uttar Pradesh, Jharkhand, Odisha and West Bengal, occupy about 21.85% geographical area and supports 34% human and 31% livestock population of India. The population density is 1.91-fold higher in Eastern states compared to national average. Agriculture is the mainstay of economy in Eastern states, where 84 per cent population is rural. Of the total geographical area of 71.84 million ha, net sown area is 29.17 million ha with a cropping intensity of 150% in the region. The region has about 2.73 m ha total area under water constituting reservoirs, ponds, tanks and beels, oxbow lakes, brackish water, etc., besides 15046 km length of rivers and canals constituting about 18 per cent of country's utilizable water resources (10 per cent of surface water and 30 per cent of groundwater). The average rainfall in Eastern region varies from 1091 to 2477 mm with a regional average of 1526 mm, which is sufficient and substantial for growing a variety of crops. However, the irrigated area in the region is 39% as against 45% of the national average. In Eastern region, about 9.2 m ha land is under rice fallow (Bhatt *et. al.*, 2013).

Inadequate supply of quality seed and planting material, low livestock productivity, low productivity of flood and flood plain ecologies, climate change impact, high population density (616 persons/km² compared to 382 persons/km² at national level), slow pace of mechanization, fragmented land holdings, poor supply of cost effective energy to the agricultural sector, the lowest per capita income, maximum number of economically most backward districts (69 out of 150 at national level) and thereby poverty (32.1% below poverty line population) in the region are some of the limitations of holistic agricultural development (NAAS, 2013; Bhatt, 2015; Bhatt and Mishra 2016a). Above-mentioned factors are also responsible to exert tremendous pressure on natural resources (Table 1). The production levels of agriculture, livestock and fisheries have also remained low due mainly to lack of location-specific production technologies, natural calamities like floods, water logging, drought, timely supply of critical inputs and social constraints (Bhatt and Mishra, 2016b).

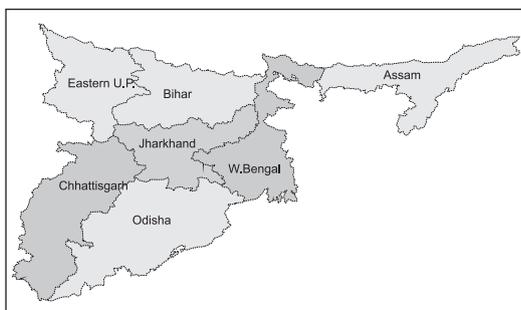


Fig. 1. Map of Eastern states

Table 1. Potential of natural resources in the Eastern region vis-à-vis national average

Natural resources	Eastern region	India	Percentage
Total geographical area (m ha)	71.84	328.73	21.85
Net sown area (m ha)	29.17	141	20.69
Net irrigated area (m ha)	14.36	65.3	22.00
Cropping intensity (%)	150	141	-
Wetland area (m ha)	4.05	15.3	26.50
Total fresh water area (m ha)	2.92	6.92	42.22
Marginal farmers (<1 ha) (%)	67.00	62.88	-
Large farmers (>10 ha) (%)	0.46	1.02	-
Total population (million)*	406	1210	33.54
Population density (no/sq km)	616	382	-
Rural population (%)	81.54	72.18	-
BPL (%)	32.10	21.90	-
Annual ground water availability (BCM)	145.12	399.25	36.35
Ground water draft (%)	36.00	58.00	-

*(2011 Census); **Source:** Bhatt *et al.* 2011.

Though the Eastern region is rich in natural resources, its potential could not be harnessed in terms of improving agricultural productivity, poverty alleviation and livelihood improvement. Keeping this fact in view, Ministry of Agriculture and Farmers' Welfare, Govt. of India has given due importance to hidden opportunities of agricultural development in the region and created Second Green Revolution (referred herein SGR) Cell with its headquarters' at ICAR-RCER, Patna. The SGR Cell has been made accountable to coordinate the research, and identify the development and policy issues related to agricultural development involving State Governments of all the Eastern states, SAUs, CGIAR and other partners. It was also aimed to explore the possibility of synergy between various schemes implemented by Govt. of India. State Coordination Committees, Technical Committee and Steering Committee have been constituted to monitor the programme (Annexure I).

Priority Areas in Second Green Revolution

The first Green Revolution (GR) in India began in mid-1960s through the introduction of high yielding varieties of wheat responsive to application of irrigation and fertilizers. However, its benefits were mainly confined to north-western states of Haryana, Punjab and western Uttar Pradesh. It helped farmers of the region, having good irrigation network and increased the farm productivity substantially over the years. The synergy between the technology and public policy made the GR a grand success and turned India from 'begging bowl' to leading producer of food grains. Following the GR, India's food grain production had increased from 82 million tonnes (mt) in 1960-61 to 264 mt by 2013-14 (Table 2). The average rice productivity increased from 1013 kg/ha to above 2500 kg/ha, and wheat from 850 kg/ha to over 3000 kg/ha in the corresponding period. Thereafter, Indian agriculture witnessed all round development as a result of which, horticulture production is now over 280 mt, milk production about 132 mt, fisheries 9.0 mt and eggs about 70 billion. These achievements have placed India among the leading producers of these food items. However, the benefits of the first green revolution could not reach to the Eastern states and other rainfed areas of the country, which contribute about 60% of the country's total food grain production.

Table 2. Progress in food grain production (million tons)

Commodities	Years			
	1960-61	1980-81	2008-09	2013-14
Rice	34.58	53.63	99.18	106.54
Wheat	11.0	36.31	80.68	95.91
Coarse cereals	23.74	29.20	40.04	43.05
Total cereals	69.32	119.14	219.90	245.50
Total pulses	12.70	10.63	14.57	19.27
Total food grain	82.02	129.77	234.47	264.77

Source: *Anonymous, 2015*

While the first GR was to ensure food security as there was severe scarcity of food in the country, the second GR should aim at creating sustainable livelihood security of resource poor farmers', poverty eradication by generating gainful employment and making not only agriculture but horticulture, livestock, fish and other allied sectors more profitable.

Though India could achieve food security through Green Revolution, it led to over exploitation of natural resources coupled with indiscriminate use of inorganic fertilizers and pesticides, and thereby declining factor productivity, increasing soil salinity, loss of biodiversity, lowering of ground water table, environmental pollution, pest resurgence and land degradation are some of its consequences. Therefore, the advantages of the green revolution have now been masked by the problems posed by it. Nevertheless, the Eastern region of the country holds promise for a second Green Revolution, which can be accomplished through holistic management of land, water, crops, biomass, horticultural, livestock, fishery and human resources.

Initiatives

Since ICAR RCER is mandated for undertaking multi-commodity and multi-disciplinary research and extension in Eastern states, the institute organized following sensitization workshops/policy workshops/seminars/symposia, etc. to implement the SGR much ahead of creation of SGR Cell. The details of the same are depicted below:

- Brainstorming Session on Second Green Revolution, 11-12th December, 2010 at ICAR Research Complex for Eastern Region, Patna.
- Brainstorming Session on Water-use Potential of Flood-affected and Drought-prone Areas of Eastern India, 14th May, 2012 at ICAR Research Complex for Eastern Region, Patna.
- Agri Summit, 2013–A Step towards Second Green Revolution, 8-9th April, 2013 at ICAR Research Complex for Eastern Region, Patna
- Workshop for Identifying the Production and Technological Gaps in Middle Indo Gangetic Plains, 07th October, 2015 at ICAR Research Complex for Eastern Region, Patna.
- Brainstorming Session on “Agro-Forestry for Rehabilitation of Water Congested Ecologies in the Eastern States, 5th April, 2016 at ICAR Research Complex for Eastern Region, Patna.
- Sensitization Workshop for Member Secretaries, State Co-ordination Committee(s) of SGR, 3rd May, 2016 at ICAR Research Complex for Eastern Region, Patna.
- State Coordination Committee Meeting of SGR, Govt. of Jharkhand, 7th June, 2016 at Nepal House, Doranda, Ranchi.
- State Coordination Committee Meeting of SGR, Govt. of Odisha, 12th July, 2016 at Rajiv Bhavan, Odisha Secretariat, Bhubaneswar.
- State Coordination Committee Meeting of SGR, Govt. of West Bengal, 14th July, 2016 at Nabanna, Howrah, Kolkata.
- State Coordination Committee Meeting of SGR, Govt. of Uttar Pradesh, 27th July, 2016 at Bahukhandi Bhavan, UP Sachivalaya, Lucknow.
- State Coordination Committee Meeting of SGR, Govt. of Assam, 2nd August, 2016 at College of Veterinary Science, Khanapara, Guwahati.
- State Coordination Committee Meeting of SGR, Govt. of Bihar, 4th August, 2016 at New Secretariat, Patna.
- State Coordination Committee Meeting of SGR, Govt. of Chhattisgarh, 5th August, 2016 at Mahandi Bhavan, New Raipur, Chhattisgarh.
- Steering Committee Meeting of SGR, 27th June, 2016 at ICAR Research Complex for Eastern Region, Patna.

Recommendations

The recommendations of the first ever meeting organized during 2010 have been compiled in the form of Policy Document entitled “*Strategies for Agricultural Transformation of Eastern Region*” in the year 2011 and circulated to all the stakeholders (Singh *et. al.*, 2011).



Fig. 2. Inauguration of first ever meeting of SGR by Hon'ble Chief Minister, Govt. of Bihar, Shri Nitish Kumar at Patna on 11th December, 2010



Fig. 3. Participants of SGR meeting

Water Use Potential of Flood Affected and Drought Prone Areas

The Eastern region has ample water resources, but the water productivity in the region is quite low. In order to critically analyze the water use potential of the flood affected and drought-prone areas in the Region, the National Academy of Agricultural Sciences organized a brainstorming session to deliberate different issues pertaining to improving water productivity on 14th May 2012. The major recommendations as listed below have been compiled as **NAAS Policy Paper 60** (NAAS, 2013) and circulated to all the stakeholders.

- Delineation of the agro-ecologies suited for different farming systems using Remote Sensing and GIS techniques and creation of agro-ecological zones as per land configuration.
- Application of GIS based Decision Support System (DSS) for assessing site suitability for aquaculture which can enhance the fish production in the region.
- Assessment of regional water demand and supply at micro-level of flood and drought-prone areas of the region so that crop plan/cropping/integrated farming systems can be suggested for higher water productivity.
- Conjunctive use of rain, surface and groundwater resources for efficient utilization of available water resources.
- Encouraging utilization of groundwater resources by providing energy supply to the farmers.
- Promotion of pressurized irrigation/micro-irrigation as an integral part of minor irrigation structures for improving water productivity.
- Development of hydro-meteorological database alongwith near real-time flood/drought forecasting/warning tools for flood and drought related risk management.
- Generating water productivity data for different crops and standardization of methodology for estimation and reporting of water productivity including assessment of total water productivity in each of the Eastern states.
- The SRI and DSR techniques need to be tested and optimized under different agro-ecological regions through large scale demonstrations involving scientists, extension personnel and stakeholders.
- Livestock in Eastern states has been considered as primary producer. Need of the hour is, therefore, to harness the synergistic role of livestock in farming systems so as to improve the livelihood of the resource poor farmers.
- Agroforestry, horticulture including lac cultivation plays an important role in improving water productivity and thereby the livelihood, particularly in Hill and Plateau region. Efforts need to be

made to rehabilitate degraded/wastelands through agro-forestry interventions.

- Development of farmers' resource based Integrated Farming System including different viable enterprises for enhanced profitability for small and marginal farmers in the region.
- Scientific cultivation of makhana, water chestnut, fish and lotus in water bodies need adequate attention for higher production and employment generation.
- Large scale demonstration of scientific 'rice-fish cultivation' is also required. Further, fish hatchery should be given due consideration (as a commercial venture for supply of fish seed) so that the appropriate fish seed can be available at farmers' door steps.
- There is a need to protect the wetlands for biodiversity conservation.
- Developing adequate infrastructure for water management, post-harvest management and rural connectivity, and strengthening supply chain from farm to the market.



Fig. 4. Inauguration of Brainstorming Session by President, NAAS, Prof. R.B. Singh



Fig. 5. Participants of Brainstorming Session

Agri-Summit 2013 – A Step towards Second Green Revolution

Agri-Summit 2013 was organized during 2013 under the Chairmanship of Dr. R.S. Paroda, Chairman TAAS and Ex. Secy. DARE & DG ICAR. The recommendations of the Summit are depicted below:

(i) Policy issues

- Policy support and political will has to be created as in Bihar to bring Green Revolution (GR) in Eastern India.
- Institutional support that created to 1st GR is also needed for 2nd GR for which SAUs, CAUs and ICAR Institutes have to be strengthened in Eastern India.
- ICAR Research Complex for Eastern Region, Patna needs to be strengthened in terms of manpower and other facilities so as to address the diverse researchable issues.
- Resource inventorization, prioritization and orientation of research and development programmes for small holdings need to be incorporated in policy and planning since Eastern states have more than 75% marginal and 160 million resource poor farmers.
- Consolidation of land holdings and lease farming policies may be streamlined for landless farmers.
- There is a need to develop location-specific land use plans for sustainable use of natural resources.
- Considerable scope for value addition at rural level for maize based agro-processing industries (weaning food, animal, poultry and fish feed), packaging and canning of baby corn, sweet corn, fruits, such as litchi, mango etc., will offer scope for diversification and off-farm job opportunities.
- Since maize is available in large quantities, considerable scope exists for establishing wet milling (starch and other products) and dry milling industries (maize floor, grits, suzi and other products) to process and export to other countries/states for more revenue to the farmers and states.
- Recurrence of flood should not be considered as threat as this occurs more or less on same time. With proper planning and planting of sweet corn, baby corn, Quality Protein Maize (QPM) for green cobs, this area can be converted into most productive as these specialty corn can be harvested about 40 days earlier than fully matured corn besides green stalk for silage/fodder.
- Diversification, value addition, improving storage infrastructure and market linkage are prerequisites in agriculture and fishery sectors for better returns and economic upliftment of poor farmers. Farmers' producer companies may be promoted in commodity based identified clusters/areas for streamlining production, processing and marketing.

- Processed foods are in great demand due to change in food habit, increased per capita income, small family size and increased working women population. Hence, food processing and packaging has great scope in Eastern region with relatively cheaper labour force.
- Agriculture related policies, such as disaster management, food security, land and water etc. should be synergistically converged at the grassroots level. Institutional adjustment and interministerial convergence are needed to ensure judicious implementation. Development of climate smart agriculture should be mainstreamed into the policy with suitable investment and financing provisions.
- Advancement of wheat sowing almost by one month from the normal practice of late December sowing is essentially required for which policy decisions need to be undertaken.
- Labour intensive operations like transplanting, seed bed preparation, sowing, weeding, irrigation, harvesting and threshing should be mechanized on priority.
- Similar to Small Farm Mechanization Mission at the Centre, the states of the region should create Small Farm Mechanization Mission. Service providers and Agro-Service Centres/Agro Processing Centres need to be promoted through developmental schemes.
- Farming system mode of food production system need to be given due importance in diverse agro-ecologies of Eastern India for sustainability of resource poor farmers.

(ii) Researchable Issues

- Soils of Eastern Indo-Gangetic Plains are fertile but deficient in micronutrients (Zn, Fe, Cu, Mn, B etc). Multi-micronutrient deficiencies are also emerging in the area. Site specific nutrient management options, therefore, should be developed to improve the soil fertility. About 35% soils have also been found deficient in sulphur. It needs to be corrected for higher yield in oilseed crops. Amelioration of acidic (7.50 mha) and sodic (3.81 mha) soils is also required in order to increase the food production.
- Ground water problems (presence of Arsenic, Fluorides, and Iron etc.) be tackled before there appear as major issues.
- Medium duration High Yielding Varieties (HYV) of rice and wheat need to be developed and popularized in the region so as to escape moisture stress and terminal heat.
- Mission mode approach may be adopted in developing robust hybrid seed production system. Apart from private sector, ICAR Institutions, KVK's and Agriculture Universities may be well equipped to balance the market forces and meet the increasing demand of hybrid seed at affordable cost.

- Rice fallow management is need of the hour in most Eastern states. Suitable pulse crops like short duration pigeonpea, chickpea, lentil etc. need to be promoted not only for sustainability of the production system but also for soil fertility management. Rain water harvesting and management need to be developed and popularized to have a regular crop after rice instead of *Utera* crop.
- Tillage and irrigation cost in rice-wheat cropping system, particularly in Eastern Indo Gangetic Plains, is the limiting factor for profitability to the farmers. Laser land leveling, unpuddled mechanical rice transplanting, direct-seeded rice, zero tillage with residue and raised bed planting are some of the options to maintain long-term sustainable production system.
- Eastern states, particularly West Bengal and Bihar, significantly contribute to the national basket for fruits and vegetables. On an average, Eastern states contribute 20.0% and 46.0%, respectively, to the total fruits and vegetables production at the national level. Eastern region is expected to enhance further the vegetable and fruit production. However, post-harvest losses need to be minimized through scientific handling, transport, storage, processing and value addition.
- Resilient dryland farming system need to be developed for reducing vulnerability of drought, floods, high temperature and infestation of insects-pests and diseases.
- Eastern states contribute 31.14% to total livestock population. However, 95% of the total livestock is non-descript type, hence the productivity is very low. An appropriate livestock improvement strategy should be put in place. Balanced feeding with locally available resources, mineral mixture, animal health care, studies on soil-animal-plant continuum etc. is required for sustainable animal husbandry practices. The livelihood of landless farmers can be improved, particularly with goat and swine husbandry besides backyard poultry and duck farming.
- Location specific and resource based integrated farming system mode of food production system together with conservation agricultural practices needs promotion for sustainability, food and nutritional security and employment generation in the projected climate change scenario.
- Package of practices need to be developed for cultivation of improved varieties of tuber crops, particularly in tribal farming practices.
- Adaptation strategies, such as, gene restriction, altered agronomic practices, diversification, integrated farming systems, efficient use of natural resources etc, to meet farm level situation and out scaling innovations for impact on small holder farmers, small scale

entrepreneurs, rural youth and women for long-term sustainable and resilient farming need to be studied.

- Strategic research on methane emission in rice production and livestock husbandry needs to be addressed.
- Focus of research and development should be on increasing productivity of small and marginal farms, agro-processing and entrepreneurship for increasing income and employment.
- Timely planting of crops must be ensured to realize potential yields through appropriate mechanization and assured timely availability of quality seed, fertilizer, pesticide, irrigation, farm machinery, electricity and diesel etc.
- Alternate sources of energy, particularly solar energy, should be harnessed for agriculture, agro-processing and rural living since Eastern states are blessed with 250-300 bright sunshine days/year.
- Protected cultivation and technologies for producing more from less land and water need to be developed and popularized.

(iii) Developmental issues

- Large productivity gap exists in the region. The productivity and total food production could be easily doubled through quality seed supply (15-20%), timeliness in operations (20-25%), improved water management practices (15-20%), integrated nutrient management (20-25%), pest control (10-15%), post-harvest handling and storage (15-20%).
- Staggered Community nursery may be promoted for timeliness of planting and subsequent agronomic management which is required for improving rice-wheat system productivity at least by 20%.
- Quality seed alone can increase productivity by 15-20%. The Seed Replacement Rate in most of the crops, particularly pulses and oilseeds, is extremely low (<10%), which affects adversely their productivity. It needs to be increased. This is even more critical in the rainfed agri-ecosystems, particularly in Hill and Plateau region. Hence, seed production may be evolved in participatory/ PPP mode and even truthfully labeled seeds may be produced and distributed.
- On-farm demonstrations and training on seed production, processing and storage technology may be adopted alongwith implementation of Seed Village Plan. Models of seed production like production through progressive farmers for meeting local demands through sale/exchange, production through progressive farmers with buy-back arrangement by an institution, seed production and marketing through farmers' association, promotion of institution-led farmers' seed company for seed production and its marketing may be adopted for large scale and timely supply of quality seeds.

- Hybrid seed production, particularly in rice and maize, need to be developed and popularized on large scale. Short duration hybrids will help, particularly in mitigating the effect of floods (starting from end of August especially in the lowland ecologies) in the states like Bihar and Eastern UP. Promoting single cross hybrid in maize for different seasons and agro-ecological situations of Bihar can further improve the productivity by 10%.
- Intercropping is a better way of avoiding risks associated with high temperature or flooding. It will also help improving the income of small farmers.
- For improving yields in waterlogged areas, surface, sub-surface and vertical drainage be put in place. Micro-reservoirs can curb run-off and resulting erosion. It is predicted that with time annual rainfall may increase but number of rainy days may decrease necessitating handling excess water through scientific drainage besides rainwater storage in micro-reservoirs, etc.
- Water conserving technologies like, proper scheduling of canals (40-60% saving), designing check basins (10-30% saving), zero tillage (20-30% saving), precision leveling (15-20% saving), drip irrigation (40-60% saving), ridge/furrow or raised/sunken beds (20-25% saving) etc. can improve the irrigation efficiency considerably. Groundwater recharge also be given due importance.
- Conservation of wetlands, renovation of silted ponds and other water harvesting structures, and conjunctive use of surface and ground water is required to improve water availability and water use potential in flood and drought prone areas.
- Culture fisheries and scientific management of natural water bodies/ wetlands can improve the productivity at least by 50%. Multiple water use technologies may be promoted on large scale to improve water productivity.
- Reclamation of degraded lands through drainage, agroforestry and horticultural interventions should be widely promoted in the region. Efforts also be made to popularize lac, sericulture, apiculture for livelihood improvement, particularly of tribal farmers.
- Entrepreneurship development through capacity building is need of the hour for small, marginal and landless farmers, service providers, input suppliers etc. HRD is also vital for scientific, technical and field level functionaries in order to equip them with forthcoming agricultural challenges.
- Since, 75% farmers of the Eastern states are small and marginal, small farm mechanization implements, like power tiller, weeder, small scale planters, mechanical transplanter for rice, seed drills, maize sheller, wheel hoe, sprayers, reaper etc. should be made available preferably through custom hiring and agri- service centers.

- Under the emerging challenges of unpredictable weather, climate streams and variability, volatility of markets, empowering farmers with real time access to information in the farm easy to understand and adopt is needed at the door steps of the farmers and hence the use of ICTs and knowledge networks have to play critical role.
- Revitalization of cooperative societies and institutional mechanism for organized credit, marketing and other services is required.
- Drudgery should be minimized and dignified ways of farming should be developed.



Fig. 6. Inauguration of Agri-summit, 2013 by Hon'ble Agriculture Minister, Govt. of Bihar, Shri Narendra Singh



Fig. 7. Participants of Agri-summit, 2013

Production and Technological Gaps in Middle Gangetic Plains (MGP)

The recommendations of focussed discussion on Production and Technological Gaps in MGP are mentioned below:

- There is a need to ensure timely availability of assured quality agricultural inputs (seed, fertilizers and pesticides) and to develop marketing intelligence system and procurement of farmers produce on MSP. (**Action: State Deptt. of Agriculture of Bihar and Uttar Pradesh, SAUs and ICAR institutes of the region**).
- Since, 75% farmers of the region are small and marginal, small farm mechanization implements, like power tiller, weeder, small scale planters, mechanical transplanter for rice, seed drills, maize sheller, wheel hoe, sprayers, reaper etc. should be made available preferably through custom hiring and agri- service centers at subsidized rates. (**Action: ICAR-CIAE, Bhopal/ State Deptt. of Agriculture**).
- Availability of quality water for drinking (for human and animals) due to increasing problems of *heavy metals* like *arsenic* in some parts of the region is a major concern. For the storage of excess water during rainy season, de-silting of old water storage structures, water harvesting, reducing conveyance losses through lining of channels and promoting micro-irrigation systems is required to increase the water-use efficiency (**Action: ICAR Institutes/SAUs/State Deptt. of Agriculture**).
- Alternate sources of energy, particularly solar energy, should be harnessed for agriculture, agro-processing and rural living since the region is blessed with 250-300 bright sunshine days/year. There is a need to promote solar pumps for irrigation as availability of electricity is a major problem in the region. Subsidy should be given on purchase of solar energy-based machineries. (**Action: State Deptt. of Agriculture/GOI**).
- Deterioration of soil health (depletion of soil organic carbon) in the IGP is a major concern. Soil organic carbon need to be improved through conservation agriculture (zero tillage), stopping residue burning, crop diversification with inclusion of legumes in the cropping system. Development of soil fertility maps at micro level is needed. (**Action: ICAR Institutes/SAUs/State Deptt. of Agriculture**).
- Sizeable area in middle IGP is under low land ecology. There is a need to diversify the aquatic crops like makhana, chestnut, etc. with fish, water lily, sweet fleg and *kewra*. More research and demonstration is needed on this aspect (**Action: ICAR Institutes/SAUs/KVKs**).

- Non availability of quality seeds of pulses at appropriate time to the farmers is the major cause of lower productivity. The KVKs should also take seed production of new varieties at small scale level. For seed processing, mobile processing plants need to be made available to KVKs. Hybrid seed production system, particularly in rice and maize, need to be developed and popularized on large scale. (**Action: NSC/ICAR Institutes/SAUs/KVKs/State Deptt. of Agriculture**).
- Damage of crops by wild animals like blue bulls, wild boars, deers, monkeys, etc. is also a major problem with farmers. Appropriate policy steps need to be taken by the Government to stop such losses. (**Action: GOI/State Govts/Forest Deptt.**).



Fig. 8. Progressive farmer expressing his views during the workshop

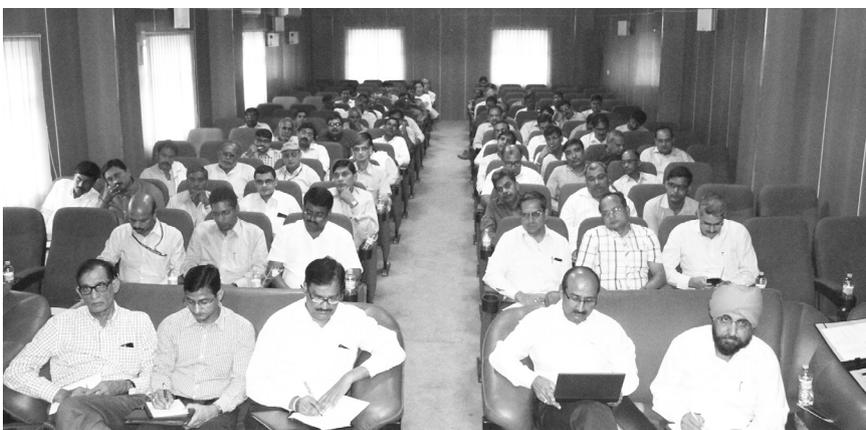


Fig. 9. Participants of the workshop

Agroforestry for Rehabilitation of Water Congested Ecologies

For restoration of agricultural wetlands, which occupy about 4.05 million ha area in Eastern India, bio-drainage could be one of the potential options besides livestock and fish farming. Keeping this fact in view, Brainstorming session on above mentioned topic was organized by the institute in collaboration with National Academy of Agricultural Sciences, New Delhi on 5th April 2016. The programme was attended by more than 65 participants representing ICAR institutes, and SAUs of Eastern states, representative from Department of Agriculture and Co-operation, Govt. of India, World Agroforestry Research and CGIAR institutes. The major recommendations are mentioned below:

- Crop diversification in aquatic ecologies, and suitable tree-crops for bio drainage and integration of woody perennials and livestock in cropping/farming systems.



Fig. 9. Inauguration of the session by Dr. Gurubachan Singh, Chairman, ASRB, New Delhi



Fig. 10. Participants of the session

- Use of vegetative shelterbelts for minimizing the effects of eroding river banks.
- Development of specific agroforestry solutions for different water congested ecologies with due concern of profitability.
- Minimum Support Price for various forestry/agroforestry products, and development of policy guidelines on bio drainage and constitution of a Task force for its implementation involving inter-ministries.
- Inventorization and characterization of water congested ecologies in different states of Eastern India.
- Development of policy guidelines on biodrainage and constitution of a Task force for its implementation.
- Developing contingency plan for different waterlogging scenarios of Eastern India.
- Popularization of rice-fish cultivation with agroforestry systems in Chhattisgarh; and Integrated farming systems with pig or goat as animal component for Jharkhand.
- Studies on existing shelterbelt models for coastal region of Odisha.
- Inter-institutional collaboration for maintaining germplasm of different fodder crops, agro-forestry species and bamboos species which can withstand the water logged area and field gene bank of waterlogging tolerant fodder species.
- Replicating farmers' innovations on management of waterlogged area like floating vegetable fields of Assam in other parts of Eastern India.
- Using the available dataset of NRSA or State Remote Sensing Agencies for characterization of waterlogged areas.
- Collection and identification of water loving local grasses of the Eastern states.
- Identification, characterization and promotion of wild rice in low lying areas of Eastern states as per the guidelines of NBPGR.
- Documentation of the success stories on agroforestry in Eastern region.

Sensitization Workshop of Second Green Revolution

After creation of SGR cell, the institute organized a Sensitization Workshop for member secretaries of State Co-ordination Committees on 3rd May 2016 at ICAR-RCER, Patna. Agriculture Production Commissioner, Govt. of Bihar, Shri Vijoy Prakash graced the occasion as Chief Guest. The workshop was attended by large number of scientists and state department officials from different organizations of the Eastern region. The major recommendations are depicted below:

- Holistic development of agriculture could be promoted under the umbrella of SGR Cell across the states involving multi-stake holders. Synergy of various programmes of GoI also needs to be explored for effective implementation of the programme.



Fig. 11. Inauguration of the sensitization workshop by Shri Vijoy Prakash, IAS, Agriculture Production Commissioner, Govt. of Bihar



Fig. 12. Interaction by the participants during the programme

- Research should not only focus on cereals and other food crops, but it should also expand its base in animal and fish productivity. Diversification must find a place in SGR with more attention on millets, pulses, small ruminants etc.
- There is a need for paradigm shift from long duration rice-short duration wheat to short to medium duration rice-long duration wheat.
- Major emphasis need to be given on participatory mode of seed production of high yielding varieties, popularizing small farm tools and implements, custom hiring of farm machineries, strengthening of storage infrastructure and pest control.
- Fish diversification, establishment of brood bank in each state, popularization of genetically improved Jaynti rohu, culture technology suiting specific geographical conditions and entrepreneurship development for development of fishery sector in Eastern India.
- There is a need for gender sensitization and gender friendly farm implements besides promoting women friendly enterprises and linking them with the market.
- Technology inventory need to be prepared for Eastern region including the need based interventions/ innovations brought out by different institutions of the region across the disciplines and institutions.
- Reducing post-harvest losses, value addition and strengthening storage facilities, particularly in perishable commodities.
- Separate Annual Report for Eastern region need to be brought out every year for better documentation and reporting of activities.
- Each state need to organize meetings of State Coordination Committees and delineate the strategies and activities to be taken up.
- Preservation and conservation of natural resources should be taken care of. Knowledge on new promising varieties in different crops should reach the farmers of Eastern region.
- Steps need to be taken up for improving the livestock productivity. Conservation of indigenous breeds also needs to be taken up.
- Duplication in implementing of research and extension activities should be avoided.
- Head/in-charge of the Regional Station of NRRI, Guwahati, Assam; North Eastern Regional Centre of CIFRI, Dispur, Assam; Ramie Research Station of CRIJAF, Sorbhog, Assam, and Regional Research Station of NBSS&LUP, Jorhat shall also be included as a member of State Co-ordination Committee.

Recommendations of the State Coordination Committee Meetings (SCCM) of SGR

Jharkhand

The meeting was held on 7th June, 2016 under the Chairmanship of Dr. N. M. Kulkarni, Secretary, Department of Agriculture, Animal Husbandry and Cooperation, Govt. of Jharkhand at Ranchi and following recommendations have been made:

- Appropriate technologies for rice-fallow management and suitable cropping systems for adoption.
- Selection and production of quality bucks to improve upon meat production.
- Development of bacterial wilt resistant varieties in vegetables.
- Development of women friendly farm implements and tools.
- Restoration of degraded lands through agroforestry interventions.
- Soil acidity amelioration to improve upon the productivity.
- Development of seed chain of important agricultural crops.
- Rain water harvesting and micro irrigation.
- Popularization of vegetable soybean to address the issue of nutritional security.
- To initiate the work on maintaining seed chain of contingent crops.
- Ensuring minimum support price to lac growers and bringing lac cultivation in ambit of agriculture.
- Developing value chain through farmer producer organizations.
- Primary processing of different agricultural commodities.
- Popularization of location specific and resource based integrated farming system models.



Fig. 13. Interaction by the participants during the SCCM, Govt. of Jharkhand

Odisha

The meeting was held on 12th July, 2016 at Rajiv Bhavan of Odisha Secretariat, under the Chairmanship of Shri Manoj Ahuja, I.A.S., Principal Secretary, Agriculture Department. The major issues are depicted below:

- Odisha has low productivity of almost all the agricultural commodities including vegetables, fruits, meat and milk compared to other Eastern states. Comprehensive planning is, therefore, required to improve upon the productivity and thereby the profitability to the farmers.
- Development of cold tolerant pulse varieties.
- Development of package of practices for organic farming.
- Development of topo sequenced cropping/farming system models.
- Re-notification of some of the old varieties which are preferred by the farmers and still has resistance to diseases and pests.
- Crop diversification, particularly in water deficit region to improve upon the productivity.
- Conservation of traditional crops and pulse varieties and their organic cultivation.
- Establishment of quality brood bank of important IMC, exotic carps including minor carps.



Fig. 14. Interaction by the participants during the SCCM, Govt. of Odisha

West Bengal

The SCCM of West Bengal was held on 14th July, 2016 at Nabanna under the Chairmanship of Shri S. Chopra, Additional Chief Secretary, Agriculture Department and major recommendations are given below:

- Package of practices for off season vegetable cultivation.
- Standardization of breeding protocol for minor carps.
- For rice-fish integration, research is needed to identify the suitable fishes for the integration.
- Renotification of some of the old varieties, preferred by the farmers and still have resistance to diseases and pesticides. It is mandatory required to ensure the seed supply of old paddy varieties, particularly for *Boro* season and wheat varieties like K0307, DBW 39, CBW 38, Raj 4120 & HI 1563 and the drought resistant jute variety JRO 524.
- In paddy, there is lack of seed supply of salt tolerant varieties.
- Since jute is cultivated in 0.574 million ha area and more than 1.2 million farmers are associated with its cultivation, the technology developed for *in situ* retting of jute, needs to be promoted.
- Popularization of the technology developed for intercropping of jute and moong bean.
- Promotion of cage and pen culture in water surplus ecologies.
- Documentation of Hot spot of zoonotic and other infectious diseases like anthrax, FMD, HS, BQ, PPR etc. in livestock.
- Cultivation of improved varieties/cultivars of green fodder.



Fig. 15. Interaction by the participants during the SCCM, Govt. of West Bengal

Eastern Uttar Pradesh

The SCCM of Eastern UP was held on 27th July, 2016 at Bahukhandi Bhawan, UP Sachivalaya, Lucknow under the Chairmanship of Shri Pradip Bhatnagar, I.A.S., APC, Govt. of Uttar Pradesh and following points emerged:

- To improve maize and oilseeds productivity, state need to prepare a detailed plan in connection with the varieties required. However, Package of Practices shall be developed by IAS, BHU, Varanasi; NDUA&T, Faizabad; and SHIATS, Allahabad.
- There is also an urgent need to improve upon the livestock productivity, particularly meat and egg production.
- Seed chain of suitable rice varieties for salt tolerant and submergence conditions need to be strengthened in order to improve upon the rice productivity.
- Protected cultivation for off season vegetables and promotion of community polyhouses.
- Promotion of Robusta variety of banana for vegetable purposes.
- The state need to implement Fisheries Management Act, 2014 for leasing policy for fish rearing. Integrated Fish Farming models need to be replicated to improve upon the productivity of composite fish culture.
- Ground water recharge shall be given due importance since Eastern UP is utilizing about 69% of the total groundwater.
- To increase the catchment area/depth of the existing water bodies for fish farming.
- Integrated Watershed Development programme shall be implemented, particularly in the districts like Mirzapur and Sonbhadra.



Fig. 16. Interaction by the participants during the SCCM, Govt. of Uttar Pradesh

Assam

The SCCM of Assam was held on 2nd August, 2016 at College of Veterinary Science, AAU, Khanapara, Guwahati under the Chairmanship of Shri V.B. Pyarelal, I.A.S., Agriculture Production Commissioner, Govt. of Assam. The following points emerged during the meeting:

- Development of complete package of practices for organic cultivation of rice and spices like turmeric and ginger.
- Strengthening of varietal developmental programme in summer rice.
- To explore the possibilities of use of Ramie as a fodder crop.
- Promotion of protected cultivation, particularly for orchids and other cut flowers, and to maintain the cold chain.
- Though the Govt. of India has sanctioned 06 nos. of pulse seed hubs for the state, there is lack of adequate seed material for planting. Further, Govt. of Assam should ensure the procurement of the pulse seed from Assam Agricultural University.
- Establishment/strengthening of custom hiring services/centres to promote small farm mechanization.
- Accreditation of mother blocks of quality planting material of fruit crops.
- Installation of solar dryers in PPP mode for drying of spices including the cereals.
- Strengthening of Assam Livestock Development Agency, particularly in the field of quality bull rearing.
- Cattle Breeding Policy, 2003 needs to be revisited and emphasis be given to rear at least 50% jersey cattle.



Fig. 17. Chairman, SCCM, Govt. of Assam, Shri Shri V.B. Pyarelal, I.A.S., addressing the gathering

- Infrastructural support for green fodder production.
- Multiplication and rearing of swamp buffalo bull for breeding.
- Propagation of the pig variety, developed by Assam Agricultural University.
- Promotion of snail farming including tuber crops as alternative source of feed to piggery sector.
- Launching of regional feed and fodder security mission (FFSM) in the line of Technology Mission on Horticulture and NFSM to improve upon livestock productivity.
- Quality brood management for ensuring supply of fish seed.
- To develop an action plan for improving the stocking of Indian Major Carps so as to increase the productivity of flood-prone plains/lake/beels.



Fig. 18. Participants of the SCCM, Govt. of Assam

Bihar

The SCCM of SGR was held on 4th August, 2016 under the Chairmanship of Shri Vijoy Parkash, IAS, APC, Govt. of Bihar. The following recommendations were made based on the discussion:

- Setting up long term experiments at Bihar Agriculture University, Sabour and Dr. Rajendra Prasad Central Agricultural University, Pusa for regular monitoring of soil carbon content.
- Monitoring of quality of the produce, particularly of fruits, vegetables and field crops, besides quantitative yields.
- Monitoring of pesticide contents in the milk and meat.
- Quality analysis of urine, dung and milk of *desi* and cross bred cattle.
- In pulses, availability of quality seeds is a major concern besides area under cultivation. Hence, to expand area under pulse production, land could be either leased or farmers participatory mode of seed production be followed.
- Strengthening of cold storage facilities for the storage of surplus seed.
- To develop progeny of quality bull for improving livestock productivity.
- Bull distribution programme in villages/panchayats involving private partners like BAIF and COMFED.
- Conservation of indigenous breeds of cattle (Bachaur, Purnea Red, Gangatiri and Sahabadi).
- Replication of integrated fish farming models, developed by ICAR, for which ICAR-RCER, Patna shall prepare a DPR and submit it to Animal Husbandry Dept. of the state for its implementation.
- To maintain the seed chain of old wheat varieties like HD 3059, HI 1563 and WH 1124 for late sown conditions, and very late sown conditions (WR 554).



Fig. 19. Participants of the SCCM, Govt. of Bihar

Chhattisgarh

The meeting was held on 5th August, 2016 at Mahandi Bhawan, New Raipur under the Chairmanship of Shri Ajay Singh, IAS, Addl. Chief Secretary & Agriculture Production Commissioner, Govt. of Chhattisgarh. The following recommendations were made based on the inputs and discussion:

- To ensure the supply of stress/drought tolerant paddy varieties.
- To workout the Cost:Benefit ratio of the technologies, developed by the IGKV, Raipur, in order to convince the farmers for technology adoption.
- In BGREI programme, there is a provision of 20% allocation of fund for asset building and 10% for water harvesting. There is a need to modify the fund allocation as 20% under water savings 10% for asset building. Asset building programme could also be supplemented even by other schemes of GoI.
- Cultivation of blackgram, *ragi* and maize in the main *kharif* season; niger and horsegram during mid *kharif* and dryland fruit crops including pigeonpea (ICPL-88039) during the *rabi* season to increase diversification and cropping intensity.
- Development of protocols for rearing of minor carps.
- Accreditation of mother blocks of fruit trees.
- To develop mechanism for the sale of bio-pesticides and bio-fertilizers, developed by the IGKV.



Fig. 20. Participants of the SCCM, Govt. of Chhattisgarh, Raipur

- There is a need to strengthen the bull rearing (Gir, Tharpakar and Sahiwal) for livestock development. Likewise, quality buck and boar needs to be distributed for improving productivity of goat and pig, respectively.
- To strengthen the disease diagnostic laboratories for improving livestock health.
- Timely release of the subsidy component under various schemes of GoI.
- Vice Chancellor and Dean, Chhattisgarh Kamdhenu Vishwavidyalaya (CGKV) should be invited to attend State Co-ordination Committee meeting as a special invitee.
- The existing potential of indigenous tribal farming systems need to be documented.

Recommendations of First Steering Committee Meeting of Second Green Revolution

First meeting of Steering Committee, Second Green Revolution (SGR) was organized at ICAR Research Complex for Eastern Region, Patna on 27/06/2016. Shri Radha Mohan Singh, Hon'ble Union Minister of Agriculture & Farmers' Welfare, Govt. of India graced the occasion as Chief Guest of the inaugural session. Directors and other senior level officers from various ICAR Institutes of the region, Vice-Chancellors from SAUs, representatives from CG Centres, progressive farmers and Principal Secretary (Agri.), Govt. of Bihar and representatives from respective State Governments attended the programme. Technical session was chaired by Dr. J.S. Sandhu, DDG (Crop Science), ICAR and Co-chaired by Dr. R.C. Srivastava, VC, RAU, Pusa. Based on the inputs and deliberations, following important points emerged:

Policy

- ICAR has already constituted Steering Committee, Technical Coordination Committee and State Level Coordination Committees for monitoring of SGR programme vide officer order No. 34(1)/2016-Cdn.(Tech.), dated 07/04/2016, however, Hon'ble Union Minister of Agriculture & Farmers' Welfare, Govt. of India desired to have the District Level Coordination Committee(s) in each state involving KVKs, ICAR Institutes and other Institutions located in the district. The District Coordination Committee(s) shall interact quarterly in order to apprise to State Coordination Committee(s) [Action: ADG (TC), ICAR]



Fig. 21. Inauguration of first ever Steering Committee Meeting of SGR by Shri Radha Mohan Singh, Hon'ble Union Minister of Agriculture & Farmers' Welfare, Govt. of India

- Since integrated farming system mode of food production would address the issues of food and nutritional security besides mitigation of climate change impact on agriculture, location specific IFS models need to be developed so as to replicate them in each KVK/ demonstration farms of SAUs and ICAR Institutions located in the region. There is also need to identify, document and propagate the potential tribal farming systems of the region. **[Action: SAUs, Directors of ICAR Institutes of Eastern Region, Head of the Regional Centres of ICAR Institutes of Eastern Region, Respective State Govts]**
- Quality seed material, particularly in case of pulses and oilseeds, is one of the major constraints to improve the productivity in rice fallow area. Hence, there is need to develop a seed chain of newly developed varieties in each state. Microbial approaches such as rhizobium inoculants and phosphorus solubilising bacteria should be adopted to improve the pulse productivity, especially in rice fallow area. In addition to this, timely indent of breeder seed requirements by various state governments of Eastern region is also need of the hour to ensure the supply of quality seeds. **[Action: Deptt. of Agriculture, Cooperation and Farmers' Welfare, Govt. of India; National Seed Corporation, State Seed Corporation, ICAR-IIPR, Kanpur]**
- Lac cultivation has now become a systematic production system instead of mere collection from the forests and cultivated in and around agricultural fields. It needs to be declared as agricultural commodity instead of being categorized as Non Timber Forest Produce. This will help the farmers a better access to different welfare and development schemes like KCC and credit from the financial institutions. **[Action: Ministry of Agriculture & Farmers' Welfare, Govt. of India; Ministry of Environment and Forests, Govt. of India]**



Fig. 22. Interaction during the session

- Each Eastern state should have MoUs with National Seed Corporation in order to ensure the supply of quality seed materials. **[Action: Respective State Govts. & National Seed Corporation]**
- There is need to take a stock of technologies needed for bringing Second Green Revolution besides the technologies already available with the Institutes so as to identify the gaps which could be fulfilled through convergence and better synergies across the disciplines and institutions. **[Action: SAUs, Directors of ICAR Institutes of Eastern Region]**
- Since the region has more than 95% non-descript cattle and buffalo population, there is an urgent need of genetic improvement through indigenous cattle like Sahiwal, Tharparkar and Red Sindhi (in case of cattle) and Murrah (in case of buffalo) in order to improve upon the milk productivity. Each Eastern state shall establish the Bull Centres of improved indigenous breeds besides Semen Storage Centres for the supply of quality semen. **[Action: SAUs, ICAR Institutes of Eastern Region & Respective State Govts.]**
- For increasing the income of landless households, improved backyard poultry and duck production units need to be established in each state in order to develop a supply chain. However, parent stock need to be arranged by NARS **[Action: Deptt. of Animal Husbandry of respective State Govts. of Eastern Region, Heads of Regional Stations of ICAR Institutes of Eastern Region, ICAR-CARI, Izzatnagar; ICAR-Directorate of Poultry Research, Hyderabad; SAUs]**
- The region has international boundaries with Nepal, Bangladesh and Bhutan. Hence, preparedness to tackle transboundary diseases in livestock need to be developed, particularly in the state like Assam, West Bengal, Bihar and Eastern UP. **[Action: ICAR-IVRI, Izzatnagar and its Regional Stations, SAUs]**
- Keeping in view the commercial potential of ornamental fishes, research, technology development and dissemination work to be initiated. **[Action: Ministry of Agriculture & Farmers' Welfare, Govt. of India]**

Research

- Acid tolerant rainfed rice, and important pulse-varieties (especially pigeonpea, horsegram and blackgram) need to be developed keeping in view the fact that Eastern states have 7.2 million hectare area under acidic soils. Further, research programme need to be strengthened for development of bacterial wilt resistant varieties of important vegetables. **[Action: Directors of ICAR Institutes of Eastern Region & SAUs]**

- As of now, lac is commercially cultivated on Kusum (*Schleichera oleosa*), Ber (*Zizyphus mauritiana*) and Palas (*Butea monosperma*), there is need to screen some more lac producing host trees so as to improve the lac production not only in Hill and Plateau but also in North Eastern part of the country. [**Action: ICAR-IINRG, Ranchi**]
- There is an urgent need to refine/develop hand tools/implements, based on ergonomic studies in order to reduce drudgery of women folk. [**Action: ICAR-CIAE, Bhopal; ICAR-CIWA, Bhubaneswar**]
- Since there is out migration of male farmers from the region, studies need to be conducted on the agricultural practices, being followed by women headed households including the issues of food and nutritional security at household level. [**Action: ICAR-NIAP, New Delhi; ICAR-CIWA, Bhubaneswar**]

Development

- Keeping in view, the climatic condition (high temperature and high humidity) of Eastern region and increase in grain production due to SGR, it will be highly pertinent to develop sufficient grain storage facility (ware house) to check post harvest losses as well as reduction in market value of the produce to protect the benefit of the farmers. [**Action: Respective State Govts, Ministry of Agriculture & Farmers' Welfare, Govt. of India; CIPHET, Ludhiana**]
- For ensuring large scale availability of quality planting material of different fruit crops, there is a need for strengthening of Nursery accreditation programme of National Horticulture Board in different Eastern states. Further, package of practices need to be standardized for high density planting of major fruit crops in different agro-ecological zones of Eastern India. [**Action: National Horticulture Board, State Horticulture Department, SAUs and ICAR Institutes of Eastern Region**]
- For minimizing post harvest losses in fruits and vegetables and ensuring better returns to the farmers, there is a need for strengthening of infrastructure on post harvest handling and capacity building on processing and value addition (pickling, dehydration, jams, jelly, sauce, juice, etc.) in different Eastern states. [**Action: National Horticulture Board; Ministry of Agriculture & Farmers' Welfare, Govt. of India; CIPHET, Ludhiana**]
- Business model need to be developed for upscaling of solar energy application in agriculture. [**Action: ICAR-CAZRI, Jodhpur; ICAR-CIAE, Bhopal; ICAR-RCER, Patna**]
- To improve upon the fish productivity, rice fish culture and integrated fish farming models (cattle-fish, duck-fish, goat-fish, poultry-fish, pig-fish) need to be replicated, particularly in water surplus ecologies. [**Action: Respective State Govts.**]

- Availability of fish seed, particularly minor carps, is major constraint for diversification in fish farming almost in all the Eastern states, except West Bengal. Hence, research programmes need to be strengthened in the areas like standardization of breeding technologies, larval rearing, nutritional requirements and fish health management. **[Action: ICAR-CIFA, Bhubaneswar; ICAR-CIFRI, Barrackpore; Respective State Govts.]**

General Recommendations

- Keeping in view the fact that large numbers of research for development projects are being implemented in Eastern Gangetic Plains (EGP) by almost all the CG Centres including donors besides ICAR & SAUs, it has been observed that there is lack of synergy between NARS and CG Centres. In order to have better coordination, a meeting shall be arranged at ICAR-RCER, Patna inviting all the CG Centres and Donors functioning in the region. It would help in effective implementation of the SGR and also avoid duplication in research across the institutions/organization. **[Action: ICAR-RCER, Patna]**
- Since SGR Cell has been created by ICAR for greater impact of SGR programme, it should have synergy with BGREI programme of Govt. of India. The recommendations of SGR programme shall be submitted to DAC for greater visibility and impact. **[Action: ICAR-RCER, Patna; ICAR-NRRI, Cuttack]**

References

- Anonymous, 2015. *Agricultural Statistics at a Glance 2014*. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India and Oxford University Press, New Delhi, pp. 452.
- Bhatt, B.P., Haris, A. Abdul, Islam, Adlul, Dey, Amitava, Mukherjee, Joydeep, Barari, S.K., Das, Bikas and Kaushal, D.K. 2011. *Agriculture in Eastern Region: Opportunities and Challenges*. ICAR Research Complex for Eastern Region, Patna, pp. 78.
- Bhatt, B.P.; Sikka, A.K.; Mukherjee, J.; Islam, A. and Dey, A. 2013. *Status of Agricultural Development in Eastern Region*. ICAR Research Complex for Eastern Region, Patna, pp. 519.
- Bhatt, B.P. 2015. *Dwitiye Harit Kranti ki aur Rashtra ke Badhte Kadam* (Hindi). Satish Serial Publishing House, New Delhi, pp. 255.
- Bhatt, B.P. and Mishra, J.S. 2016a. Production and technological gaps in middle Indo-Gangetic plains. *Policy Document*, ICAR Research Complex for Eastern Region, Patna, pp. 15.
- Bhatt, B.P. and Mishra, J.S. 2016b. Prospects of bringing Second Green Revolution in Eastern India. In : Souvenir, 4th International Agronomy Congress, on *Agronomy for Sustainable Management of Natural Resources, Environment, Energy and Livelihood Security to Achieve Zero Hunger Challenge*, November, 22-26, 2016, New Delhi, India.
- NAAS, 2013. Water use potential of flood affected and drought-prone areas of Eastern India. *Policy Paper No. 60*. National Academy of Agricultural Science, New Delhi, pp. 20.
- Singh, A.K., Bhatt, B.P. and Minhas, P.S. 2011. *Technical Output and Recommendations of Brainstorming Session on Second Green Revolution: Strategies for Agricultural Transformation of Eastern Region*. ICAR Research Complex for Eastern Region, Patna, pp. 111.



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Dated the 7th April, 2016

OFFICE ORDER

The Competent Authority is pleased to appoint the Director, ICAR Research Complex for Eastern Region, Patna, Bihar as the Nodal Officer to coordinate the various ongoing agricultural Research & Development Activities in Eastern Region being undertaken by various ICAR Institutes located in the region and the concerned Central and State Government Departments/agencies with the purpose of enhancing the production and productivity of various agricultural commodities in the region. The approval has also been accorded for establishing a Special Cell in the Institute campus for this purpose and contractual hiring of a Coordinator with maximum remuneration not exceeding Rs.50,000/- per month and two Data-Entry-Operators on purely temporary basis within the permitted provisions under GFR till the permanent arrangement in this regard is made. It has also been approved to enhance the Non-Plan Budget allocation of the Institute by the Council to meet the expenditure for the purpose. The following Committees are also constituted for effective monitoring and implementation of the programme along with their terms of reference and composition.

1.	Steering Committee	The Steering Committee shall meet once in a year to discuss the policy, investment, convergence and related issues for successful implementation of Second Green Revolution programme of Govt. of India. The Committee shall apprise directly to Hon'ble Minister of Agriculture & Farmers' Welfare, Govt. of India.
2.	Technical Coordination Committee	The Technical Coordination Committee will meet twice in a year in different states on rotation basis and will review the recommendations/suggestions of State Coordination Committee and shall put up it to Steering Committee with some refinement/modifications, as deemed fit.
3.	State Coordination Committee	The State Coordinating Committee will meet twice in a year before each season in different states on rotation basis and will submit its recommendations/suggestions pertaining to location specific research and developmental issues, constraints faced in implementation of the programme and the thrust of the state to Technical Coordination Committee.

The constitution of various committees is depicted below:-

Steering Committee

1.	Secretary (DARE) & DG, ICAR	Chairman
2.	Secretary (Agriculture), Govt. of India	Special Invitee
3.	Principal Secretary (Agriculture), Govt. of Assam	Member
4.	Principal Secretary (Agriculture), Govt. of Bihar	Member

5.	Principal Secretary (Agriculture), Govt. of Chhattisgarh	Member
6.	Principal Secretary (Agriculture), Govt. of Jharkhand	Member
7.	Principal Secretary (Agriculture), Govt. of Odisha	Member
8.	Principal Secretary (Agriculture), Govt. of Uttar Pradesh	Member
9.	Principal Secretary (Agriculture), Govt. of West Bengal	Member
10.	Two Vice-Chancellors of State Agricultural Universities of Eastern Region (on rotation basis)	Member
11.	Agriculture Commissioner, Govt. of India	Member
12.	Horticultural Commissioner, Govt. of India	Member
13.	Animal Husbandry Commissioner, Govt. of India	Member
14.	Two representatives of CGIAR Centres having major operations in Eastern India (on rotation basis)	Member
15.	Two representatives of Donors having major operations in Eastern India (on rotation basis)	Member
16.	Representative of Private Sector	Member
17.	Representative of NGO	Member
18.	DDGs of ICAR (on rotation basis)	Member
19.	Representative of Farmers (01 or 02)	Member
20.	Director, NRRI, Cuttack	Member
21.	Director, ICAR-RCER, Patna	Nodal Officer & Member-Secretary

Technical Coordination Committee

1.	DDG (ICAR)/Vice-Chancellor of SAUs of the region	Chairman
2.	Vice-Chancellor, AAU, Assam	Member
3.	Vice-Chancellor, BAU, Sabour, Bhagalpur	Member
4.	Vice-Chancellor, RAU, Pusa, Samastipur	Member
5.	Vice-Chancellor, IGKV, Raipur, Chhattisgarh	Member
6.	Vice-Chancellor, BAU, Ranchi, Jharkhand	Member
7.	Vice-Chancellor, OUA&T, Bhubaneswar, Odisha	Member
8.	Vice-Chancellor, BHU, Varanasi, Uttar Pradesh	Member
9.	Vice-Chancellor, BCKV, Nadia, West Bengal	Member
10.	Vice-Chancellor, WBUA&FS, Kolkata, West Bengal	Member
11.	Director, IVRI, Izzatnagar, Bareilly	Member
12.	Director, NDRI, Karnal	Member
13.	Director, IARI, New Delhi	Member
14.	Director, CIFE, Mumbai	Member
15.	Director (Agriculture), Govt. of Assam	Member
16.	Director (Horticulture), Govt. of Assam	Member
17.	Director (Fisheries), Govt. of Assam	Member
18.	Director (Animal Husbandry), Govt. of Assam	Member
19.	Director (Agriculture), Govt. of Bihar	Member
20.	Director (Horticulture), Govt. of Bihar	Member
21.	Director (Fisheries), Govt. of Bihar	Member
22.	Director (Animal Husbandry), Govt. of Bihar	Member
23.	Director (Agriculture), Govt. of Chhattisgarh	Member
24.	Director (Horticulture), Govt. of Chhattisgarh	Member
25.	Director (Fisheries), Govt. of Chhattisgarh	Member
26.	Director (Animal Husbandry), Govt. of Chhattisgarh	Member
27.	Director (Agriculture), Govt. of Jharkhand	Member

28.	Director (Horticulture), Govt. of Jharkhand	Member
29.	Director (Fisheries), Govt. of Jharkhand	Member
30.	Director (Animal Husbandry), Govt. of Jharkhand	Member
31.	Director (Agriculture), Govt. of Odisha	Member
32.	Director (Horticulture), Govt. of Odisha	Member
33.	Director (Fisheries), Govt. of Odisha	Member
34.	Director (Animal Husbandry), Govt. of Odisha	Member
35.	Director (Agriculture), Govt. of Uttar Pradesh	Member
36.	Director (Horticulture), Govt. of Uttar Pradesh	Member
37.	Director (Fisheries), Govt. of Uttar Pradesh	Member
38.	Director (Animal Husbandry), Govt. of Uttar Pradesh	Member
39.	Director (Agriculture), Govt. of West Bengal	Member
40.	Director (Horticulture), Govt. of West Bengal	Member
41.	Director (Fisheries), Govt. of West Bengal	Member
42.	Director (Animal Husbandry), Govt. of West Bengal	Member
43.	Director, NRC on Pig, Guwahati	Member
44.	Director, NRC for Litchi, Muzaffarpur	Member
45.	OSD, NRC-IF, Motihari	Member
46.	Director, NIBSM, Raipur, Chhattisgarh	Member
47.	OSD, IIAB, Ranchi, Jharkhand	Member
48.	Director, IINRG, Ranchi, Jharkhand	Member
49.	Director, NRRI, Cuttack, Odisha	Member
50.	Director, IIWM, Bhubaneswar, Odisha	Member
51.	Director, CIWA, Bhubaneswar, Odisha	Member
52.	Director, CIFA, Bhubaneswar, Odisha	Member
53.	Director, DSR, Mau, Uttar Pradesh	Member
54.	Director, NBAIM, Mau Nath Bhanjan, Uttar Pradesh	Member
55.	Director, IIVR, Varanasi, Uttar Pradesh	Member
56.	Director, CRIJAF, Barrackpore, Kolkata	Member
57.	Director, NIRJAFT, Kolkata	Member
58.	Director, CIFRI, Barrackpore, Kolkata	Member
59.	NAAS Fellow 1	Member
60.	NAAS Fellow 2	Member
61.	Need based Experts (02 or 03)	Member
62.	Director, ICAR-RCER, Patna	Member-Secretary

State Coordination Committees

Assam

1.	Agriculture Production Commissioner, Govt. of Assam	Chairman
2.	Director (Agriculture), Govt. of Assam	Member
3.	Director (Horticulture), Govt. of Assam	Member
4.	Director (Fisheries), Govt. of Assam	Member
5.	Director (Animal Husbandry), Govt. of Assam	Member
6.	Director, NRC on Pig, Guwahati	Member
7.	Director Research, AAU, Assam	Member
8.	Director Extension, AAU, Assam	Member-Secretary

Bihar

1.	Agriculture Production Commissioner, Govt. of Bihar	Chairman
2.	Director (Agriculture), Govt. of Bihar	Member
3.	Director (Horticulture), Govt. of Bihar	Member
4.	Director (Fisheries), Govt. of Bihar	Member
5.	Director (Animal Husbandry), Govt. of Bihar	Member
6.	Director, NRC for Litchi, Muzaffarpur	Member
7.	OSD, NRC-IF, Motihari	Member
8.	Director Research, BAU, Sabour, Bhagalpur	Member
9.	Director Extension, BAU, Sabour, Bhagalpur	Member
10.	Director Research, RAU, Pusa, Samastipur	Member
11.	Director Extension, RAU, Pusa, Samastipur	Member-Secretary

Chhattisgarh

1.	Agriculture Production Commissioner, Govt. of Chhattisgarh	Chairman
2.	Director (Agriculture), Govt. of Chhattisgarh	Member
3.	Director (Horticulture), Govt. of Chhattisgarh	Member
4.	Director (Fisheries), Govt. of Chhattisgarh	Member
5.	Director (Animal Husbandry), Govt. of Chhattisgarh	Member
6.	Director, NIBSM, Raipur, Chhattisgarh	Member
7.	Director Research, IGKV, Raipur, Chhattisgarh	Member
8.	Director Extension, IGKV, Raipur, Chhattisgarh	Member-Secretary

Jharkhand

1.	Agriculture Production Commissioner, Govt. of Jharkhand	Chairman
2.	Director (Agriculture), Govt. of Jharkhand	Member
3.	Director (Horticulture), Govt. of Jharkhand	Member
4.	Director (Fisheries), Govt. of Jharkhand	Member
5.	Director (Animal Husbandry), Govt. of Jharkhand	Member
6.	OSD, IIAB, Ranchi, Jharkhand	Member
7.	Director, IINRG, Ranchi, Jharkhand	Member
8.	Director Research, BAU, Ranchi, Jharkhand	Member
9.	Director Extension, BAU, Ranchi, Jharkhand	Member-Secretary

Odisha

1.	Agriculture Production Commissioner, Govt. of Odisha	Chairman
2.	Director (Agriculture), Govt. of Odisha	Member
3.	Director (Horticulture), Govt. of Odisha	Member
4.	Director (Fisheries), Govt. of Odisha	Member
5.	Director (Animal Husbandry), Govt. of Odisha	Member
6.	Director, NRRI, Cuttack, Odisha	Member
7.	Director, IIWM, Bhubaneswar, Odisha	Member
8.	Director, CIWA, Bhubaneswar, Odisha	Member
9.	Director, CIFA, Bhubaneswar, Odisha	Member
10.	Director Research, OUA&T, Bhubaneswar, Odisha	Member
11.	Director Extension, OUA&T, Bhubaneswar, Odisha	Member-Secretary

Eastern Uttar Pradesh

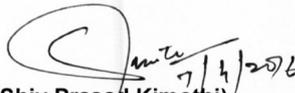
1.	Agriculture Production Commissioner, Govt. of Uttar Pradesh	Chairman
2.	Director (Agriculture), Govt. of Uttar Pradesh	Member
3.	Director (Horticulture), Govt. of Uttar Pradesh	Member
4.	Director (Fisheries), Govt. of Uttar Pradesh	Member
5.	Director (Animal Husbandry), Govt. of Uttar Pradesh	Member
6.	Director, DSR, Mau, Uttar Pradesh	Member
7.	Director, NBAIM, Mau Nath Bhanjan, Uttar Pradesh	Member
8.	Director, IIVR, Varanasi, Uttar Pradesh	Member
9.	Director Institute of Agri, BHU, Varanasi, Uttar Pradesh	Member
10.	Dean, Faculty of Agri, BHU, Varanasi, Uttar Pradesh	Member-Secretary

West Bengal

1.	Agriculture Production Commissioner, Govt. of West Bengal	Chairman
2.	Director (Agriculture), Govt. of West Bengal	Member
3.	Director (Horticulture), Govt. of West Bengal	Member
4.	Director (Fisheries), Govt. of West Bengal	Member
5.	Director (Animal Husbandry), Govt. of West Bengal	Member
6.	Director, CRIJAF, Barrackpore, Kolkata	Member
7.	Director, NIRJAFT, Kolkata	Member
8.	Director, CIFRI, Barrackpore, Kolkata	Member
9.	Director Research, WBUA&FS, Kolkata, West Bengal	Member
10.	Director Extension, WBUA&FS, Kolkata, West Bengal	Member
11.	Director Research, BCKV, Nadia, West Bengal	Member
12.	Director Extension, BCKV, Nadia, West Bengal	Member-Secretary

Note: The Nodal Officer of the programme will be the Special Invitee in all the meetings of State Coordination Committee.

These committees have been constituted with a view to prioritize, synergize, implement and monitor the programme effectively for larger impact of the investment of Govt. of India made for Second Green Revolution in the region. It will also enable to meet the mission of the Hon'ble Prime Minister of India on minimum government maximum governance through synergizing the investment in different schemes in Eastern India. It would also provide a platform to all the State Governments to communicate with other partner States effectively.


(Shiv Prasad Kimothi)
7/4/2016

Assistance Director General (Coord)

Distribution:

1. Chief Secretaries of all Eastern Region States for information.
2. All the Chairmen and Members of the Steering Committee, Technical Coordination Committee, State Coordination Committee.
3. The Director & Nodal Officer, ICAR Research Complex for Eastern Region, Patna, Bihar
4. All DDGs, ICAR
5. ADG(PIM), PD(DKMA)
6. Director (F)/ Director (P), Dy. Secretary (A), ICAR
7. Sr. PPS to Secretary, DARE & DG, ICAR / PPS to Additional Secretary & FA, DARE/ICAR / PPS to Additional Secretary, DARE & Secretary, ICAR
8. Information System Officer, DKMA, KAB-I, Pusa, New Delhi for placing the above officer order on ICAR Website.
9. Guard file



भारत
ICAR



हर कदम, हर डगर

किसानों का हमसफर

भारतीय कृषि अनुसंधान परिषद

*Agri*search with a *h*uman touch