Quinquennial Review Team Report of ICAR-NIBSM

2012 - 2017

ICAR-National Institute of Biotic Stress Management

Baronda, Raipur -493225 Chhattisgarh

Website: www.nibsm.res.in

Fax No. (0771) 2225351; Telephone No. (0771) 2225333

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Quinquennial Review Team

Dr. S.M. Paul Khurana, Chairman
(Ex. VC, Rani Durgavati University, Jabapur and
Ex.Director, CPRI, Shimla)

Dr. Vijay Singh Thakur, Member
(Ex. VC, DR. YSPUH&F, Solan)

Dr. T.P. Trivedi, Member
(Retd., Director, DKMA, New Delhi)

Dr. K.C. Bansal
(Ex. Director, NBPGR, New Delhi)

Dr. P.S. Naik, Member
(Ex. Director, IIVR, Varanasi)

Dr. Rajesh Rana, Member
(Principal Scientist, ATARI, Ludhiana)

Dr. Anil Dixit, Member Secretary
(Principal Scientist, NIBSM, Raipur)

भारतीय कृषि अनुसंधान परिषद

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

कृषि भवन, डॉ0 राजेन्द्र प्रसाद मार्ग, नई दिल्ली–110 001

Krishi Bhawan, Dr. Rajendra Prasad Road

New Delhi 110 001

F.No. CS.19/3/2017 - IA.III **Dated the 09th March, 2018**

OFFICE ORDER

The Director General, ICAR is pleased to constitute the Quinequennial Review Team (QRT) comprising of following members to review the research work done by ICAR-NIBSM, Raipur for the period 2012- 2017.

1.	Dr. S.M. Paul Khurana, Ex. VC, Rani Durgavati University, Jabalpur and Ex. Director, CPRI, Shimla, H. No. E-1101, Park View City-2, Sector-49,Sohna Road, Gurgaon-120001 (Haryana)	**Chairman**
2.	Dr. Vijay Singh Thakur, Ex. VC, Dr. YSPUH&F, Solan.	Member
3.	Dr. T.P. Trivedi, Retd., Director, DKMA	Member
4.	Dr. K.C. Bansal, Ex. Director, NBPGR, New Delhi.	Member
5.	Dr. P.S. Naik, Ex. Director, IIVR, Banaras Flat # 505, Building A-6,Kumar Pinnacle, Dhole-Patil Road (Off Tadiwala Road), Pune-411001	Member
6.	Dr. Rajesh Rana, Principal Scientist (Economics), ATARI, Ludhiana.	Member
8.	Dr. Anil Dikshit, Principal Scientist, NIBSM, Raipur.	**Member Secretary**

FUNCTIONS:-

The QRT shall conduct the review of the work of the NIBSM, Raipur keeping in view the relevant guidelines thereon and submit its recommendation on future research thrusts through its report to the Council within 6 months from the issue of this order for further submission to the Governing Body of ICAR.

PROCEDURE:-

The Member Secretary on the advice of the Chairman of the Review Team will initiate action to convene the meeting of the Team as early as possible. The Chairman will also inform the Director, NIBSM, Raipur to provide the information required by the Team in regard to the work done or proposed to be done or other relevant information, as may be required for conducting the review. The Director, NIBSM, Raipur will provide necessary stenographic, technical and administrative assistance etc. to the QRT members for efficient functioning of the Team and preparation of their report.

The T.A. of the Non-Official Members of the QRT for attending its meeting will be paid by the NIBSM, Raipur in accordance with the relevant rules of the Council.

(Rajeshwar Dayal)
Under Secretary (CS)
Telephone No. 23046422

DISTRIBUTION:-

1. Chairman, QRT for NIBSM, Raipur.
2. All members of the QRT- as per list
3. Director, NIBSM, Raipur. The guidelines and terms of references relating to the QRT may be provided to the Chairman and Members of the QRT. The T.A. of the non-official members of the QRT will be met by the Institute for which necessary budget provision in the budget may be made under" **other charges**" and not under T.A. which is meant for the staff of the Institute.
4. DDG (CS), ICAR. Krishi Bhawan, New Delhi.
5. ADG (PP), ICAR, Krishi Bhawan, New Delhi.
6. Director (Finance), ICAR. Krishi Bhawan, New Delhi.
7. Administrative Officer, NIBSM, Raipur.
8. Finance & Account Officer, NIBSM, Raipur.

9- Guard File

Preface

The ICAR-National Institute of Biotic Stress Management (ICAR-NIBSM) is the research institute under ICAR with a national mandate on Biotic Stress in agriculture and its main focus is to strengthen research on all aspects of biotic stresses in plants.

The Indian Council of Agricultural Research (ICAR) vide ICAR Office Order No. CS/19/3/2017-IA.III dated 9th March 2018 constituted QRT to review the progress of research work done by ICAR-NIBSM for the period 2012 to 2017 and to suggest areas of strengthening the research programme with Chairman QRT, Dr. S.M.Paul Khurana, Former Vice-Chancellor RDVV Jabalpur and Former Director, ICAR-CPRI, Shimla and members: Dr. Vijay Singh Thakur, Former Vice-Chancellor, Dr YSPUH&F Solan, Dr. T.P.Trivedi, former Director, DKMA, Dr K.C.Bansal, Former Director NBPGR. Dr P.S.Naik, Former Director IIVR, Varanasi, Dr Rajesh Rana, Principal Scientist, ATARI, Ludhiana and Dr Anil Dixit, Principal Scientist as Member Secretary from ICAR-NIBSM, Raipur. This is the first QRT constituted by the Council for ICAR-NIBSM. The team visited ICAR-CPRI, Shimla, ICAR-NIASM Baramati, DRDO DIHAR, Leh and ICAR-NIBSM, Raipur laboratories, experimental fields, farmers fields, and held discussions with various stakeholders.

The QRT is grateful to Dr Trilochan Mohapatra, Director General, ICAR, New Delhi for providing opportunity to review the progress of work of the ICAR-National Institute of Biotic Stress Management, Raipur for the period from ***1st April, 2012 to 31st March, 2017***. The team is also thankful to Dr Anand Kumar Singh, Deputy Director General (Crop Science), ICAR and Dr. P.K. Chakraborty, Asst. Director General (PP&B), ICAR for arranging a preliminary meeting at ICAR, New Delhi and guiding the team in conducting the review in the right direction.

The team acknowledges the assistance, co-operation and help received from the Director, Joint Director (Research), PME Cell, Scientists and other staff of ICAR-National Institute of Biotic Stress Management, Raipur. The team also puts on record its appreciation to the institute for technical and logistic support extended during the visit of QRT.

The team could analyse existing research activities of the institute, as well as understand

the biotic stresses sector in the country. It also examined the various constraints that are acting as stumbling blocks in the progress of mandated activities. Accordingly, in this report, we are putting forth our observations, suggestions and priorities for research and development of biotic stress management in the country.

Prof. S.M. Paul Khurana
Chairman

Dr Vijay Singh Thakur
Member

Dr K.C. Bansal
Member

Dr T.P. Trivedi
Member

Dr P.S. Naik
Member

Dr Rajesh Rana
Member

Dr Anil Dixit
Member Secretary

Content

Quinquennial Review Team of ICAR-NIBSM

(2012 - 2017)

Background Information

1. Historical Background and Establishment

The institute known as ICAR - NIBSM was created after recommendations of the Veerappa Moily Oversight Committee on the implementation of the reservation in higher educational institutions for expansion, inclusion and excellence. The recommendation said "establishment of a dedicated research institute of Deemed-to-be-University Status on Biotic Stress Management in agriculture". Institute came into being as a follow up of this recommendation pursued after union cabinet's approval to the proposal of ministry of agriculture, Department of Agricultural Research and Education during the 12th five year plan. The Chhattisgarh government handed over 50.19 ha land, the erstwhile Dr. Richhariya Research and Training Centre of the Indira Gandhi Krishi Vishwavidyalaya to NIBSM. The land is fertile and has various edaphic and pedological characteristics that can be utilized in the biotic stress research on crops. The foundation stone of the institute has laid on 7th October, 2012 as the 99th research institute under Indian Council of Agriculture Research. The then Union Agriculture and Food Processing Industries Minister, Shri Sharad Pawar ji, laid its foundation stone in the gracious presence of Dr. Raman Singh, Chief Minister, Chhattisgarh, Dr. Charan Das Mahant, the then Union minister of State for Agriculture and Food Processing Industries, Shri Chandra Shekhar Sahu, the then Agriculture Minister of Chhattisgarh state, Dr. S. Ayyappan, Secretary, Department of Agriculture and Cooperation, Director General, Indian Council of Agricultural Research and Dr. S. K. Patil, Hon'ble Vice Chancellor Indira Gandhi Krishi Vishwavidyalaya. Senior officials of the ICAR such as Dr. S. K. Datta, Deputy Director General (Crop Science), Dr. T. P. Rajendran, Assistant Director General (Plant Protection) from ICAR were present on the occasion along with other senior officials of Chhattisgarh Government.

The NIBSM apprises to undertake research and academic programmes that would contribute to the national necessity of manpower in bio-security and bio-safety in agriculture. The NIBSM is mandated to take up basic and strategic research in biotic stresses, develop human resources and provide policy support for the national network of research and development organizations in health management and agriculture. is the only institute of its kind in the country. The research institute has an over-arching domain amongst the existing plant protection research

establishments of the National Agricultural Research and Education System (NARES) and it would also integrate the resources available under various universities and equivalent institutions through the deemed-to-be-university status that it desires to attain soon after its establishment. NIBSM is entrusted with an unique research mandate of devising ***novel mitigation measures*** of biotic stresses in farming sector through revamping the inadequacy of the ongoing national programmes for assuring national food and nutrition security menaced by viciously vibrant pests/pathogens in the pursuit of climate change, pathogenic mutations, intervention to keep a clean environment and global regulations under WTO/IPR regimes. The NIBSM shall exclusively undertake basic, strategic and adaptive research on mining, isolating, characterizing and deploying novel genes for biotic stress tolerance in agriculture. To meet this goal, NIBSM envisions to generate intermediate products for tolerance to multiple stresses such as gene constructs and stress induced promoters, which will be made use of by crops based institutes to develop end products with applicability in the farmer's field. Discerning molecular mechanisms of host- pest/pathogen recognition, pest/pathogenic invasion and colonization in the host tissue will be of prime concern and will be addressed as pre-requisite research themes. Another equally important issues of NIBSM mandate is to evolve novel technology of biotic stress management with respect to climate change, biosafety and biosecurity concerns. HRD and capacity building befitting modern global trends in biotic stress management is still another crucial component under obligation of deemed university, the legal status bestowed on NIBSM. The institute will strongly complement the ongoing R&D in science and technology platforms under National Agricultural Research System (NARS).The institute will conduct research programme through four schools namely crop health management, crop resistance system, crop health biology and crop policy support system.

2. Mandate and objectives of the Institute

Vision

Freedom from biotic stresses for enhancement of farm prosperity

Mission

Alleviating biotic stresses for increased agricultural production

MANDATE

EFC (12th plan) approved

1. To undertake basic and strategic research on the pre-emptive, causative as well as epidemiological aspects of biotic stresses in crops using available data-bases converging genomics/proteomics technologies, bio-informatics, biodiversity, bio-security assessment to enable plant protection development
2. To develop human resources, networking institutions and universities at national/ international levels for academic excellence and establishing linkages with industry for technology management
3. Linkages and policy support research

Modified (ICAR) as on F.No.13 (102)/2015:C dn.Tech. 20th May 2016

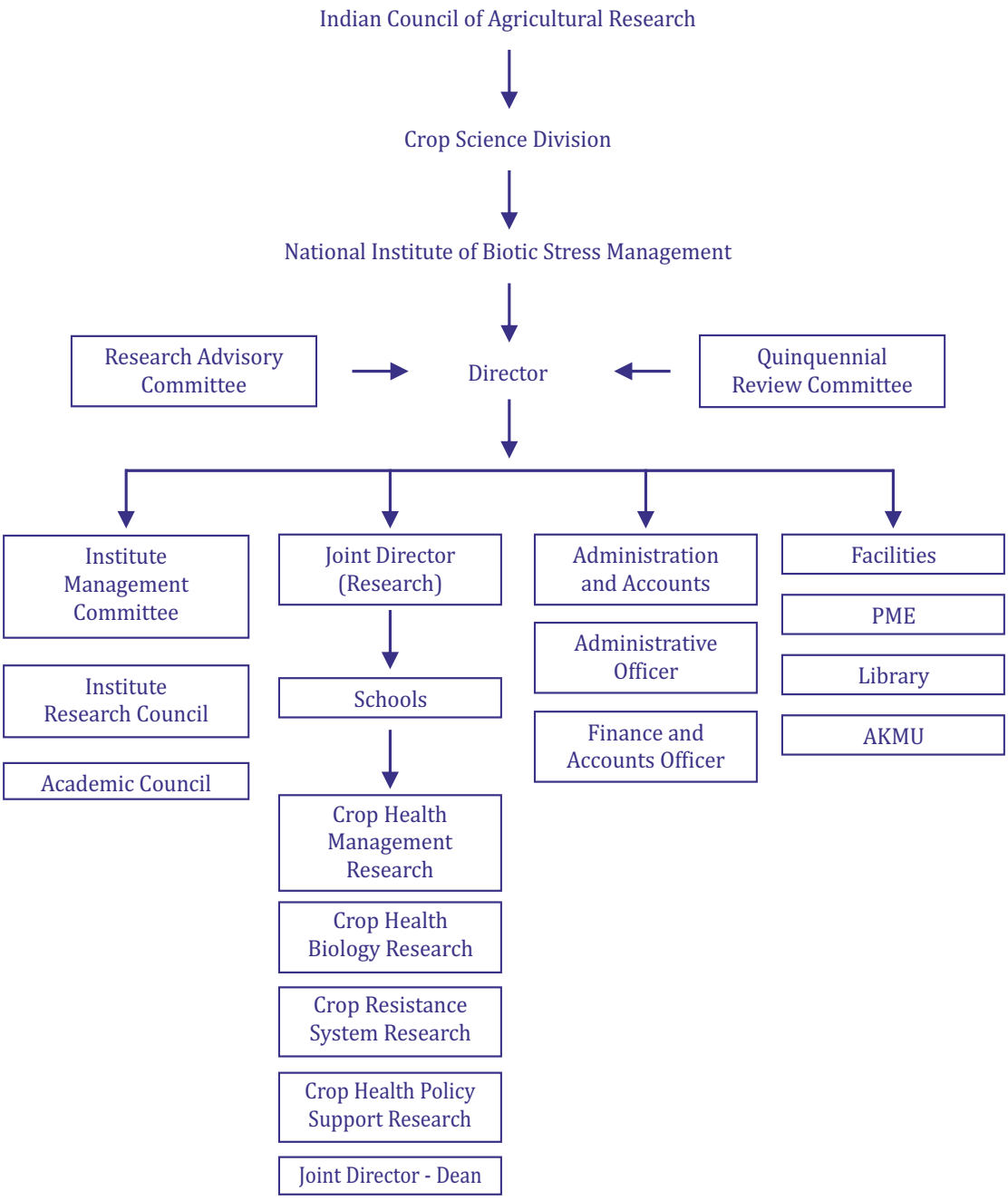
1. Basic, strategic and adaptive research on biotic stresses in agriculture
2. Development of quality human resources for academic excellence, linkage with various stakeholders for technology management and policy support research

Objective

1. To provide scholastic leadership in contemporary areas and offer post-graduate degree in identified areas
2. To develop suitable projects in network mode on pernicious pestilence issues with desired plurality and priority
3. To develop relevant policy support research for biotic stress management

3. Organization and structure: An Organogram be given along with the scientific, technical and supporting staff in the various Divisions including the qualifications of the scientific staff. This information needs to be provided in relation to the staff ratio suggested by the Council

Organisational Structure



Staff strength of NIBSM

S. No.	Name and Designation of staff	Discipline	Qualification	Staff ratio
I. Scientific				
1.	Dr. Jagdish Kumar, Joint Director & Director (Acting)	Plant Pathology	Ph. D.	
2.	Dr. Pankaj Kaushal, Joint Director (Research)	Genetics and Cytogenetics	Ph. D.	
3.	Dr. Anil Dixit, Principal Scientist	Agronomy	Ph. D.	
4.	Dr. S.K. Jain, Principal Scientist	Plant Pathology	Ph. D.	
5.	Dr. R. K. Murali Baskaran, Principal Scientist	Agricultural Entomology	Ph. D.	
6.	Dr. K. C. Sharma, Senior Scientist	Agricultural Entomology	Ph. D.	
7.	Dr. P.N. Sivalingam, Senior Scientist	Plant Biotechnology	Ph. D.	
8.	Dr. (Mrs) Mamta Choudhary, Scientist	Veterinary Pathology	Ph. D.	
9.	Dr. Binod Kumar Choudhary, Scientist	Fish & Fishery Science	Ph. D.	
10.	Dr. Vinay Kumar, Scientist	Agricultural Biotechnology	Ph. D.	
11.	Dr. Lata Jain, Scientist	Veterinary Microbiology	Ph. D.	
12.	Mr. Lalit L. Kharbikar, Scientist	Agricultural Biotechnology	M. Sc.	
13.	Dr. P. Mooventhan, Scientist	Agricultural Extension	Ph. D.	
14.	Dr. Mallikarjuna, J., Scientist	Agricultural Entomology	Ph. D.	
15.	Mr. Yogesh Yele, Scientist	Agricultural Entomology	M. Sc.	
II. Technical- NIL				
III. Supporting				
1.	Sh. Saguni Paswan, Assistant	Administration	-	

4. Previous QRT report and action taken on its recommendations along with implementation report. A copy of the previous report may be appended with action taken on the recommendations on the basis of the approval by the Governing Body of the ICAR:

Not applicable as it is the first QRT for ICAR-NIBSM, Raipur.

5. Research programmes of the institutes for the period under review (year-wise), ongoing and as envisaged in the perspective plan. This information may be given Division/programme-wise:

5.1 Research programmes and projects

The institute proposes to take up research through its four schools:

(i) School I- Crop Health Management Research (CHMR)
(ii) School II- Crop Health Biology Research (CHBR)
(iii) School III- Crop Resistance System Research (CRSR)
(iv) School IV- Crop Health Policy Support Research (CHPR).

5.1.1 The research project started at NIBSM are

S.No.	Project Title	Project Duration
1.	Studies on biotic stress under crop management practices in rice-wheat cropping system	2013-2016
2.	Studies on biotic stresses under nutrient management practices in rice-wheat cropping system with reference to weeds	2014-2017
3.	On-farm evaluation, assessment of biotic stress management technologies for adoption and impact	2014-2017
4.	Pilot study on collection and study of weedy rice diversity available in Chhattisgarh	2013-2015
5.	Pilot study on comparison of with and without dhaincha (Sesbania aculeata) for weed suppression ability and productivity in transplanted rice	2013-2015
6.	Pilot project on rodent control and zoonotic disease management in Chhattisgarh state	2014-2016
7.	Bio-efficacy evaluation of new insecticide molecule "Lancer gold" (Acephate 50% + Imidachloprid 1.8% SP) against insect pests of Rice, (*Oryza sativa* L.)	2014-2015
8.	Evaluation of new insecticide molecule "UPI 1810" against insect pests of Rice, (*Oryza sativa* L.)	2014-2015

5.1.2 During first IRC, three project themes had been prioritized at NIBSM are

1. Loss assessment methodology of biotic stress in agriculture
2. Nutrition and biotic stress management in agriculture and
3. Policy support research in agricultural bio-security and bio-safety

The research projects were formulated and ongoing projects were categorized on the basis of project themes. They had been implemented till 3rd IRC, held in July 2017 as described under

A. Institute funded projects

Project code	Project Title	Project Duration
Programme 1: Loss assessment methodology of biotic stress in agriculture		
1.1	Estimating the crop losses due to various biotic stresses in Rice crop (*Oryza sativa* L.)	2015-2018
1.2	On-farm evaluation, assessment of biotic stress management technologies for adoption and impact	2014-2017
1.3	Epidemiology and economic loss assessment of hemorrhagic septicaemia (HS) in cattle and buffaloes	2015-2018
Programme 2: Nutrition and biotic stress management in agriculture		
2.1	Studies on biotic stress under crop nutrition regimes in rice-wheat cropping system	2014-2017
2.2	Studies on biotic stress under crop management practices in rice-wheat cropping system	2013-2016
2.3	Unravelling plant-endophytes in legume crops for enhanced crop nutrition and biotic stress management	2015-2018
2.4	Vector-borne zoonotic infections -ecological and serological studies	2015-2018
2.5	Studies on immune responses of Indian major carps to biotic stresses in integrated farming system	2015-2018
2.6	Studies on microbes associated with reproductive biotic stress diseases in bovine	2015-2018
2.7	Characterization of viruses and virus-like-organisms affecting economically important crop plants	2016-2019
2.8	Incidence and management of the pink stem borer, *Sesamia inferens* (Walker) on wheat under different agronomic practices	2016-2018
2.9	Developing and testing the effectiveness of user friendly educational knowledge tools on biotic stress management -An Experimental study	2016-2019
Programme 3: Policy support research in agricultural bio-security and bio-safety		

B. Externally Funded Projects

Project code	Project Title
EF001	Translation centre for molecular epidemiology of *Listeria monocytogenes*
EF002	Bio-efficacy evaluation of "Lancer gold" (Acephate 50% + Imidachloprid 1.8% sp) against insect pests of rice, (*Oryza sativa* L.)
EF003	Evaluation of bio-efficacy of new insecticide molecule "UPI 1810" against insect pests of Rice, (*Oryza sativa* L.)
EF004	Evaluation of bio-efficacy of pretilachlor+pyrazosulfuron (UPH 814) in direct seeded rice and follow-up study in succeeding crop.
EF005	All India Co-ordinated Research Project on nematodes in cropping systems
EF006	Socio-economic upliftment of tribal farmers through biotic stress management strategies in rice fallow pulse cropping system- A integrated farming approach

5.1.3 Later, for proper management of research programmes, and till various schools becomes active in functioning, four research programmes (divided into sub-programmes) were formulated in the 3rd IRC meeting (11-12 July 2017) considering the thrust areas and the research mandate of the Institute.

Programme	Programme Title	Sub-programme
1.	Pest and pathogen genetic resources (PPGR) and their management	1.1 Collection, Cataloguing and Characterization 1.2 Screening 1.3 Differentials (development/procurement)
2.	Molecular biology of biotic stress reaction	2.1 Host pathogen interactions 2.2 Molecular markers 2.3 Molecular approaches to understand gene functions and stress induced promoters
3.	Genetic and Genomic resources for stress tolerance	3.1 Germplasm screening for mapping biotic stress tolerance 3.2 Interspecific diversity and Alien introgressions
4.	Strategic and adaptive research in biotic stress management	4.1 Allelopathy and nano-biosensors 4.2 Management strategies for addressing Biotic stresses 4.3 Entomological aspects including pheromones/ kairomones

Programme	Programme Title	Project Code	Project Name
1.	Pest and pathogen genetic resources (PPGR) and their management	1.1	Characterization of viruses and virus-like-organisms affecting economically important crop plants
		1.2	Isolation and characterization of pathogens causing various diseases in animals and fishes
2.	Molecular biology of biotic stress reaction	2.1	Exploring endophytes in legume crops (Pigeon pea and *Lathyrus*) for enhanced nutrition and disease tolerance
		2.2	Identification of biotic stress induced promoters from resistance source plants
		2.3	Development of super donors in rice carrying tolerance to multiple stresses (Bactrial leaf blight, Brown plant hopper and Blast)
3.	Genetic and Genomic resources for stress tolerance	3.1	Genepool profiling in crop plants for tolerance to biotic stresses
4.	Strategic and adaptive research in biotic stress management	4.1	Development of methodologies for estimating the crop losses due to different biotic stresses in Rice crop (*Oryza sativa* L.)
		4.2	Bio-ecology and management of the pink stem borer in wheat
		4.3	Developing and testing the effectiveness of user friendly educational knowledge tools on biotic stress management in Rice and *Lathyrus*
		4.4	Isolation and evaluation of native bio-control agents for the management of lepidopteran pests

5.2 Research Highlights

Research theme: Analytical and Weed Science

5.2.1 On-farm evaluation, assessment of biotic stress management technologies for adoption and impact

(Anil Dixit, V. K. Choudhary, P. Mooventhan)

A ready mix formulation, Sulfosulfuron 75% + Metsulfuron methyl 5% WG, formulation was demonstrated and the chemistry had significantly increased the growth and yield attributing characters of wheat, resulted in higher grain yield. The formulation had the weed control efficiency of 78-88%, which curtailed competition among weed and wheat plants. Application of this formulation provided yield increment of 56.4% over the hand weeding practice followed by farmers. Pretilachlor (6%) + Pyrazosulfuron (0.15%) GR (600+15 g/ha) and weedy check were tested in farmers' field along with farmers practice at Dhamtari, Bilaspur and Raipur districts of Chhattisgarh. Pretilachlor 6% + Pyrazosulfuron 0.15% was applied 5-7 days after transplanting for evaluating this molecule at farmers' field. The study sites were predominantly dominated with *Cyperus rotundus, C. difformis, Echinochloa colona, E. crusgalli, Cynadon dactylon, Ischaemom rogusum, Commelina* sp., *Amaranthus* sp., *Alternenthra sessilis, Monochoria* sp., *Marsilia quadrifolia* and *Ludwigia parviflora.* It was recorded that weed control efficiency was about 80-91% and there was yield improvement of 40-50%, irrespective of locations and varieties.

Farmer's Feedback: Farmer's reaction was positive towards the technology assessed. They are easily adopted the technology due to effective control of weeds by using Pretilachlor 6% + Pyrazosulfuron 0.15% GR on their field. Highest average net returns (Rs 58,650/ha) recorded with the application of Pretilachlor 6% + Pyrazosulfuron 0.15% GR.

5.2.2 Studies on biotic stresses under crop management practices in rice-wheat cropping system with reference to weeds

(V.K. Choudhary, Anil Dixit)

Weed suppression ability and productivity on transplanted rice: a comparison with and without dhaincha *(Sesbania aculeata)*

During *kharif*, rice crop was mainly dominated with broad-leaved weeds like *Marsilea quadrifolia, Ludwigia prostrate, Alternanthera sessilis, Alternanthera philoxeroides, Caesulia axillaris, Cyanotis axillaries, Eclipta alba, Commelina benghalensis, Tridex procumbens,* while major grasses were *Echinochloa colona, E.*

crusgalli, Digitaria sanguinalis, Dactyloctenium aegyptium, Paspalum distichum and *Cyperus difformis, C.iria,* and *Eriocaulon sieboldianum* were important sedges. Incorporation of *dhaincha* before transplanting of rice recorded 57% reduction in weed density over without *dhaincha*. Reduction in density of grasses, broad leaved weeds and sedges were 56, 60 and 52% respectively, with 37% reduction of weed dry biomass was recorded with *dhaincha* over without *dhaincha*. *Dhaincha* plots had 13.8% higher panicles/m^2, 2.7% longer and 7.4% heavier panicles, 14.9% more filled grains and 21.1% lesser chaffy grains over without *dhaincha* plots. These led to 16.4% increment in grain yield and 5% of straw yield over without *dhaincha*. The panicle/m^2 and grain yield had followed positive linear relationship without *dhaincha* ($r=0.93$) and with *dhaincha* (r=0.89).

- **Comparative performance of recommended rice varieties for weed suppression ability**

Ten most popular rice varieties (5 short and 5 tall statures) were evaluated for their weed competitive ability. It was found that the total weed density was not much influenced by varieties. However, different categories of weeds were significantly influenced by varieties. The density of grasses was higher with tall varieties and ranged from 10-10.8/m^2, whereas, Swarna recorded the density of 6.8 grasses/m^2 followed by Mahamaya and MTU 1010 (7.5 grasses/m^2). The number of broadleaved weeds was higher with short stature varieties and highest with PKV HMT and Mahamaya (13.8/m^2), whereas, tall stature varieties had fewer broad-leaved weeds. The average relative density of broad leaved weeds was 40.3% (33.6 to 45.1%), 30.5% sedges (24.5-33.6%) and 29.2% grasses (24.5-33.6%). The SPAD value was highest with Swarna (43.8%), whereas, the solar radiation interceptions were more with tall stature varieties (55.8-57.8%) at middle and at bottom of the crop canopy (83.8-84.5%), whereas, the short stature variety recorded only 35.9-45.5% at middle and 65-75.7% at bottom of the crop canopy. Among the tested varieties the yield of tall stature varieties had recorded grain yield of 3.37-3.68 t/ha, whereas, short stature varieties ranged from 3.31-6.73 t/ha. The lowest grain yield was obtained in PKV HMT. Weed suppression ability on grasses with respect to short stature varieties was recorded as 29.2% (with var. Dubraj), whereas, tall stature varieties had only 4.2%. In contrast to grasses, the suppression ability on broad leaved weeds had 16.7% with tall stature varieties (over var. Mahamaya) and only 4% suppression with short stature varieties.

- **Effect of integrated weed management on productivity and weed dynamics in rice**

At 45 days after transplanting (DAT), the relative density of grasses, broad leaved weeds and sedges were 46, 44.1 and 9.9%, respectively and at 75 DAT, relative density changed to 31.9, 65.7 and 2.3%, respectively. The highest weed control

efficiency (WCE) was recorded with three hand weedings at 20, 40 and 60 DAT (89.4%) followed by (*fb*) two hand weeding at 20 and 40 DAT (85.9%), bispyribac sodium 10 SC *fb* one hand weeding at 40 DAT (85.2%), pyrazosulfuron-ethyl 10 WP *fb* fenoxaprop-p-ethyl 9.3 EC (81.3%). Among the various weed control treatments it was recorded that weed density and weed dry matter were considerably lower with addition of one hand weeding along with the applied herbicides. However, among applied herbicides WCE followed the trend of highest to lowest as pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR>pyrazosulfuron-ethyl 10 WP *fb* bispyribac sodium 10 SC >pyrazosulfuron-ethyl 10 WP *fb*fenoxaprop-p-ethyl 9.3 EC >pendimethalin30 EC*fb*bispyribac sodium 10 SC >pretilachlor 50 EC *fb*bispyribac sodium 10SC >bispyribac 10SC >penoxsulam 24% SC>pyrazosulfuron-ethyl 10 WP >pendimethalin 30 EC >metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP >pretilachlor 50 EC >2, 4-D 38% EC. The highest grain yield was recorded with three hand weeding (7.34 t/ha) followed by two hand weeding (7.13 t/ha) and was statistically comparable to bispyribac sodium10 SC *fb* one hand weeding at 40 DAT (7.0 t/ha) and pyrazosulfuron-ethyl 10 WP *fb* fenoxaprop-p-ethyl 9.3 EC (6.94 t/ha). However, the lowest yield was recorded under control (3.63 t/ha). From these experiments, bispyribac sodium10 SC *fb* one hand weeding at 40 DAT was found to be recommended for both weed management and to obtain higher yield.

- **Bio-efficacy and selectivity of different post-emergence herbicides against weed flora in rice**

Fenoxaprop-p-ethyl 9.3 EC alone or in combination with any other molecules are equally effective against grasses. Similarly, pendimethalin 30 EC followed by (*fb*) bispyribac sodium 10 EC and pyrazosulfuron-ethyl 10 WP *fb* bispyribac sodium10 SC along with ready mix application of pretilachlor 6% + pyrazosulfuron 0.15% GR had also suppressed the grasses. Bispyribac sodium 10 SC showed effective against *Echinocloa* sp. However, pyrazosulfuron-ethyl 10 WP was poor against most of the grasses. Among the tested post-emergence herbicides, most of them were effective against the broad leaved weeds except fenoxaprop-p-ethyl 9.3 EC. However, it was noticed that tank mix application of pretilachlor 50 EC and pyrazosulfuron-ethyl 10 WP was comparatively less effective than the ready mix of pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR. Therefore, it can be recommended that pyrazosulfuron-ethyl suppresses broad leaved weeds and sedges, pendimethalin 30 EC suppresses the emergence of grasses, whereas, fenoxaprop-p-ethyl 9.3 EC was effective on controlling grasses. However, ready mix application of pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR had suppressed the wide range of weeds and also showed phytotoxic effect on the crop. At 45 DAT, the highest WCE recorded with two hand weeding at 20 and 40 DAT (93.9%), followed by pyrazosulfuron-ethyl 10 WP *fb*

bispyribac sodium 10 SC (80.3%) and pendimethalin 30 EC *fb* bispyribac sodium 10 SC (78.7%), ready mix of pretilachlor 6% + pyrazosulfuron 0.15% GR (75.5%) and bispyribac sodium 10 SC (72.4%) over the control. However, the efficacy of the molecules was further improved at 75 DAT. The grain yield was recorded highest with two hand weeding at 20 and 40 DAT (7.45 t/ha) followed by pyrazosulfuron-ethyl 10 WP *fb* bispyribac sodium 10 SC, pendimethalin 30 EC *fb* bispyribac sodium 10 SC and ready mix application of pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR over the control (3.62 t/ha). The grain yield had positive correlation with filled grains (r=0.93) and weed control efficiency (r= 0.85).

- **Evaluation of bio-efficacy and selectivity of different herbicides on direct seeded rice**

Scarcity of water and labour compels to shift from transplanting to direct seeded rice (DSR). Weeds are major biotic constraints in DSR, because of absence of establishment of anaerobic condition. Rice and weeds emerge together and compete for various resources available. The performance of early-post or post-emergence herbicides (bispyribac sodium 10 SC 25 g a.i/ha, pretilaclor 6% + pyrazosulfuron 0.15% GR, pyrazosulfuron-ethyl 10 WP 15 g ai/ha + bispyribac sodium 10 SC 25 g ai/ha, fenoxaprop-p-ethyl 9.3 EC and 2, 4-D 38 EC) and their efficacy with one hand weeding at 40 DAS in direct seeded rice were tested. All tested herbicides significantly reduced the weed density and dry matter. Two hand weedings at 15 and 30 DAS recorded WCE by 88, 82.1 and 80.7% at 45 DAS, 75 DAS and at harvest, respectively. Among herbicides, fenoxaprop-p-ethyl 9.3 EC was effective on suppressing grasses, pretilaclor 6% + pyrazosulfuron-ethyl 0.15% GR, pyrazosulfuron-ethyl 10 WP *fb* bispribac sodium 10 SC, bispyribac sodium 10 SC considerably reduced the grassy weeds. However, bispyribac sodium 10 SC was less effective against *Dactyloctenium aegyptium* and *Digitaria sanguinalis*. Among the tested herbicides, pretilaclor 6% + pyrazosulfuron 0.15% GR, pyrazosulfuron-ethyl 10 WP *fb* bispribac sodium 10 SC, bispyribac sodium 10 SC and 2,4-D 38 EC were found effective against broad-leaved weeds. Two hand weeding followed by pretilaclor 6% + pyrazosulfuron 0.15% GR, pyrazosulfuron-ethyl 10 WP + bispribac sodium 10 SC followed by one hand weeding at 40 DAS were the best possible combination of treatments to control weeds. Two hand weeded plots harvested with grain yield of 4.76 t/ha, which was 1.2 times higher than control, followed by bispyribac sodium 10 SC *fb* hand weeding at 40 DAS (4.45 t/ha), pyrazosulfuron-ethyl 10 WP *fb* bispyrbac sodium 10 SC (4.38 t/ha), and pretilaclor 6% + pyrazosulfuron 0.15% GR (4.13 t/ha). Sequential application of herbicide (early-post or post-emergence) with one hand weeding provided better weed control than the single application of herbicides in direct seeded rice.

- **Effect of herbicides on weed management in wheat in rice-wheat cropping system**

Better efficiency, less time requirement and low cost involvements are major advantages of chemical weed management in wheat. Manual weeding may cause mechanical damage to the crop and also escape of similar morpho-type weeds. Broadleaved weeds were major invaded weeds (72%) in wheat followed by grasses (28%). As per survey, 2, 4-D was found less effective against *Anagallis arvensis*, *Medicago denticulata* and grasses. Thus, various herbicide chemicals were tested alone or in combination to know their efficacy. It was found that WCE was the highest with three hand weeding at 20, 40 and 60 DAS (96%), which was considerably equal to 2 hand weeding at 20 and 40 DAS (92%) and Clodinofop-propargyl 15% + Metsulfuron-methyl 1% (85.9%). Tank mix application of 2,4-D and fenoxaprop considerably lowered the number of tillers/hill, this was mainly due to plants had experienced yellowing and stunting during this period. It took about 10-15 days to get the plants recovered. This period was most crucial to produce tillers. Tillers/hill had positive correlation with grain yield (r=0.91) with linear relationship. Application of clodinatop + metsulfuron gave the wide spectrum weed control. Weed control efficiency and grain yield had followed the positive correlation with r=0.94.

- **Row spacing and weed management practices on weed control efficiency and productivity in transplanted rice**

Swarna variety has 4.7% more grain yield than variety mahamaya when it was sown with two row spacing (15 and 20 cm) and different weed management intensities. Between row spacing, narrow row spacing had 10% more grain yield over wider row spacing. Among the weed management intensity, moderately weeded plots had increased the grain yield by 83.6% followed by 75.1% in partially weeded plots over control (4.0 t/ha). Mahamaya variety of rice has suppressed 5.8% of weed dry biomass, whereas, narrow spacing had suppressed by 11% and moderately weeded plots had controlled by 78.8% weed dry biomass followed by partially weeded plots (68.1%) over the control.

- **Study on the performance of best performing herbicides against weed flora in transplanted rice**

Application of pyrazosulfuron 20 g/ha within 3 days of transplanting followed by the application of bispyribac 25 g/ha and penoxsulam 22.5 g/ha at 17-20 days after transplanting had suppressed the weeds up to 80-85% which was statistically comparable to 2 hand weeding at 30 and 60 days after transplanting. The phytotonic effect of pretilachlor + pyrazosulfuron at 615 g/ha on plants might be responsible to suppress the weeds only in presence of thin water layer. The highest grain yield was

recorded with two hand weeding (7.2 t/ha), followed by pyrazosulfuron *fb* bispyribac and pyrazosulfuron *fb* pinoxsulam and the lowest with control (3.5 t/ha).

5.2.3 Studies on biotic stresses under nutrient management practices in rice-wheat cropping system with reference to weeds

(V. K. Choudhary, Anil Dixit)

- **Productivity and weed spectrum influenced by nitrogen regimes in rice-wheat cropping system**

Rice crop was supplied with different nitrogen regimes, N_0-$_{125\%,}$ recommended dose of nitrogen (RDN) with the increment of 25 kg N/ha. Omission of N significantly increased the weed density and weed diversity, whereas it was lowest with $N_{125\%}$. Plants under N_{125} and $N_{100\%}$ were greener and darker with higher SPAD value (>40), this promoted the lavish growth of plant and improved the solar radiation interception. The weed species richness had followed the trend with highest to lowest with N_0>N_{25}>N_{50}>N_{75}>N_{100}>N_{125}. In contrary to these, the dominance of weeds was highest with $N_{125\%}$ and lowest with N_0. At 45 DAT, the relative density of broad-leaved weeds ranged from 48.2-62.4%, grasses (8.4-30.1%) and sedges (13.4-43.4%) irrespective of N regimes. However, the density of broad leaved weeds increased and density of grasses and sedges gradually decreased as the crop advanced. The weed dry weight was decreased with increase in N regimes. The highest rice grain yield was recorded with $N_{125\%}$ (6.43-6.48 t/ha) followed by $N_{100\%}$ (6.10-6.23 t/ha), whereas, the lowest under N_0 (2.98-3.60 t/ha). Grain yield had positive correlation with filled grain/panicle (r=0.99), negative correlation with chaffy grains/panicle (r=0.95). However, grain yield had strong positive relationship with solar radiation interception (r=0.99) and SPAD (r=0.98). The density of grasses, broad-leaved weeds and sedges were comparatively lower with higher N regimes and it considerably increase with decrease in N regimes.

Wheat crop was also supplied with different nitrogen regimes N_0-$N_{125\%}$ of RDN with the increment of 25 kg N/ha. The weed growth and development was similar to the trend of rice. Due to initial poor canopy coverage maximum weed density was estimated in N_0. The SPAD value was highest with $N_{125\%}$ followed by $N_{100\%}$ and lowest with N_0. The growth and yield attributes improved with increase in N regimes. The grain yield was harvested higher with N_{125} (2.50-3.30 t/ha) which was statistically comparable to N_{100} (2.43-3.23 t/ha), whereas, the lowest grain yield was harvested with N_0 (1.35-1.00 t/ha). It was noticed that the application of 25% additional nitrogen than the RDN has shown some additional yield but was statistically comparable. The grain yield had strong negative correlation with weed density and weed dry weight (r=0.99).

- **Productivity and weed spectrum influenced with combinations of primary nutrients in rice-wheat cropping system**

Low weed density was recorded in rice when it was applied with recommended dose of fertilizer (100:60:40 kg N, P_2O_5 and K_2O/ha) which was due to restricted the solar radiation transmission to the ground, resulting better growth and development of rice plant. Interestingly, the highest total weed density was noticed with $N_0P_{60}K_0$, followed by $N_0P_0K_0$ and $N_0P_0K_{40}$. Although the group of weed density greatly varied and it was measured that grassy weed density was higher on N applied plots, whereas, broadleaved weeds were more with P applied plots and lowest with $N_{100}P_{60}K_{40}$, while sedges did not show any trends. Total weed density was considerably lower in recommended doses of N, P_2O_5 and K_2O, over the control plots. Weed dry weight and diversity followed the trend of highest to lowest from control plots ($N_0P_0K_0$)>K>P>KP>N>NK>NP>NPK. The highest grain yield was harvested with $N_{100}P_{60}K_{40}$ (6.84 t/ha) followed by $N_{100}P_{60}K_0$ (6.40 t/ha), whereas, the lowest yield noticed with $N_0P_0K_0$ (4.43 t/ha).

In wheat, it was noticed that all the growth and yield attributes were considerably better with application of full dose of NPK. However, omission of each nutrient had drastically reduced the growth performance of wheat. It was also observed that N had the prominent role in determining growth and yield attributes, followed by P, whereas K had the least effect. The highest seed yield was recorded with $N_{100}P_{60}K_{40}$ (2.97 t/ha), followed by $N_{100}P_{60}K_0$and $N_{100}P_0K_0$ (2.4 t/ha). However, the lowest seed yield was harvested in $N_0P_0K_0$ (0.8 t/ha).

- **Sustainable weed management in direct seeded rice**

Weeds were major problem in direct seeded rice, use of single weed control option reduced the weed problems considerably. However, inclusion of other options further augments the weed control efficiency. *Sesbania* co-culture suppressed the weed density to the tune of 54% and weed dry weight by 42%. Seed priming with $CaCl_2$ improved the early germination and establishment of seedlings resulted reduced dry biomass of grasses by 19%, broadleaved weeds by 21.6% and sedges by 22.2% followed by bio-priming (*Pseudomonas fluorescence*). Weed dry biomass reduction on moderately weeded plots (two hand weeding at 20 and 40 DAS) had 94.6% grasses, 91% broadleaved and 94.3% sedges followed by partially weeded plots (bispyribac sodium at 25 g/ha; 76, 77.8 and 90%, respectively) over control. Seeds sown at 15 cm had suppressed by 45% reduction in grasses, 45.3% broadleaved weeds, and 35.6% sedges over wider row spaced crop (25 cm). The plots sown with 100 kg/ha had reduced weed dry biomass by 41.9, 52.8 and 40.7% of grasses, broadleaved and sedges, respectively over 40 kg/ha. However, 60 kg/ha was comparable to 100 kg/ha. The highest weed control efficiency was recorded with three hand weeding (20, 40 and 60 DAS) followed

by two hand weeding (20 and 40 DAS) over control. Among the herbicides, pendimethalin *fb* penoxsulam, and pendimethalin *fb* bispyribac sodium was the next best set of treatment in dry direct seeded rice. Hand weeded plots with wider row (25 cm) plots has less efficient because of concurrent growth of weeds and remains with crop till harvest. Un-weeded plots were the worst affected by weeds, and maximum crop loss was noticed with respect to various experiments

5.2.4 Pilot study on collection and study of weedy rice diversity available in Chhattisgarh

(V. K. Choudhary, Anil Dixit)

The weedy rice was collected from Raipur, Raigarh, Mahasamund, Janjgir-Champa and Baloda Bazar district of Chhattisgarh. Various weedy rice accessions were collected from above places and as per the distinct characters, 15 different group of weedy rice were identified. Under normal condition, only two land races could germinate that took more than seven days, and were more close to Mahamaya type. Imposition of hot water treatment stimulated eight land races to germinate. These were grown on pots. The preliminary findings warn the potential threat of weedy rice in summer rice too. Increase in water temperature may stimulate the seeds of weedy rice available in seed bank to germinate and get them established, which may escape of early weed management and flowering and maturity may synchronise with main crop and potential chance of seed mixture and further dissemination of seeds in larger area due to seed mixture.

5.2.5 Pilot study on comparison of with and without dhaincha (Sesbania aculeata) for weed suppression ability and productivity in transplanted rice

(V. K. Choudhary, Anil Dixit)

Findings depicted that rice plants took 30% lesser time to get established in main field (5.25 days) coupled with a savings of 27.5% of fertilizer over without *Sesbania* incorporated plots. Similarly, water requirement was reduced by 40.3% in *Sesbania* incorporated plots. The rice plants in *Sesbania* incorporated plots were 3% taller, 30.3% more tillers, 15.1% higher panicles (panicles were 4.7% longer, 8.2% heavier), 14.2% more filled grains, and 19.8% lower chaffy grains than the without *Sesbania* incorporated plots. This led to enhance the grain yield of rice (7521.1 kg/ha), which was 20.3% higher over without *Sesbania*. Similarly, straw yield (8647.2 kg/ha) was increased by 7.1% than without *Sesbania* plots.

It was also noticed that *Sesbania* incorporated rice plots had suppressed 58.5% of grasses, 59.1% of broadleaved weeds and 44.9% of sedges. The total weed suppression was noticed with 58.7%. The reduction in weed density significantly lowered the weed dry

matter accumulation, however, the dry matter suppression was lesser than that of weed density and measured as 38.3% less weed dry matter over without *Sesbania* incorporation.

Research Theme: Agricultural Entomology

5.2.6 Bio-efficacy evaluation of new insecticide molecule "Lancer gold" (Acephate 50% + Imidachloprid 1.8% SP) against insect pests of Rice, (*Oryza sativa* L.)

(Mallikarjuna, J., V. K. Choudhary, Anil Dixit)

Under this project, 8 treatments of different doses of Lancer gold were tested for their efficacy against insect pests of rice for two consecutive seasons during kharif and rabi seasons of 2014-15 under field conditions. Acephate 50% + Imidacloprid 1.8% SP @ 600 + 21.6 g a.i./ha was found best treatment with significantly less damage of yellow stemborer, leaf folder, BPH and GLH compared to other treatments during both seasons. Highest yield (50.14 Q/ha and 51.02 Q/ha for Kharif 2014 and Rabi 2014-15, respectively) was also recorded above treatment. No phytotoxicity symptoms such as leaf tips/ leaf surface injury, wilting, vein clearing, necrosis, epinasty and hyponasty were observed on Rice crop due to the application of any of the treatments. All the tested doses of Lancer gold were found safer to natural enemies.

5.2.7 Evaluation of new insecticide molecule "UPI 1810" against insect pests of Rice, (*Oryza sativa* L.)

(Mallikarjuna, J., V. K. Choudhary, Anil Dixit)

Under this project, 8 treatments of different doses of UPI 1810 were tested for their efficacy against insect pests of rice for two consecutive seasons during kharif and rabi seasons of 2014-15 under field conditions. UPI 1810 @ 75 + 75 g a.i./ha was found best treatment with significantly less damage of yellow stem borer, leaf folder, BPH and GLH compared to other treatments during both seasons. Highest yield (52.04 Q/ha and 54.12 Q/ha for Kharif 2014 and Rabi 2014-15, respectively) was also recorded above treatment. No phytotoxicity symptoms such as leaf tips/ leaf surface injury, wilting, vein clearing, necrosis, epinasty and hyponasty were observed on Rice crop due to the application of any of the treatments. All the doses of UPI 1810 tested were found safer to natural enemies.

5.2.8 Development of methodologies for estimating the crop losses due to various biotic stresses in rice (*Oryza sativa* L.)

(Mallikarjuna, J., S. K. Jain, K. C. Sharma)

In this project, an attempt has been made to estimate the yield losses due to various biotic stresses mainly insect pests, diseases and weeds in rice crop under field conditions. As a part of the project, we formulated five different treatments *viz*., T1-Insect and disease

free; T2-Insect and weed free; T3-Disease and weed free; T4-Insect, disease and weed free; T5-Untreated control. Observations on per cent incidence of various biotic stresses including yield were taken in all the treatments for three consecutive seasons. Development of a multiple regression model encompassing various biotic stresses as independent variables and yield as dependent variable will be developed and process is underway. We have collected previous 50-60 years data of AICRIP to study the changing insect pest and disease scenarios in different agro-climatic zones of India. It was found that number of insect pests attacking rice crop has been increased to 15 in 2015 from 3 in 1965. Some of the pests like leaf folder, brown plant-hopper, gall midge have attained major pest status over the years. Yellow stem borer was the major monophagous pest till date in all the rice ecosystems. Among the diseases, sheath blight, leaf blast and bacterial blight was the major in different agro climatic zones of India. Efforts are underway to estimate real time yield losses due to various biotic stresses in rice using remote sensing/GIS approach.

5.2.9 All India Coordinated Research project on Nematodes in cropping systems

(Mallikarjuna, J.)

Since inception of the project, 11 districts of Chhattisgarh state were surveyed for studying the diversity and distribution mapping of plant parasitic nematodes infesting different crops of the state. Vegetable crops in and around Raipur and Durg districts were found heavily infested with root knot nematode. Paddy crop in Raipur, Bilaspur and Dhamthari districts found infested with root knot nematode. I have reported the incidence of *Meloidogyne graminicola* infesting rice for the first time from Chhattisgarh state. As part of technical programme, various germplasm lines of rice and different pulses were evaluated for their resistance against root knot nematode. Mass rearing of *Corcyra cephalonica* is initiated to study the diversity of entomopathogenic nematodes of state. Isolation and identification of native bio control agents for the effective management of plant parasitic nematode has been stared. Bioassay of different isolates isolated from the rhizospheric soils different crops against plant parasitic nematodes is in progress.

5.2.10 Bio-ecology and management of the pink stem borer in wheat

(K. C. Sharma, Mallikarjuna, J.,Yogesh Yele)

- **Survey to record the status of wheat pink stem borer in various districts of Chhattisgarh**

Surveys were conducted in six districts *viz*., Baloda Bazar (villages, Khorsi, Pallari Kodwa, Kadiakar, Limahi and Bhatapara) Bilaspur (Hardikalan and Dhuma), Janjgir Champa (Pakaria, Kuthur and Mukta Baradwar), Raigarh (Thakurpali, Dhunsekalan, Pandripani and Tarapur), Mahasamund (Memra, Karrabhavana and Samhar) and Raipur

(Pathri) during rabi 2016-17 to record infestation of pink stem borer in wheat. Low to medium infestation of pink stem borer has been recorded in the districts surveyed.

- **Reaction of wheat germplasm/cultivar to pink stem-borer**

With a view to find out tolerance/resistance in wheat germplasm against pink stem borer twenty wheat varieties released for Central India and 46 germplasm lines of wheat were screened against pink stem borer (PSB), *Sesamia inferens* for their relative tolerance/resistance during *rabi* 2017. The pink stem borer infestation ranged from 3.05 (RWP 2015-15) to 14.15 (DBW71) per cent among the germplasm lines while among the varieties the pink stem borer infestation varied from 0.0 (WH147) to 17.29 (HD2160) per cent. Wheat variety 'WH147' and germplasm RWP 2015-15 were found to be resistant against pink stem borer.

- **Field evaluation of silicon against wheat pink stem-borer**

A field experiment was carried out during *rabi* 2016 to evaluate the effect of different doses of potassium (K) and silicon (Si) on the incidence and damage levels of PSB. The experiment was laid down in randomised block design with 13 treatments which were replicated thrice. A wheat cultivar, 'GW 273' was used for this experiment. The sources of Si and K were diatomaceous earth for soil application, silicic acid for foliar Si and potassium chloride for K. The treatment details as follows: T_1-K_{30} + foliar Si (0 ml/l); T_2-K_{30} + foliar Si (2 ml/l); T_3-K_{30} + foliar Si (4 ml/l); T_4-K_{30} + Soil Si (0 kg/ha); T_5-K_{30} + soil Si (150 kg/ha); T_6-K_{30} + soil Si (300 kg/ha); T_7-K_{60} + foliar Si (0 ml/l); T_8-K_{60} + foliar Si (2 ml/l); T_9-K_{60} + foliar Si (4 ml/l); T_{10}-K_{60} + foil Si (0 kg/ha); T_{11}-K_{60}+ soil Si (150 kg/ha); T_{12}-K60 + soil Si (300 kg/ha). Soil Si was applied as basal along with the fertilizers. Foliar silicic acid was applied for three times at an interval of two weeks. The first spray was given on 21 days after sowing. The observations were recorded on per cent white ear (WE) in each treatment. Experimental results revealed that the minimum % WE damage of 14.00 was observed in T9 which was significantly superior over all treatments followed by T_{12} with 20.33 % WE. T_5 and T_{11} treatments were next best treatments with 23.00 and 23.67 % WE, respectively with statistically at par with each other. The maximum % WE damage (42.33) was noticed in T_7 followed by T_1 with 41.67% WE which were statistically at par with each other.

5.2.11 Isolation and evaluation of native bio-control agents for management of lepidopteran pests

R. K. Murali Baskaran, K. C. Sharma, Lata Jain, J. Sridhar)

- **Seasonal and relative abundance of rice stem-borer and leaf-folder in low land rice**

Seasonal abundance of stem-borer and leaf-folder was monitored in low land rice

during *kharif* 2016 at ICAR-National Institute of Biotic Stress Management, Raipur by erecting yellow stem-borer sex pheromone and light traps. Activity and feeding of three species of stem-borer including yellow stem-borer, *Scirpophaga incertulas*, stripped stem-borer, *Chilo suppressalis* and white stem-borer, *Scirpophaga innotata* were noticed, among them, *Sc. incertulas* dominated. First catch of female of yellow stem-borer in light trap appeared during 1st week of August 2016 (31st MSW) which caused 1.1% dead-heart, thereafter reached the first peak during 3rd week of August 2016 (33rd MSW) and second peak during 4th week of August 2016 (35th MSW) which caused the dead heart, respectively of 3.60 and 3.83%. Leaf-folder damage was low throughout the crop period. Relative humidity and rainfall were positively correlated with trap catches while maximum (26.0^{0}C to 29.3^{0}C) and minimum (17.4^{0}C to 25.5^{0}C) temperature were positively correlated to damage caused by two insects.

- **Detection of chemical profile in damaged rice plant and host insects**

Hexane extracts of female and male yellow stem-borer and acetone extracts of yellow stem-bore and leaf-folder damaged plants were subject to GC-MS analysis to detect the chemical profiles. A saturated fatty acid, n-hexadecanoic acid was detected in both male and female yellow stem-borer extracts. In addition, few alkanes like decane, tridecane, tetradecane, octadecane, eicosane, hexatriacontane, tritetracontane and tetratetracontane were detected in the extracts of female yellow stem-borer while β-pinene, α-pinene and caryophyllene were abundant in yellow stem-borer damaged rice plants.

- **Kairomonic activity of extracts of rice yellow stem-borer and its by-products**

Host insects produce characteristic hydrocarbons, fatty acids and proteins which stimulate natural enemies to intensify their search in the near vicinity of the host. Various hexane extracts of yellow stem-borer and its by-products were evaluated during first fortnight of April 2017, in a choice test under *in vivo* to study their kairomonic efficiency in enhancing the foraging activities of *Trichogramma chilonis* and *T. japonicum*. Hexane washed and untreated eggs were used as negative and positive check, respectively. The parasitization rate of *T. chilonis* was enhanced from naught to 12.34%, 6.80 to 65.44% and 11.66 to 87.84% on 3rd, 5th and 7th day after exposure to parasitoids, respectively when eggs were treated with hexane extract of whole body female yellow stem-borer (1000 ppm) while they were naught to 10.94, 11.66 to 77.30% and 15.02 to 95.96% for the same period of exposure in *T. japonicum*.

- **Isolation of native bio-control agents**

Native bio-control agents are efficient in management of lepidopteran pests of crops. Native population of egg parasitoid collected from low land rice of Baronda farm and

Balod district were identified as *Trichogramma japonicum* and *T. chilonis*, respectively. A total of 67 soil samples were collected from various agro and forest eco-systems of Chhattisgarh, Tripura, Meghalaya and Assam for isolation of *Bacillus thuringiensis*.

- **Optimization of time and number of release of Trichogramma spp. for management of rice stem-borer**

Sequential release of egg parasitoid @ 6.25 cc/ha at weekly interval *ie*. three releases of *T. japonicum* on 32nd, 39th and 46th day after transplanting (DAT), followed by three releases of *T. chilonis* on 46th, 53rd and 60th DAT was optimum to manage rice stem-borer, resulting 1.25% dead heart and 1.09% white ear, in contrast to control with 2.29 and 2.25%, respectively.

Research Theme: Plant Pathology

5.2.12 Characterization of viruses and virus-like-organisms affecting economically important crops

(P. N. Sivalingam, K. C. Sharma, Yogesh Yele)

Surveys were conducted to generate the database on viral diseases affecting crop plants of Chhattisgarh.Information on the prevalence of virus and virus-like diseases and vectors were recorded by surveying in the farmer's fields of 22 districts belongs to northern hill, Chhattisgarh plain and Bastar plateau of Chhattisgarh state. No viral disease has been observed in rice, wheat and maize. However in mungbean, urdbean and cowpea were found to be affected with 5-90 % yellow mosaic disease. Vegetable crops such as bhendi (4-100% yellow vein mosaic and 78-100% leaf curl disease), sponge gourd (10-98% leaf crinkle disease), bitter gourd (12-100% leaf crinkle and mosaic disease), pumpkin (50 % yellow vein mosaic), tomato (4-90 % leaf curl), chilli (8-70 % leaf curl), and fruit crop; papaya (20-83 % leaf curl) were found likely to be infected with whitefly transmitted *Begomovirus*. Other viral diseases such as leaf crinkle disease was prevalent in mung bean (5-98%), ring spot disease in papaya (20-97%) and mosaic disease in cucumber (3-5%) were also noticed in this region. Vector population was also recorded and correlated with incidence of viral disease in the field. Incidence of Pigeon pea yellow mosaic disease was recorded 8-10%, caused by Begomovirus for the first time. Little leaf disease in *Ziziphus rotundifoli*a and *Carissa carandas* were also recorded. *Begomovirus* are the most important and causing huge economic losses to the growers in vegetable and pulse crops in Chhattisgarh. The important virus species will be selected for further characterization

5.2.13 Genepool profiling in crop plants for tolerance to biotic stresses

(Sanjay Jain, Anil Dixit, R. K. Murali Baskaran, K. C. Sharma, P. N. Sivalingam, Mallikarjuna, J., Yogesh Yele)

A total of 2038 germplasm of major crops including rice, wheat, millets, pigeonpea,

mung bean, lathyrus, chickpea and brinjal were procured during 2016-17 and 2017-18 for screening against biotic stresses. The millets and teosinte were screened during *kharif* 2017.

Germplasm of major crops procured by NIBSM for screening against biotic stresses

S. No.	Crop	Accessions	Differentials	Wild species	Control	Total	Donor institutes
1.	Rice	008	29	-	01	38	IRRI, Philippines, IIRR, Hyderabad
2.	Chickpea	236	-	-	04	240	NBPGR, New Delhi, ICRISAT, Hyderabad
3.	Millets	706	-	-	-	706	IIMR, Hyderabad
4.	Mung bean	002	-	-	-	002	NIBSM, Raipur
5.	Pearl millet	238	-	23	03	264	ICRISAT, Hyderabad, IGFRI, Jhansi
6.	Brinjal	192	-	-	-	192	NBPGR, New Delhi IARI, New Delhi,
7.	Pigeonpea	146	-	23	04	173	ICRISAT, Hyderabad
8.	Lathyrus	110	-	-	-	110	IGKV, Raipur
9.	Wheat	244	69	-	-	313	IARI-RS, Wellington, Tamil Nadu
Grand Total = 2038							

5.2.14 Identification of biotic stress induced promoters from resistant source plants

(P. N. Sivalingam, Vinay Kumar)

Plant genes associated with defence responses are activated by stress-factors are known to be regulated by promoters or the upstream elements. Promoters induced by abiotic stress factors in plants are fairly well studied compared to biotic stresses. This project has been initiated to identify promoters and regulatory elements involved in defence gene expression due to fungal, bacterial and viral infection in crop plants. The promoter(s)

induced upon infection of pathogen in wheat isogenic lines by *Puccinia triticina*, wild species and resistant rice accessions infection by *Xanthomonas oryzae* pv. *oryzae* in source and wild species of *Vigna* by begomovirus. Nearly 50 wild species of *Vigna* was obtained from IITA, Nigeria and reached to ICAR-NBPGR, New Delhi for quarantine. Obtaining isogenic lines of wheat from IARI regional station, Wellington and IIWBR, regional station, Floridale, Shimla is also in process.

Research Theme: Agricultural Biotechnology

5.2.15 Exploring endophytes in legume crops (pigeon pea and *Lathyrus*) for enhanced nutrition and biotic stress management

(Vinay Kumar, Lata Jain)

Endophytes are the microbes that live inside the plant tissues without causing any apparent harm to the host. These microbial communities are known to play a crucial role in the functioning of plants by influencing their physiology and development. Samples from different plant tissues *viz.,* phyllosphere (leaf, stem, flower and seed) and rhizosphere (root) of pigeonpea var. Asha and Lathyrus var. Mahatiwara and Prateek were collected. The protocol such as isolation of endophytic microbes (bacterial and fungal) from pigeonpea and lathyrus, DNA isolation from bacterial and fungal endophytes were standardized. These endophytes were characterized using morphological such as rod, cocci, coccobacilli, gram starining etc., biochemical parameters *viz.,* oxidase, catalase, indole, methyl red (MR), Voges Proskauer (VP) and citrate, urease and triple sugar iron tests gram staining, nitrate and oxidase activities and molecular parameters *viz.,* rDNA and Internal Transcribed Spacer (ITS). A total of 34 bacterial endophytic microbes were isolated from pigeon pea (20) and Lathyrus (14). The endophytic bacteria identified based on these characters are; *Bacillus* sp., *Klebsiella* sp., *Enterobactor* sp., etc. A total of 72 fungal endophytes were isolated and pure cultured from pigeonpea and Lathyrus. and endophytic fungal species identified are; *Fusarium* sp., *Aspergillus* sp., *etc*. The selected bacterial endophytes were screened for their efficacy against the stem rot causing pathogenic fungi *Scleratium rolfsii,* and *Rhizoctonia solani* showed potential inhibition of pathogen growth. Metagenomic analysis of bacterial endophytes from different tissues of *lathyrus* was done using next generation illumine sequencing approach. This sequence was registered with NCBI with bio project ID PRJNA392219.

In addition to leguminous hosts, the endophytes were also isolated from rice. A total of 32 bacterial endophytes were isolated and characterized using morphological and biochemical attributes namely, Gram staining, oxidase, catalase, indole, methyl red, Vogus Prokeauer and citrate tests. Gram staining of bacteria showed 19 Gram positive and 13 Gram negative bacteria. About 24 isolates revealed oxidase positive test revealed

the presence of enzyme cytochrome oxidase and thus ability of bacteria to use oxygen for energy production. Isolated endophytes were also screened for their potential to produce indole from degradation the amino acid tryptophan. Molecular characterization of bacterial endophytes using PCR amplification of 16s rDNA region showed significant genetic diversity among the microbes isolated from different tissues and varieties of rice. Isolated bacterial endophytes were identified as the *Bacillus species*, *Enterobacter, and Klebsiella* genera. 16S rRNA gene sequences of 32 bacterial endophytes have been submitted and accessioned at NCBI. A total of 68 16s rDNA sequences have been submitted to NCBI. These bacterial endophytes were screened for their efficacy against the stem rot causing pathogenic fungi *Scleratium rolfsii* showed variable inhibition of pathogen growth.

5.2.16 Development of super donors in rice carrying tolerance to multiple stresses (Bacterial leaf blight, Brown plant hopper and Blast)

(Vinay Kumar, P. N. Sivalingam, Sanjay Jain, Mallikarjuna, J.)

The project has been initiated to develop rice line having resistance genes for important biotic stresses namely bactrial leaf blight, brown plant hopper and blast. IRBB lines containing *Xa* gene resistance to the bacterial leaf blight (BLB) disease (*Xanthomonas oryzae*) namely IRBB57, 60, 61, 62, 63, 64, 65 and IR 28 were obtained from International Rice Research Institute (IRRI), Philippines and National Rice Research Institute, Cuttack through material transfer agreement (MTA). These seeds were multiplied in the field. These lines are being maintained in pots along with the Mahamaya, MTU 1010 and IR 64. The presence of BLB resistance genes in the IRBB lines was confirmed using linked molecular markers. Crossing between MTU 1010 and rice line having five genes for BLB resistance and F_1seeds were harvested. These seeds will be further tested for the presence of five BLB resistance genes and will be crossed with BPH and blast resistance lines.

Research Theme: Animal and Fisheries Science

5.2.17 Pilot project on rodent control and zoonotic disease management in Chhattisgarh state

(Mallikarjuna, J., V. K. Choudhary, Anil Dixit, S.B. Barbuddhe, Vinay Kumar, Lata Jain, B.K. Choudhary, Mamta Choudhary)

The project was implemented in two phases starting with trainers training and then through participatory social engineering campaign activities. A planning meeting on the project was organized at NIBSM and the meeting was attended by PC (AINP rodent control), FAO Consultant on rodent control, Directors of Agriculture,

Horticulture, Animal Sciences, Fisheries of Chhattisgarh state and officials and scientists from CGKV, Durg, IGKV Raipur. Capacity enhancement programmes (CEP) of three day duration each were conducted for all Chhattisgarh state officials in three phases regarding Rodent control and zoonotic disease management techniques. As part of project, 4 different village panchayats were identified from Raipur and Dhamthari districts for conducting rodent control campaigns in social engineering/participatory mode. Successful rodent control campaigns were conducted in Baronda, Bodara, Adsena, Pathri, Kapsada villages and results and feedback from farmers was excellent. During the campaigns, live demonstrations were given to stake holders on bait preparation, live burrow counting, bait placement and burrow count post treatment.

5.2.18 Epidemiology and economic loss assessment of hemorrhagic septicaemia (HS) in cattle and buffaloes

(Mamta Choudhary, S.B. Barbuddhe (Till 30 May 2017), B. K. Choudhary and Lata Jain)

The occurrence of diseases is an important factor which influences the productivity and cause significant economic losses predominantly to poor, marginal and landless farmers. The total economic losses due to Haemorrhagic Septicaemia in cattle and buffaloes were estimated to be ₹ 3,43,34,000 during the rainy season of 2015-16. A total of 288 samples comprised of nasal swabs and blood from diseased animals and tracheal swabs, tissue samples taken during necropsy from lungs, heart, liver and kidneys were examined from both natural outbreaks and sporadic cases of haemorrhagic septicaemia in cattle and buffaloes. Overall prevalence of HS in cattle and buffaloes in different districts of Chhattisgarh state was recorded to be 44%, Morbidity rate and mortality rate were recorded to be 13.85% and 7.27% respectively during the year 2015-16. The causative agent of HS was identified as *Pasteurella multocida*, capsular type B. The organism was identified on the basis of species specific PM-PCR. The pathological lesions revealed that the lungs are the primarily affected organ. To evaluate protective efficacy of HS vaccines a total of 450 post vaccination serum samples from cattle and buffaloes from different districts of Chhattisgarh were collected. The protective efficacy of vaccines in the field condition confers protection against Haemorrhagic Septicaemia (HS) for only 8 months. Therefore there is great risk of animals to acquire infection during rest 4 months of the period. Apart from *P. multocida,* we have isolated and characterized a new respiratory pathogen, *L. adecarboxylata* as co-pathogen in case of Bovine Pneumonia. This is the first report of the organism from animal clinical case from India and world as well.

5.2.19 Vector-borne zoonotic infections in Chhattisgarh state: ecological and serological studies

(S. B. Barbuddhe (Till 30 May 2017), Mamta Choudhary, V. K. Choudhary (Till 31st March, 2017), Lata Jain and B. K. Choudhary)

Rodents are important competitors globally with humans for food, particularly through the pre-harvest damage they cause to cereals. Since a number of wild rodent species live close to humans, rodents constitute a vector for pathogens to circulate among wildlife, domestic animals, and humans. A total 334 samples comprising of 227 from bovines, 89 from humans and 18 from rodents were collected and screened for leptospirosis and Q fever. Thirty samples from cattle and 9 samples from humans were positive for leptospirosis while 41samples from bovines were positive for Q fever by PCR. Metagenomic analysis of the ticks revealed higher amount of microflora belonging to family *Coxiellaceae.* Of 32 samples of ticks 9 were positive for *Coxiella* by PCR. Further studies are in progress for detection of *Leptospira* and *Coxiella*. Evaluation of adaption of rodent control measures done in the villages covered under rodent campaign confirmed the farmers are following the demonstrated techniques for rodent management.

5.2.20 Translation Centre for Molecular Epidemiology of *Listeria monocytogenes*

(S. B. Barbbudhe)

A project under Centre of Excellence and Innovation in Biotechnology on "Translational Centre for Molecular Epidemiology of *Listeria monocytogenes"* was sanctioned by DBT, New Delhi for the period 2012-2017, under multi-institutional network mode with ICAR Research Complex for Goa, Old Goa as lead centre and Indian Veterinary Research Institute, Izatnagar, ICAR Research Complex for NEH region, Umian, Shillong and Nagpur Veterinary College, Nagpur as collaborators. This project has been transferred to ICAR-NIBSM, Raipur as PI of the project transferred from ICAR Research Complex for Goa, Old Goa. Later ICAR-NIBSM became a lead centre for this multi-institutional project since 2014. The disease, listeriosis caused by *L. monocytogenes* is saprozoonoses and a serious public health hazard. The pathogen is ubiquitous in nature with possible cycling between animal and human hosts, food and environment. The major achievements during 2014-2017 are described under,

- *Listeria* species have been isolated from novel habitats and atypical sources such as mangrove swamps, estuary, mosquitoes and houseflies (*Musca domestica*) which extended the boundaries of current knowledge for the genus *Listeria*.
- Antigens of *Listeria* were cloned and serological assays are being developed for screening sera samples from humans and animals

- Developed a multiplex PCR based protocol for diagnosis of listeriosis from food and clinical (human and animals).
- Discovered a predominant, stable and widespread epidemic clone of *L. monocytogenes* serotype 4b in the Indian subcontinent. The routes of transmission of this clone ('Ind-4b-dom-pulsotype', ST328, VT20), are geographically unique and distributed over enormous distances in both space and time (published in Nature Group of journal).
- Analyzed a large collection of strains comprising different *Listeria* species that were isolated from different sources (animal, human and environmental), time span (>15 years) and from distinct geographical locations across India. Of the 830 strains studied, 396 were *L. monocytogenes* of which 60% were members of the serotype 4b. Pulsed-field gel electrophoresis (PFGE) pattern revealed singular distinct patterns for 68% of serotype 4b strains.
- Sequenced and analyzed the whole genomes of subset of PFGE-clonal serotype 4b strains. Majority of the strains were observed to be multi-locus sequence type 328, multi-locus-virulence sequence type 20 and genomically closely related to epidemic clone F2365. These serotype 4b strains were highly clonal which could only be differentiated only at nucleotide level and in some cases type and location of the mobile genetic elements.
- Data from our studies have also revealed the presence of new species of *Listeria* that is probably endogenous to the Indian subcontinent. The strains have been isolated from mangrove swamps of Goa. These strains have 16S rDNA sequences that are *Listeria*-specific but exhibit unusual fermentation properties. The data has been presented at XVIII International Symposium on Problems of Listeriosis (ISOPOL XVIII) held in Goa during 19-22 September, 2013. The strain has been deposited at VTCC under the accession nos. VTCCBAA863; VTCCBAA864.
- An indirect ELISA employing immunodominant non-cross-reactive synthetic peptides (LLO-1 and LLO-2) of Listeriolysin O (LLO) has been developed. A latex agglutination test employing peptides as antigen has been developed.
- Strains were also subjected to analysis for biofilm formation that are commonly used in food processing plants.
- Repository of *Listeria* strains (Indian *Listeria* Culture Collection)
- Established a well characterized repository of the strains of *Listeria* (>1000) isolated from almost 16 states of India. Archival of all the strains is under progress. Part of the collection has been submitted to National Veterinary Type Culture Facility, NRC Equines, Hisar. The VTCC has communicated Accession

numbers. The repository is based on the concept of archival of strains of bacterial pathogens through electronic databases. The cultures have been given unique ID under "Indian *Listeria* Culture Collection, ILCC" and the characteristics have been uploaded on Indian *Listeria* Culture database.

5.2.21 Studies on microbes associated with reproductive biotic stresses of bovine

(Lata Jain, Vinay Kumar, S. B. Barbuddhe (Till 30 May 2017), and Mamta Choudhary)

A total of 642, 464 and 432 serum samples of cattle and buffaloes from different districts of Chhattisgarh were tested by i-ELISA for presence of antibodies for brucellosis, leptospirosis and Infectious Bovine Rhinotracheitis (IBR) respectively. The overall seroprevalence for brucellosis, leptospirosis and IBR was found to 11.06%, 47.6% and 63.66% respectively in bovine of Chhattisgarh. Extraction of total genomic DNA from 458 blood samples and standardization of PCR protocol for detection of brucellosis, leptospirosis and IBR was done. Out of 458 blood samples, 65(14.2%), 94(20.5%) and 122 (26.6%) were positive for brucellosis, leptospirosis and IBR using gene specific PCR.

5.2.22 Studies on immune responses of Indian major carps to biotic stresses in Integrated farming system

(B. K. Choudhary, S. B. Barbuddhe (Till 30 May 2017), Mamta Choudhary, V. K. Choudhary (Till 31 March 2017)

A total of 350 samples were examined from ailing fishes in Farm and market fishes showing tissue lesions, anorexic and swollen abdomen. The samples were collected from fish farms of different districts of Central Plain Zone (50%), and Bastar Plateau zone (29%) of Chhattisgarh. Prevalence and sampling work was conducted during reporting period for studying Prevalence, pathological and molecular characteristics of *A. hydrophila* strain from samples collected. Recovered *Aeromonas species* were confirmed on the basis of biochemical tests, molecular characterization and MALDI-TOF MS analysis. The prevalence of Aeromonas species was found to be 87% followed by *Escherichia spp* represented 8% and Other strains belonging to *Acinetobacter jejuni*, Citrobacter spp., *Enterobacter spp., Pseudomonas putida, Klebsiella pneumonia, Providencia spp., Alcaligens* spp., *Microbacterium paroxydans* and *Roultella ornithinolytica by* 5% respectively as confirmed by MALDI-TOF MS analysis. Antibiogram of Aeromonas spp revealed presence of multi-drug resistant Aeromonads in the food chain. All The bacterial isolates procured during research activities were cryopreserved at -20 ˚C and -80˚C in duplicate and the isolates were deposited at Veterinary Type Culture Collections, NRC on Equines Sirsa Road, Hisar Haryana, for

authentication and accession numbers.

Research Theme: Agricultural Extension

5.2.23 Developing and testing the effectiveness of interactive educational multimedia module on biotic stress management in rice and lathyrus

(P. Mooventhan, Anil Dixit, R. K. Murali Baskaran)

Multimedia will offer learners more complete and individual control over their learning. The main reason behind recommending the use of computer-based multimedia system for farmers is to facilitate interactivity and better understanding between individual learners and the subject matter. Multimedia tools are ideally suited to demonstrate complex and dynamic process that cannot be explained easily with conventional media and methods. The biotic stress management practices disseminated to the farmers through appropriate multimedia communication tools will increase the scientific knowledge base as well as standards of living through higher crop yield. With this background the present study entitled as "Developing and Testing the Effectiveness of Interactive Educational Multimedia Module on Biotic Stress Management in Rice and Lathyrus"

5.2.24 Awareness Programme organised on Protected Cultivation and Precision Farming for tribal farmers of Chhattisgarh under Farmer FIRST Programme

(P. Mooventhan, Anil Dixit, K.C. Sharma, P.N. Sivalingam, A.K. Gupta, Amit Dixit)

- **Approach of Farmer FIRST Programme**

The Farmer FIRST Programme (FFP) is an ICAR initiative to move beyond the production and productivity, to privilege the smallholder agriculture and complex, diverse and risk prone realities of majority of the farmers through enhancing farmers-scientists interface. There are concepts and domains that are new in emphasis like resource management, climate resilient agriculture, production management including storage, market, supply chains, value chains, innovation systems, information systems, etc. The Farmer FIRST as a concept of ICAR is developed as farmer in a centric role for research problem identification, prioritization and conduct of experiments and its management in farmers' conditions. The focus is on farmer's Farm, Innovations, Resources, Science and Technology (FIRST). Two terms 'enriching knowledge' and 'integrating technology' qualify the meaning of Farmer FIRST in Indian context. Enriching knowledge signifies the need for the research system as well as farmers to learn from each other in context to existing farm environment, perception of each other and interactions with the sub-systems established around. Technology integration is looked from the perspective that the scientific outputs coming out from the research

institutions, many times do not fit as such in the farmers' conditions and thus, certain alterations and adaptations are required at field level for their acceptance, adoption and success.

- **Farmer FIRST Programme**

The past efforts brought lot of success in terms of raising production and productivity and addressing issues of the farmers and the technology was considered as a vital factor in the production system and farmer as a recipient of the technology outputs. The knowledge and innovations of the farmers were not valued much and their presence was relegated at most as a participant but not as a partner in the experimentations. The wisdom available with the farmers was also not channelized so much to derive suitable options for different production systems. The participation of multiple stakeholders was also not taken up in perspective for technology development, integration and adoption. Now the situation has changed drastically in terms of increased number of smallholders, growing proposition of women-led agriculture, need for higher return per unit area and addressing the changing socio-economic environment, etc. This necessitates new approach for project development involving innovation and technology development with the strong partnership of the farmers for developing location specific, demand driven and farmer friendly technological options.

- **Applying Farmer FIRST Approach**

Farmers tend to face problems related to production and natural resource management but they might not have found out solutions to overcome them. In such situations, Farmer FIRST is an opportunity for the researchers, extension professionals and farmers to work together and find appropriate ways through assessing different solutions. During the production process, farmers often evolve new ideas to improve their cultivation and natural resource management activities. This creates a space for researchers, extensionists and farmers to design and organize new experiments. Farmer FIRST can be applied not only at household level but also at village and community level as community experimentation.

Usually, the experiments are managed at the individual farmer's level who are involved in the project or who are selected by the village as the representatives to conduct experiments. In addition, there are some cases where experiments focus to solve problems of the whole village. Farmer FIRST is a concept in which the farmers participate in the research process with scientists. Research questions are found out together with selected farmers or the whole village and villagers' participation in monitoring experiments with scientists. The aim is to find out new ways of doing and bringing in synergy of the stakeholders. The experiments need to be adapted to specific conditions of a farming system and to have the participation of farmers as well as scientists. Especially they must acknowledge local wisdom as a vital element for the

development of useful innovations. The role of extensionists is to ensure implementation. Farmer FIRST will create linkages between farmers-researchers and extensionists to support farmers to conduct appropriate experiments selected by them. It will help researchers and extensionists understand and know real needs of villages. In this process, priority does not come from researchers or extensionists but from the end users of results of research and technology development.

6. Major achievements of research; division-wise and in a summarized form for the whole institute or programme

Salient findings

6.1 Analytical and Weed Science

6.1.1 A ready mix formulation, sulfosulfuron 75% + metsulfuron methyl 5% WG was demonstrated in wheat, resulted in higher grain yield. The formulation had the weed control efficiency of 78-88%, which curtailed competition among weed and wheat plants. Application of this formulation provided yield increment of 56.4% over the hand weeding practice followed by farmers.

6.1.2 Pretilachlor (6%) + Pyrazosulfuron (0.15%) GR (600+15 g/ha) and weedy check was tested in farmers' field along with farmers practice at Dhamtari, Bilaspur and Raipur districts of Chhattisgarh. Pretilachlor 6% + Pyrazosulfuron 0.15% was applied 5-7 days after transplanting for evaluating this molecule at farmers'field. The study sites were predominantly dominated with *Cyperus rotundus, C. difformis,Echinochloa colona, E. crusgalli, Cynadondactylon, Ischaemomrogusum, Commelina sp., Amaranthus sp., Alternenthra sessilis, Monochoria sp., Marsilia quadrifolia* and *Ludwigia parviflora.* It was recorded that weed control efficiency was about 80-91% and there was yield improvement of 40-50%, irrespective of locations and varieties.

6.1.3 Incorporation of *dhaincha* at vegetative stage before transplanting of rice recorded 57% reduction in weed density over without *dhaincha*. Reduction in density of grasses, broad leaved weeds and sedges were 56, 60 and 52% respectively, while 37% reduction of weed dry biomass was recorded with *dhaincha* over without *dhaincha*

6.1.4 The application of bispyribac sodium10 SC, followed by one hand weeding at 40 DAT was found to be effective for both weed management and to obtain higher yield in rice

6.1.5 Among the post-emergence herbicides tested in rice field, pyrazosulfuron-ethyl was effective against broad leaved weeds and sedges while pendimethalin 30 EC

and fenoxaprop-p-ethyl 9.3 EC were effective on controlling grasses. However, ready mix application of pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR had suppressed the wide range of weeds and also showed phytotoxic effect on rice crop

6.1.6 Scarcity of water and labour compels to shift from transplanting to direct seeded rice (DSR). Weeds are major biotic constraints in DSR, because of absence of establishment of anaerobic condition. Sequential application of herbicide (early-post or post-emergence) with one hand weeding provided better weed control than the single application of herbicides in direct seeded rice.

6.1.7 Weed control efficiency was the highest with three hand weeding in wheat at 20, 40 and 60 DAS (96%), which was considerably equal to 2 hand weeding at 20 and 40 DAS (92%), followed by the application of Clodinofop-propargyl 15% + Metsulfuron-methyl 1% (85.9%)

6.1.8 Application of pyrazosulfuron 20 g/ha within 3 days of transplanting of rice, followed by the application of bispyribac 25 g/ha and penoxsulam 22.5 g/ha at 17-20 days after transplanting had suppressed the weeds up to 80-85% which was statistically comparable to 2 hand weeding at 30 and 60 days after transplanting.

6.1.9 The density of grasses, broad-leaved weeds and sedges in lowland rice were comparatively lower with higher N_{120} regime while it considerably increased with decrease in N_0 regime. Same trend was noticed in wheat eco-system also with reference to weed suppression

6.2 Agricultural Entomology

6.2.1 The foliar application of acephate 50% + imidacloprid 1.8% SP @ 600 + 21.6 g a.i./ha was the effective dose to suppress the population of yellow stemborer, leaf folder, BPH and GLH in wetland rice.

6.2.2 UPI 1810 @ 75 + 75 g a.i./ha was effective to suppress the population of yellow stem borer, leaf folder, BPH and GLH in wetland rice

6.2.3 Data obtained from AICRIP reports for 50-60 years indicated that number of insect pests attacking rice crop have increased to 15 in 2015 from 3 in 1965. Some of the pests like leaf folder, brown planthopper and gall midge have attained major pest status over the years. Yellow stem borer was the major monophagous pest till date in all the rice ecosystems. Among the diseases, sheath blight, leaf blast and bacterial blight were the major in different agro climatic zones of India.

6.2.4 Among 20 cultivars and 46 germplasm of wheat screened under filed condition against pink stem-borer, the infestation ranged from 3.05% (RWP 2012-15) to 14.15% (DBW 71) in cultivars while it ranged from no infestation (WH 147) to

17.29% (HD 2160) in germplasm and concluded that a variety WH 147 and a germplasm, RWP 2015-15 were resistant to pink stemborer

6.2.5 The minimum infestation of pink stemborer in wheat (14% white ear) was recorded in plots, applied with K_{60} + foliar Si (4 ml/lit) while the maximum infestation of 20.33% was noticed in plots, applied with K_{60} + soil Si (300 kg/ha)

6.2.6 Three species of rice stemborer *viz.*, yellow stem-borer, *Scirpophaga incertulas*, stripped stem-borer, *Chilo suppressalis* and white stem-borer, *Scirpophaga innotata* were recorded in Baronda Farm, among them, *Sc. incertulas* dominated. Relative humidity and rainfall were positively correlated with trap catches of rice stemborer and leaf-folder while maximum (26.0^0C to 29.3^0C) and minimum (17.4^0C to 25.5^0C) temperature were positively correlated to damage caused by two insects

6.2.7 Sequential release of egg parasitoid @ 6.25 cc/ha at weekly interval *ie*. three releases of *T. japonicum* on 32nd, 39th and 46th day after transplanting (DAT), followed by three releases of *T. chilonis* on 46th, 53rd and 60th DAT was optimum to manage rice stem-borer, resulting 1.25% dead heart and 1.09% white ear, in contrast to control with 2.29 and 2.25%, respectively

6.2.8 Native population of egg parasitoid collected from lowland rice of Baronda farm and Balloda Bazar district were identified as *Trichogramma japonicum* and *T. chilonis*, respectively

6.2.9 In order to develop kairomone formulation to enhance the field activity of natural enemies in rice, chemical profile of damaged rice plant and host insects were studies through GC-MS analysis. In this study, a saturated fatty acid, n-hexadecanoic acid was detected in both male and female yellow stem-borer extracts. In addition, few alkanes like decane, tridecane, tetradecane, octadecane, eicosane, hexatriacontane, tritetracontane and tetratetracontane were detected in the extracts of female yellow stem-borer while β-pinene, α-pinene and caryophyllene were abundant in yellow stem-borer damaged rice plants

6.3 Plant Pathology

6.3.1 Among the viral diseases**,** *Begomovirus* are the most important and causing huge economic losses to the growers in vegetable and pulse crops in Chhattisgarh.

6.4 Agricultural Biotechnology

6.4.1 Potential bacterial endophytes isolated from pigeonpea and lathyrus were

identified screened for their efficacy against the stem rot causing pathogenic fungi *Scleratium rolfsii,* and *Rhizoctonia solani* under laboratory conditions.

6.4.2 Metagenomic analysis of bacterial endophytes from different tissues of Lathyrus was done using next generation sequencing Illumina Sequencing approach (NCBI with bio project ID PRJNA392219)

6.5 Animal and Fisheries Science

6.5.1 The total economic losses due to Haemorrhagic Septicaemia (HS) in cattle and buffaloes was estimated to be $ 3,43,34,000. Overall prevalence of HS in different districts of Chhattisgarh was recorded to be 44%, morbidity rate and mortality rate were recorded to be 13.85% and 7.27%, respectively The causative agent of HS was identified as *Pasteurella multocida*, capsular type B. The protective efficacy of vaccines in the field condition confers protection against HS for only 8 months.

6.5.2 Out of 458 blood samples cattle and buffaloes from Chhattisgarh, 65(14.2%), 94(20.5%) and 122 (26.6%) were positive for brucellosis, leptospirosis and IBR, respectively.

6.5.3 Out of 300 fish samples, *Aeromonas* species was found in 87% followed by *Escherichia spp* (8%) and other strains belonging to *Citrobacter* spp , *Enterobacter spp., Pseudomonas putida, Klebsiella pneumonia, Flavobacterium*, *Alcaligens* & *Roultella ornithinolytica* (5%). Sixty isolates were accessioned from VTCC, Hisar. There was a First report of novel isolate co-harbouring ^{bla}*QnrA,* ^{bla}*TEM,* ^{bla}*Int-2 genes and* ^{bla}*tetW* genes multi drug resistant *Raoultella ornithinolytica* isolated from fishes in India.

6.5.4 Developed diagnostics for *Listeria monocytogenes* from human and animal. Discovered a predominant, stable and widespread epidemic clone of *L. monocytogenes* serotype 4b in the Indian subcontinent. The routes of transmission of this clone ('Ind-4b-dom-pulsotype', ST328, VT20), are geographically unique and distributed over enormous distances in both space and time. Established a well characterized repository of the strains of *Listeria* (>1000) isolated from almost 16 states of India. Archival of all the strains is under progress. Part of the collection has been submitted to National Veterinary Type Culture Facility, NRC Equines, Hisar.

6.6 Agricultural Extension

6.6.1 Digital documentary on mass production of bio control agents (*Trichogramma*),

weedy rice and pheromone technology completed to produce the bilingual instructional videos as content generation activity to prepare the Interactive Educational Multimedia Module.

6.6.2 Digital data base of major pest, disease, weed and predators in paddy documented for demonstration and publication purpose.

6.6.3 As a part of m-extension initiatives, registration process completed in Farmer SMS portal (http://mkisan.gov.in/) and creation of farmer's mobile number database initiated

6.7 ICAR sponsored Farmers FIRST project

6.7.1 Goat farming established with Sirohi, Jamunapari and Barbari breeds and 83 tribal farm families covered under this enterprise. Backyard poultry farming with Kadaknath established and 100 tribal farm families covered under this enterprise. Oyster mushroom production unit established and 80 tribal farm families covered under this enterprise.

6.7.2 Nutritional garden established with IIHR varieties tomato (Arka Rakshak) F1, chilli (Arka Meghna) F1, Brinjal (Arka Anand) F1, Okra (Arka Anamika) TFL seeds and Arka Mega Seed Kit (Vegetable). Totally 110 tribal farm families covered. About 80 acres of rice fallow land converted into cultivable with Lathyrus (Mahateora), Chick pea (JAKI 74), back gram (Azad - 03), mustard (FS), lentil (KLS - 218) crops.

6.7.3 Custom Hiring Centre (CHCs) established in the project site with variety of drudgery reduction farm implements including Happy seeder, drum seeder etc.

6.7.4 Five informative PRA report prepared for each tribal village with all necessary baseline information to explore the technological gaps, research problem and prioritization. Technology assemblage on different module completed and need based capacity building programmes organised on different interventions.

7. Production, process, technologies developed by the institute with credited scientists

Technology developed at NIBSM

S. No.	Technology developed/ validated	Methodology	Outcome/% gain over check	Credited scientists
Effective and Economical Weed Management in Rice (*Oryza sativa*)				
1.	Pretilachlor (6%) + Pyrazosulfuron (0.15%GR) in Rice	Apply Pretilachlor 6%) + Pyrazosulfuron (0.15%GR) at 600+15 g/ha at 6-8 days after transplanting with the help of appropriate sand. Maintain the thin layer of water after 2-3 days after application	Weed control efficiency improved by 82% over weedy check, and yield improvement with 39%, with the saving of Rs 6000-7000/ha than two hand weeding.	Anil Dixit, V. K. Choudhary
2.	Pyrazosulfuron 10 WP followed by Bispyribac sodium 10 SC against partial weeding in rice	Apply pyrazosulfuron 10 WP @ 25 g/ha within 3 days after transplanting with 25 kg sand/ha followed by Bispyribac sodium 10 SC @ 25 g/ha at 20 days after transplanting and maintained water layer 3 days after application	Weed control efficiency 76% over control with yield improvement 90% over weedy check. It was noticed that these technology has yield reduction of 8.5% than two hand weeding but there was saving of Rs 5700/ha over two hand weeding.	Anil Dixit, V. K. Choudhary
3.	Dhaincha (*Sesbania aculata*) for weed suppresion and soil health improvement in rice	During first week of June, 30 kg/ha of *Dhaincha* seeds (*Sesbania aculata*) were broadcasted and irrigation of 5 cm was applied for uniform germination. After 30-35 DAS, 10 cm of water was filled and 4 t/ha of biomass was incorporated in the soil with the help of rotavator. 21 days old seedlings were transplanted after 5 days after incorporation.	Reduction in weed density by 57%, weed dry biomass by 37%, curtailed the NPK requirement by 25%, and measured 16.4% of yield improvement. It was also noticed that *dhaincha* incorporated plots had thin water layer during prolonged dry spell for 15 days, whereas there were formation of cracks on soil on without *dhaincha* plots.	V. K. Choudhary, Anil Dixit

Chemical Weed Management in Wheat (*Triticum aestivum*)				
4.	Clodinafop propargyl 15% + Metsulfuron methyl 5% WG against partial weed management in wheat	Apply Clodinafop propargyl 15% + Metsulfuron methyl 5% WG at 20-25 days after sowing of wheat for broad spectrum control of weeds	Clodinafop propargyl 15% + Metsulfuron methyl 5% WG has noticed with 82% of weed control efficiency over weedy check; these had advantages of 12% more weed control efficiency than two hand weeding. The yield increment was recorded 40% more than the farmers practice (partial weeding).	Anil Dixit, V. K. Choudhary

8. Infrastructure and physical facilities planned and developed during the period under review commensurate with the mandate:

2014-15

- To establish basic infrastructure for existing scientific and administrative staff, renovation of existing buildings was taken up. The administrative office, laboratory building as well as two staff quarters were converted into laboratories and Director office. Modular office set up was created with partition etc.

- The major portion (pocket A) of the land of NIBSM (105 acres) was secured with compound wall and main gate construction by CPWD.

2015-16

- Preparation of detailed master plan for the NIBSM campus was undertaken with the CPWD and their project management consultant, and made ready for presentation to the ICAR for suggestions and finalization.

2016-17

- Master Plan of ICAR - NIBSM, Baronda, Raipur (Chhattisgarh) developed by CPWD was approved by the Competent Authority of ICAR in July, 2016. In the approved master plan 70% of the total area is kept for research farm and the

remaining 30% area will cater the need of different infrastructures. The following components were finalized in the master plan:

Administration Buildings including four school buildings, different laboratories, Library, Auditorium, Conference Room, Computer facilities, Directors office, Registrar Office, Comptroller Office, Canteen etc, Girls hostel, Boys hostel, Foreign student hostel, Married scholars accommodation, farmers centre, shopping complex, residences, sports complex and other developmental works.

- Administrative approval and expenditure sanction of Rs. 52.87 Crores by the Competent Authority of ICAR for the construction of new works approved under XII plan EFC was granted in March 2017 for the construction of (i) Administrative building, Library, Auditorium and school buildings (02) (ii) Girls Hostel (iii) Boys Hostel and (iv) Development of site for ICAR-NIBSM.

2017-18

- During 2016-17 renovation of the following existing buildings was started to cater the need of laboratory expansion and sitting of scientists so that research work under different projects could be conducted smoothly**:** Seed store building, Cattle shed building, Type II (4) and Type I (2) quarters. All these works completed during the year

- A new toilet for Ladies & Gents was constructed.

- Construction work of administrative building, library, auditorium and school buildings (02), girls hostel, boys hostel and development of site in the main campus of NIBSM has been started in January 2018 by the CPWD.

9. Human resource development efforts for different categories of staff:

S. No.	Training Programme	Duration and Organizer	Name and Designation of the Scientist
1.	Executive Development Programme on "Leadership Development"	July 29 to August 1, 2017 at ICAR-NAARM	Dr. Jagdish Kumar Director (Acting)
2.	Executive Development Programme on "Leadership Development"	August 27 to Sept. 1, 2016 at ICAR-NAARM	Dr. P. Kaushal Joint Director (Research)
3.	Management Development Programme on "Leadership Development"	Dec. 19-30, 2016 at ICAR-NAARM, Hyderabad	Dr. S. K. Jain Principal Scientist (Pl. Pathology)
4.	Competency Enhancement Programme for Effective implementation of Training Functions by HRD Nodal Officers of ICAR	Feb. 23-25, 2017 at NAARM, Hyderabad	Dr. S. B. Barbuddhe Principal Scientist (Vet. Public Health)
5.	Management Development Programme on Leadership Development	November 30-December 11, 2015, NAARM, Hyderabad	Dr. K. C. Sharma Principal Scientist (Ag. Entomology)
6.	Agricultural Research Management	February 03-March 05, 2016 at NAARM, Hyderabad	
7.	Refresher course on "Advances in eco friendly pest management strategies in Millets"	August 22-31 2016 at Indian Institute of Millets Research, Hyderabad	
8.	Five days Finance Management Training	November 15-19, 2016 at ICAR-NAARM, Hyderabad	
9.	Two days e procurement training	February 22- 23, 2017 at IASRI, New Delhi	
10.	Training on 'Analysis of Experimental Data'	August 17-22, 2015 at NAAR, Hyderabad	Dr. B. K. Choudhary Sci. (Fish & Fisheries)
11.	Workshop on SAFE WATERS	23-27 March, 2015 at ICAR-NBFGR, Lucknow, UP	
12.	CAFT on 'Microbial Genomics and Proteomics in Diagnosis and Control of Diseases of Veterinary Importance' during organised by	November 07-27, 2017 at Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar-125004, Haryana	Dr. Mamta Choudhary Sci. (Vet. Pathology)

13.	Short term training on 'Metagenomics: Role of Next Generation Sequencing and Bioinformatics'	October 26-November 04, 2015 at College of Veterinary Science and Animal Husbandry, AAU, Anand	Dr. Lata Jain Sci. (Vet. Microbiology)
14.	ICAR-winter school on 'Recent approaches in animal disease diagnostics and vaccinology' from, organized	September 26-October 16, 2017 at School of Animal Biotechnology, GADVASU, Ludhiana	
15.	Identification, mass production and utilisation of parasitoids, predators and entomo-pathogens for sustainable insect pest management	December 4-10, 2017 at NBAIR, Bengaluru	Dr. J. Sridhar Sci. (Ag. Entomology)
16.	Training course on Innovative Agricultural Extension Systems to improve farm Productivity and Income	July 25-27, 2016 organized by Asian Productivity Organization at Manila, Philippines	Dr. P. Mooventhan Sci. (Vet. Extension)
17.	Training programme on mExtension: "all-in-one" Mobile Phones for Agricultural Extension"	September 12-16 2016 organized by Manage, Hyderabad in collaboration with TNAU, Coimbatore, at Madurai	
18.	Training on 'Taxonomy of insect and mites'	March 2-22, 2016 at Department of Agricultural Entomology, UAS, Bengaluru	Dr. Mallikarjuna, J. Sci. (Ag. Entomology)
19.	Refresher course on bio-agents	July 18-29, 2016 at TNAU, Coimbatore	
20.	K. S. Krishnan School of Chemical Ecology training on 'Chemical Ecology'	February 16-27, 2015 at NCBS, Bengaluru	
21.	Refresher course in Nematology	September 28-October 09, 2015	
22.	Training on 'Statistical Analysis System (SAS) software, basic installation and analysis procedures	February 9-12, 2015 at Indian Agricultural Statistics Research Institute, New Delhi	Dr. Vinay Kumar Sci. (Biotechnology)
23.	CAFT training on "Perspectives of plant-microbe interactions in promoting plant health and disease management"	September 7-27, 2016 at G.B. Pant University of Agriculture and Technology, Pantnagar	

24.	Professional Attachment Training on off-season population of whitefly and its related aspects in selected locations	Nov. 21, 2016 to Feb. 20, 2017 at NCIPM, New Delhi.	Mr. Yogesh Yele Sci. (Ag. Entomology)
25.	ICAR-short course on 'New frontiers in biotic stress management for doubling farmers income'	September 11-20, 2017 at IGKV, Raipur	
26.	Special training programme for ICAR employees	August 25-September 05, 2014	Shri Saguni Paswan, Assistant

10. Budget and Finance: Allocations to various heads be given along with the details and budget for the years covering the review period along with the status report on resource generation and project-based budgeting implementation:

Enclosed as annexure I

11. SWOT Analysis of the Institute/Project:

In the process of SWOT analysis, QRT has identified the following major key elements as regard Strength, Weakness, Opportunities, and Threats for ICAR-NIBSM.

Strength

- Blend of experienced and young scientific manpower
- Multidisciplinary scientific team and research programme
- Broader mandate and objectives
- Deemed to be university status
- Sole ICAR institute in the state
- Fertile farm land
- Campus surrounded by farming community and villages

Weakness

- Lack of scientific, technical, administrative and finance manpower
- Lack of infrastructure
- Lack of funds for establishment
- Campus in establishing stage

Opportunities

- Biotic stress management technologies are the basic requirement of any successful farming system.
- Increasing global concern in favour of crop protection technologies
- Ample scope to increase the yield through promising biotic stress management technologies
- NIBSM can be a model institute of agricultural research with its broader mandate
- Unexplored agro-ecosystem of Chhattisgarh has plenty of scope to work under different farming system.

Threats

- Emergence and re-emergence of new pest, pathogens and diseases
- Increasing pesticide and antimicrobial usage and residual level
- Low adaptability of eco-friendly crop protection technologies

MANAGEMENT

12. Frequency of meetings of the Management Committee and highlights of important recommendations and their implementation

INSTITUTE MANAGEMENT COMMITTEE

Action taken report on the recommendation of IMC meeting held on October 25, 2013

S. No.	Agenda item	Decision	Action taken
1.	Information on Establishment of NIBSM at Raipur	The IMC noted the information provided.	--
2.	Development of Master Plan	The IMC suggested that the action in this regard to be taken up soon enough following the procedure laid out for this purpose. While NIBSM may consult with various architects for generating ideas, the process of finalising the party should be undertaken through CPWD, Raipur.	The institute is working closely with Central PWD, Raipur. The tender process by CPWD for appointing comprehensive consultancy services agency to develop the NIBSM campus township is in progress

3.	Research programmes of the Institute	The Director provided an overview of the institute and explained the research priorities and processes. The IMC appreciated the concepts of outreach network based research programmes on frontier and basic sciences. The IMC approved and endorsed the NIBSM proposal to take up funded research projects with NARS institutions and other scientific institutions through structured and approved research areas of the institute.	The institute has finalised the draft Vision 2030 for approval of ICAR. The four areas of research have been finalized as given in the present agenda notes
4.	EFC Budget approval, allocation for 2013-14 and progress of expenditure	The IMC noted the position. IMC advised to accelerate the expenditure, particularly in non-recurring heads. It was told that the due payment for compound wall to CPWD would be done soon after the actual work commences at the site. The finalisation of Master plan would also incur expenditure from the relevant head.	The allocated revised estimate of 200 lakhs could be fully utilized last financial year. The current progress in this regard is given in the agenda notes.
5.	Purchase of furniture and fixtures – ratification by IMC	The IMC dealt with the items and approved and ratified the purchases of relevant items as proposed.	The procurement of these items have been completed
6.	Construction of security / boundary wall	The IMC noted and concurred with the proposal.	The progress is given in the agenda notes
7.	Creation of scientific, Technical, administration and Supporting staff posts	The IMC noted efforts taken by NIBSM in this regard and requested ICAR to accelerate the process of creation of all recommended posts under each category. Since NIBSM is being established newly and currently functioning with one Administrative Officer to work	Suitable administrative steps were taken and the Sr F&AO of NBSS& LUP is given additional charge of NIBSM too. Separate Agenda on the need to revisit this working arrangement is given in ths agenda

		for all branches of administration with only 3 scientists. The proposed post with positions as in EFC should be deployed by ICAR. IMC also noted that the time lag in processing for settlement of expenditure due to the Senior FAO of NCIPM providing part time service to NIBSM from Delhi is a cause for concern. IMC recommended to look out for an early and practical solution situation by seeking the transfer of an experienced FAO and until such time the FAO from nearby ICAR institute may be identified and given charge. The OSD explained that the matter on creation of posts has been taken up with the Crop Science Division for being pursued with the Finance Ministry, Nevertheless the SMD may consider to provide personnel on transfer.	notes.
8.	Purchase of EFC approved items	The IMC was briefed about the list of the equipments, furniture and vehicles. The OSD explained that since adequate scientific manpower is not available to take up research using these equipments, it is proposed to defer their purchase. The NIBSM propose to seek revised EFC in the near future by including equipments and vehicles needed immediately.	The due action was taken and based on ICAR approval no. CS. 19/3/2013-IA. III. dt. 13.8.14 for purchase of essential equipments is in completion stage
9.	List of the Lab instruments,	The IMC was presented with the list of equipments,	The due action was taken and based on

	appliances, equipments required immediately	appliances and other items that are essential for both lab and field research at NIBSM. The list of requirement was approved against the already approved equipments as given in the Agenda.	ICAR approval no. CS. 19/3/2013-IA. III. dt. 13.8.14 for purchase of essential equipments is in completion stage
10.	Proposal for appointing Authorised Medical Attendant & hospitals for medical attention for NIBSM staff and families at Raipur	The IMC approved the proposal stating that the recent ICAR direction in this regard may be followed. The claims of staff in this regard could be admitted by limiting to CS (MA) rates.	Due compliance is done
11.	New staff / ACP/ promotion /confirmation/ Transfer/joining/ superannuation/ deputation/obituary	The information was noted by IMC.	--
12.	Any other items with the permission of the Chair 1. The IMC was told about the current difficulties due to the absence of regular staff in administration and accounts. The IMC deliberated the matter including the sluggish pace of expenditure and other administrative matters. The IMC recommend that the SMD may consider to provide minimum staff on transfer against the existing pool of posts in various categories in ICAR.	 1. The IMC recommended that the SMD may consider to provide minimum staff on transfer against the existing pool of posts from various categories in ICAR. 2. The IMC proposed that the unserviceable structures in the NIBSM campus may be listed for dismantling through the due administrative processes. 3. The NIBSM OSD may like to take up a suitable accommodation for Camp Office-cum-guest house nearer to the campus.	 Follow up with ICAR Hq. is in progress Due action after Asset Register completed

	2. The IMC proposed that the Unserviceable structures in the NIBSM campus may be listed for dismantling through the due administrative process. 3. The NIBSM needs a suitable accommodation for Camp Office-cum-guest house nearer to the campus.		This is yet to be taken up.

Action taken report on the recommendation of the 2nd IMC meeting (March 24, 2015)

S. No.	Agenda Items	Council's Comments	Action Taken Report
1	Confirmation of the proceeding of the 1st IMC meeting held on 25.10.2013	Information only	No action required
2	Action taken reports on the recommendations of 1st IMC meeting held on 25.10.2013	Information only	
3	Important activities during October 2013 up to 20.3.2015	Information only	
4	Research/ Extension/ training activities	Information only	
5	Financial Progress of the Institute in r/o year wise Plan and Non plan budget allocation & expenditure Revenue Generation etc.	Information only	
6	Administrative Matters	Information only	
7	Any other item with the permission of the Chair	Information only	
i	Providing adequate administrative and financial staff suited for the Institute.	Information only	
ii.	Proposal to replace procurement of split air conditioners in place of energy inefficient window ACs.	Separate proposal may be sent for concurrence of the IFD	Proposal sent to council for approval on 07-05-2015 (F.No.2-3/NIBSM/2013 /105)

Action taken report on the recommendation of the 3rd IMC meeting (March 18, 2016)

S. No.	Agenda Items	Council's Comments	Action Taken Report
1	Confirmation of the proceeding of the 2nd IMC meeting held on 24.03.2015	Information only	No action required
2	Action taken reports on the recommendations of 3rd IMC meeting held on 18.03.2016	Information only	
3	Important events and activities during 2015-16	Information only	
4	Research/ Extension/ training activities	Information only	
5	Year-wise allocation and annual budget allocation	Information only	
6	Plan and Non plan budget allocation & expenditure	Information only	
7	Revenue Generation	Information only	
8	Position of outstanding advances	Information only	
Administrative matters			
9	Status/progress of procurement of equipments approved under 12th plan for the financial year 2015-16	Approved, as per delegation of powers	Equipments approved in EFC were procured
10	List of furniture/ fixtures purchased during 2015-16	Action may be taken as per Delegation of powers and availability of funds	Complied
11	Proposal for approval of list of equipments essentially required for research in place of surrendering minor equipments without affecting the total approved EFC budget	Not approved	Complied
12	Proposal for approval for expenditure towards entertainment and light refreshment charges	As per delegated powers	No action required
13	Construction of field crops research centre	In process	Being pursued, included in new EFC
14	New staff/ promotion/ probation/ confirmation/transfers/ joining/ resignation/ superannuation/ deputation/obituary	Information only	No action required
15	Any other item with the permission of the Chair	Information only	
16	Proposed master plan of NIBSM received from CPWD has been presented in IMC	Information only	

4th Institute Management Committee Meeting (March 15, 2017)

The 4rd meeting of the Institute Management Committee was held on March 15, 2017 at ICAR-NIBSM, Raipur. The meeting was attended by Dr. Jagdish Kumar, Director (Acting) as Chairman, Dr. Pankaj Kaushal, Joint Director (Research) as special invitee, Dr. Jagdish Rane, Head, ICAR-National Institute of Abiotic Stress Management, Baramati, Dr. A. K. Sarawgi, Head, Dept. of Genetics & Plant Breeding, IGKV, Raipur, Dr. D. K. Ghosh, Principal Scientist, Central Citrus Research Institute, Nagpur, Dr. K. N. Mohanta, Principal Scientist, ICAR- Central Institute of Fresh water Aquaculture, Bhubaneshwar, Dr. A.K. Mukherjee, Senior Scientist, ICAR- National Rice Research Institute, Cuttack and Dr. S. R. Ratre, Director, Directorate of Agriculture, Govt. of Chhattisgarh as Members, Shri A. A. Goswami, Administrative Officer and Member Secretary, Dr. Anil Dixit, Principal Scientist, Dr. S. B. Barbuddhe, Principal Scientist, Dr. S. K. Jain, Principal Scientist, Dr. K. C. Sharma, Senior. Scientist, Dr. P. N. Sivalingam, Senior Scientist and Dr. Vinay Kumar, Scientist as special invitees.

S. No.	Agenda item	Decision	ICAR comments
1.	Confirmation of the Proceedings of the last meeting (3rd meeting)	The Institute Management Committee (IMC) noted the ICAR-approved proceedings of the last meeting.	
2.	Action taken report on the recommendations of the 3rd IMC meeting	The IMC expressed happiness for the prompt and complete action on the recommendations of the last meeting.	
3.	Important Events & Activities, 2016-17	The IMC expressed happiness over the events and activities of the Institute.	
4.	Research / Extension / Training Activities	An overview of the institute, research priorities, on-going programmes and processes of the Institute were presented before IMC. The IMC appreciated the initiation of research programmes on biotic stress related aspects with bare minimum facilities.	
5.	Approval of master plan of ICAR-NIBSM	The IMC expressed happiness over approval of master plan of ICAR-NIBSM	

S. No.	Agenda item	Decision	ICAR comments
Financial Matters			
6.	Year-wise allocation and annual budget allocation	Year-wise allocation and annual budget allocation, Plan & Non Plan Budget allocation and expenditure, Revenue Generation and Position of outstanding advances were presented by the Member Secretary. The IMC noted the position.	
7.	Plan &Non Plan Budget allocation and expenditure		
8.	Revenue generation		
9.	Position of outstanding advances		
Administrative Matters			
10.	Status/progress of procurement of equipments approved under 12th plan for the financial year 2016-17	The IMC noted these items as good progress in accordance with the plans of the current financial year.	
11.	List of furniture/ fixtures purchased during 2016-17	The IMC noted the progress of the purchase of furniture/ fixtures during 2016-17 and ratified the expenditure.	
12.	List of equipments approved in XII Plan EFC proposed to be procured during 2016-17	The IMC noted and satisfied on the progress of procurement process during 2016-17	
13.	Proposal for approval for expenditure towards entertainment and light refreshment charges	The IMC ratified the expenditure for the entertainment and light refreshment charges	
14.	New staff/ promotion/ probation/ confirmation/ transfers/ joining/ resignation/ superannuation/ deputation/obituary	The IMC noted the position on staff redeployment through transfers and promotions.	
15.	Any other items with permission of chair	NIL	

13. Staff Research Committees and RACs recommendations and action taken on their recommendations

INSTITUTE RESEARCH COUNCIL

S. No.	IRC	Date
1.	1st IRC	April 10, 2015
2.	Mid-term IRC	March 29-30, 2016 and May 27, 2016
3.	2nd IRC	December 01-03, 2016
4.	3rd IRC	July 11-12, 2017
5.	Supplementary IRC	August 09, 2017

Recommendations of 1st IRC meeting (April 10, 2015)

The first IRC meeting of NIBSM was held at Conference room of the Directorate of Student's Welfare, IGKV, Raipur on April 10, 2015 under the chairmanship of Dr. T. P. Rajendran, OSD, NIBSM, Raipur. The OSD briefed about the biotic stresses in agriculture and its importance in one health and integrated farming system. He emphasized the importance of research projects in the three flagship programmes of the institute *viz.,* i) studies on loss assessment methods due to biotic stresses in agriculture; ii) studies on optimization of nutrition for biotic stress management in agriculture; and iii) Rodent control for zoonotic disease management of Chhattisgarh. During the occasion, eight new research projects were presented by the scientists.

Recommendations of Mid-term IRC meeting (March 29-30 & May 27, 2016)

Documentation and repositories

1. Status report (national) of major diseases and pests of crop plants, livestock and fisheries, with report on epidemiology over time (past 25-50 years), with special reference to Chhattisgarh and adjoining states. (Action: JD(R) to coordinate).
2. Develop a central repository of pests and pathogens prevalent in Chhattisgarh and adjoining states including live samples wherever possible (eg bacterial pathogens). (Action: Nodal officers: Dr S K Jain (for crop plants), Dr S B Barbudde (animals and fisheries)
3. Concept of museum to be developed which should include specimen and exhibits depicting various biotic stresses (weeds herbarium, insects, organisms under biotic stresses) (Action: Nodal officers – Dr M Baskaran (Plant component); Dr B.K. Choudhary (animal & fish component).

4. Updated (revised) atlas of weed flora for Chhattisgarh to be developed (Action: Dr Anil Dixit).

Experiments

1. Efforts to be initiated for collection, conservation and characterization of prevalent races/biotypes of pests and pathogens. Optimization of artificial inoculation methods, *in vivo* and *in vitro* screening protocols for major pests and pathogens (viral, fungal, bacterial, nematodes, etc.) in crops, livestock and fishes to be done. (Action: JD(R) to coordinate).
2. Development of 'super donors' in major crops following pyramiding and stacking of genes for multiple resistance/tolerance to major pests and diseases. To start with rice as a model system, BB and BPH tolerance to explore (Action Dr Vinay Kumar, Dr PN Sivalingam)
3. Exploring wild relatives for desirable genes especially for biotic stress tolerance: pre breeding/interspecific hybridization. (Action: JD(R) to coordinate)
4. Identification of novel stress induced promoters (Action: Dr Vinay Kumar, Dr PN Sivalingam)
5. Initiate studies on bio control/bio pesticides for eco-friendly biotic stress management (Nodal Officer: Dr K C Sharma).
6. Pilot experiment on allelopathic effect of *dhaincha* to be conducted (Action: Dr VK Choudhary).

Farm issues

1. In addition to fields dedicated for experiments, distinct blocks for cereals, pulses, oils seeds, horticultural and vegetable crops, fodders etc., needs to be developed in the farm area to showcase available stress management technologies relevant to this region (Nodal officer: Dr VK Choudhary)
2. Development of IFS at farm (Nodal officer: Dr A Dixit).

Projects and PME issues (Action: PME cell)

1. Develop and update list of technologies generated at NIBSM
2. Projects for external funding to be presented and discussed in presence of all scientists 7-10 days prior to submission. However, concept notes may be discussed in smaller committee constituting PI of proposed project, I/C PME and JD(R)

3. RPP I of old projects as well as newly approved projects during present mid IRC need to be submitted before 30 April 2016, and RPP II of ongoing projects to be submitted by 15 July 2016.
4. Work load of each scientist was discussed and it was decided that each scientist should have a maximum of one project at PI and two as Co-PI in institute funded projects. Minor/limited contribution of scientists not listed in investigators list may be appropriately addressed by the PI.
5. Institute funded projects may be coded in [(Programme).(Project)] format, as 1.1, 1.2., 3.1, 3.2, etc., while external funded projects to start with EF001 format.
6. Brainstorming to be conducted with scientists of IGKV and CGKV Raipur for research collaboration and sharing students.
7. Collaboration in specialized areas of mutual interests to be established with SAUs, ICAR and other research organizations. PME to develop a frame work map taking help from senior level scientists.
8. ATR of various meetings/committees' recommendations to be given in quantifiable terms.
9. Project Monitoring Committee to be formulated as per ICAR norms.
10. Scientists are encouraged to apply for post-doc fellowships and various awards. Suitable guidance may be provided by the PME.

Out-reach programmes (Action: Outreach programme committee)

1. As per out-each programmes of the Institute, it was suggested that the scientists should visit farmers' field at least once in a month. This activity may be tagged with MGMG visits.
2. It was decided to adopt 1-2 villages to be developed as Model biotic stress-free villages.

Recommendations of the 2nd IRC (December 01-03, 2016)

1. All the institute research projects have to be followed under programme mode (Action: PME)
2. RPP-II evaluation should be done by PME as per new guidelines (Action: PME).
3. On the basis of huge sample collections made during survey and surveillance work on diseases of livestock and fisheries during last year, it was discussed and decided that these works has to be stopped and advised to concentrate on one health programme as per institute mandate (Action: Dr. SB Barbuddhe, Dr. Lata Jain, Dr. Mamta Choudhary & Dr. BK Choudhary)

4. Brain storming programme on biotic stress management of crops planned to be conducted during first/second week of February 2017 (Action: PME)
5. Citation format of reference must be common for all institute publication (Action: PME in consultation with publication committee)
6. Introduction of wild species of wheat, rice, pulses, pearl millet and maize may be taken up from NBPGR/ other CGIAR institutes (Coordinator: JD(R)).
7. RPP-II of ongoing project and RPP-III of completed projects should be submitted on or before 30th January 2017 (Action: All concerned scientists).
8. New concept note proposals/ new experimental activity will be discussed again after incorporation of suggestions by 30 January 2017 (Action: PME and concerned PI)
9. Update files for all externally funded projects (Action: PME)

Recommendations of the 3rd IRC (July 11-12, 2017) & Supplementary IRC (August 09, 2017)

Merging of veterinary and Fisheries projects

As per 2nd RAC recommendations, the projects of purely veterinary and fisheries science (projects 1.3, 2.4, 2.5 and 2.6) have been merged and formulated as new project which will run up to 31st March 2018.

1. **Title of the project:** Isolation and characterization of pathogens causing various diseases in animals and fishes
2. Dr. BK Choudhary will be PI of this project as being senior most in this group, the Co-PIs are Dr. Lata Jain and Dr. Mamta Choudhary
3. Title of the projects 1.3, 2.4, 2.5 and 2.6 will be objectives of this project.
4. The project is approved with above modifications
5. The project files must be combined together and RPP-II for 2017-18 and RPP-III should figure out in new project file.

Programme mode Approach of Research

Programme mode approach of research was discussed during supplementary IRC on the research programmes proposed by Research Programme Formulation Committee constituted by the Competent Authority. The following research

programmes, programme leader and projects belongs to the programmes have been decided.

S. No.	Programme and sub-programmes	Ongoing Projects	New project*	Programme leader
1.	**Pest and pathogen genetic resources (PPGR) and their management** a. Collection, Cataloguing and Characterization b. Screening facilities c. Differentials (development/procurement) d. Evolution and ecology of pests and pathogens	1.1 (virus) 1.2 (animal)	Agro-ecology	Dr. S.K. Jain
2.	**Molecular biology of biotic stress reaction** a. Host-insect/pathogen interactions b. Genomic resources including molecular markers c. Molecular approaches to understand gene functions and gene/ genome edition d. Stress- induced promoters	2.1 (Endophyte)	Promoter Super donar	Dr. P.N. Sivalingam
3.	**Genetic resources for stress tolerance** a. Germplasm screening for mapping biotic stress tolerance b. Interspecific diversity and Alien introgressions	NIL	Germplasm	Dr. R.K. Murali Baskaran
4.	**Strategic and adaptive research in biotic stress management** a. Management strategies IPM, Biocontrol/biopesticides, Pheromones/kairomones, acoustic techniques agronomical approaches, weed management & allelopathy, nanotechnology etc. b. Policy research and validation of technology, extension modules c. Remote sensing , development of disease/pest prediction models in relation to climate change d. Bio safety and bio security	4.1 (PSB) 4.2 (Extn) 4.3 (DSR)	Bio-control	Dr. Anil Dixit

*Details of new projects

Code*	New Projects
Agroecology	Agroecology-pathogen-host-environment interplay and disease emergence
Promoters	Identification of biotic stress induced promoters from resistance source plants
Super donor	Development of super donors in rice carrying tolerance to multiple stresses (Bactrial leaf blight, Brown plant hopper and Blast)
Germplasm	Genepool profiling in crop plants for tolerance to biotis stresses
Bio-control	Isolation and Development of efficient native biocontrol agents of Chhattisgarh for management of lepidopteran pests

Section In-charge

For smooth and efficient functioning of different laboratories and proper utilization of resources Sectional concept is being introduced. Following sections are formulated.

Name of section	In-charge
Analytical and Weed Science Laboratory	Dr. Anil Dixit
Plant Pathology Laboratory	Dr. S.K. Jain
Entomology and Nematology Laboratory	Dr. R.K. Murali Baskaran
Biotechnology Laboratory	Dr. P.N. Sivalingam

The Section In-charges will take care of overall control and regulate all resources including equipments and their proper usage by different users including effective management of the laboratories. They will take care of maintaining equipments and relate consumable requirements.

GENERAL COMMENTS

1. RPP-II of ongoing project and RPP-III of completed projects should be submitted on or before 30th September 2017 (Action: All concerned scientists).
2. RPP II presentation of project should include plan of work for the next one year in subsequent IRC presentation (Action: All scientist)
3. New project proposals may be circulated to all scientist for preparedness in discussion and valuable input (Action: PME)
4. Draft of biotic stress status report may be submitted by the end of September 2017. (Action: Dr. RK Murali Baskaran; Dr. Binod Choudhary)
5. Update the files for all externally funded projects (Action: PME)
6. Annual Maintenance Contract should be regularized. Indent should be placed to In-charge (store) (Action: I/c store and all scientists).

7. A copy of all the details of germplasm/ correspondence/ character if any should invariably submitted to PGR cell for record (Action: all scientists)
8. Field boards needs to be prepared on priority (Action: I/c Farm)
9. Establishment of IFS model system should be taken up in priority
10. Work load of each scientist was discussed and decided which need modification of PI and Co-PI of the projects as suggested in the IRC.

Action taken report on the recommendations of 1st RAC meeting

S. No.	Recommendations	Directors Comments	ICAR Comments	Action Taken
1	Considering the limited scientific manpower it was suggested that time being with NIBSM may leave out biotic stresses of Livestock and fish, and focus on 3 to 6 selected areas of biotic stresses of crop plants, including the horticulture crops.	Agreed	Further, it is clarified in the EFC that work on livestock and fisheries are already in progress in various ICAR Institutes of Animals and fisheries Divisions. NIBSM may not duplicate such efforts on animal stresses and whenever required only the issues overarching these sectors can be facilitated on need based basis	Complied. No new Institute funded project is proposed having sole animal and fishery science disciplines. Scientists are encouraged to submit multi-disciplinary projects for external funding.
2	ICAR should support NIBSM in quickly establishing the much – needed buildings and other infrastructures in a phased manner in this plan and subsequent five year plans, based on the master plan that is under preparation.	Master plan has been discussed thoroughly in presence DG, ICAR, CPWD and other competent authorities in ICAR. Based on suggestions	DG, ICAR has approves the suggested plan and instructed Director (Works) to convey the final modification to CPWD for further necessary action.	Modified as per instruction of the DG, ICAR. DG-ICAR and other authorities visited the site on 04th April 2016, followed by meeting held in his chamber on 22nd April 2016. Revised master plan submitted for approval of Competent Authority on 5h July 2016.

		made the plan has been revised.		
3	Based on NIBSM's revised priority to restrict studies on biotic stresses of crop plants, the qualification processed for the posts of 6 Joint Directors of the Institute was suggested to be revisited and/or the process of selection stalled till the appropriate qualification is restored.	Agreed	The rationale for reducing the number of Schools proposed for NIBSM with overlapping mandates and accordingly, downsizing of RMP are under considerations of competent authorities.	Necessary modification has been sent to the council and case is under active processing and consideration in ICAR. Schools of Crop Resistance System Research (CRSR) and Schools of Crop Health Biology Research (CHBR) are proposed to be merged as one school. Another proposal is to reduce post of six Joint Directors to two by abolishing four posts of JD. Only two Joint Directors to continue *viz*., Joint Director (Education) and Joint Director (Research). JD(Research) is already appointed through ASRB. JD (CHBR) is further proposed to be converted to Joint Director (Education). Schools are to be converted into Divisions which are to be headed by the ASRB selected Heads.

Action taken report on the recommendations of the 2nd RAC (July 11-12, 2016)

S. No.	Recommendations	ICAR Comments	Action to be taken by NIBSM
1	**Mandate of the Institute** As per the approval of the structure and mandate of the NIBSM by the Union Cabinet, the objective of the Institute is to work on "Biotic stress management for crop health". Therefore, the Committee suggested that the wording of the 1st mandate as notified on May 20, 2016, may be suitably re-worded to "Basic, strategic and adaptive research on biotic stresses of crop plants".	Crop Science Division may review the first mandate and consider replacement of Agriculture with Crop Plants. Plan to comply with objectives approved by the Union Cabinet recommendation.	Request letter to be forwarded to the SMD for needful modification in the mandate as previously approved by ICAR as per F. No. 13(102)/2015-Cdn. Tech. dated 20th May 2016. A request letter for change of mandate to ICAR has already been sent to ICAR (F. No. 15-3/NIBSM/316 dated 28th June 2017). (Details in Annexure 1)
2	**Infrastructure** A)The existing arrangement of research laboratories is not satisfactory. There is an urgent need to develop laboratories for efficient utilization of the facilities, which have been developed and are being developed. For this, the institute may acquire portacabins to develop temporary laboratories as the work in buildings is yet to start.	NIBSM may explore possibilities of bringing the porta cabins from NIASM as the Institute has already developed its own building.	Request letter was sent to Director, NIASM, Baramati for transfer of the porta cabins to NIBSM but same has been denied. (letter enclosed) Alternatively, existing buildings are planned to be renovated and utilized as central laboratory, to be met from EFC (2017-2020). Estimated cost from CPWD was obtained as 32.93 lakhs including (i) 14.92 Lakhs for Civil works (ii) 18.01 Lakhs for electrical works. The same has send to ICAR for approval of Director (Works) on 11-08-2017. (Annexure 2)

	B) NIBSM has plan to utilize about 100 acres of the total 125 acres area available with them, for developing research farm. There is a need to engage a consultant to develop a state-of-the-art research farm for using latest farm operations related technologies. NIBSM Farm should become a model agricultural research farm for the country	We may engage professional consultant and organizations like FICCI etc. NIBSM may identify and suggest suitable consultants having experiences of farm development	Necessary provision has been made in the EFC document (subjected to approval).
3	**Manpower Planning** **1)** The institute should concentrate on development of understanding and management of biotic stresses of plants related to weeds, parasitic plants, insects pests, diseases caused by diverse pathogens, nematodes and vertebrates		Research projects are re-organized in to programme mode, suitable modifications were done in IRC 2017. All the institute projects are running under four programme viz.,1. Pest and pathogen genetic resources and their management, 2. Molecular biology of biotic stress reaction 3. Genetic resources for stress tolerance and 4. Strategic and adaptive research in biotic stress management.
	2) Activities, not connected with the mandate of the institute must be stopped with immediate effect. And the scientific personnel with specialization not relevant to NIBSM may be transferred to other institutes of the ICAR. This will create four vacancies immediately to recruit scientists or work on	Cadre revision recently under process in ICAR seems to take care of the recommendations.	One Principal Scientist (Veterinary Public Health) has been transferred and other three scientists (one each Vety. Pathology, Vety. Microbiology and Fishery Science) are under review at ICAR. Three projects on veterinary and fisheries sciences are

	biotic stresses of plants. The four vacancies created by implementing the above recommendations may be filled by recruiting scientists with specialization in fungal pathology, virology, bacteriology and nematology.		merged in the IRC2017 under one project which will be running upto 31st March 2018 for conclusion. Scientists belong to veterinary and fisheries have also associated with crop based activities. Relevant request letter for additional postings, as suggested, was send to the SMD (F.No. 15-3/NIBSM/ 316 dated 28th June 2017). (Details in Annexure 1)
	3) The overall cadre strength must be reviewed and re-structured to cover the biotic stresses caused by insect-pests, mites, pathogens (viroids, viruses, fastidious prokaryotes, bacteria, fungi, etc.), nematodes, weeds, parasitic plants and vertebrates and their effective management through genetic biotechnological and agronomical approaches. A possible outline for the organization of NIBSM and its manpower requirement is suggested (Annexure II) for the consideration of the ICAR.	The relevant positions indicated in areas of biotic stresses (indicated in Annexure II), within the approved cadre strength may be considered in the EFC of institute from 2017-20	Suitable modifications already proposed in EFC of institute (2017-2020). Details given in Annexure 3.
	It is suggested that the Institute may organize academic consultation with experts of areas of interest - such as weed science, entomology, virology, bacteriology, fungal		Suitable speakers/experts are being consulted for consultations. (Detail list of speakers identified, is attached as Annexure 4)

	pathology and vertebrate pests.		
4	**Collaboration** The Institute must develop active collaboration with relevant ICAR Institutes, Coordinated Schemes and SAUs engaged in research on biotic stresses of plants.	A Brain storming may be conducted with members of RAC and relevant scientists and Institutes to deliberate in the area of crop bio-security. Institute may work as a bridge to link activities / technologies in biotic stress related AICRPs/AINPs.	Collaboration with relevant AICRPs/AINPs such as AICRP on rice with ICAR-IIRR, Hyderabad, ICAR-NRRI, Cuttack already done for monitoring, AICRP on nematode is already running at the institute and ICAR institutes such as IARI, New Delhi, NBPGR, New Delhi, IIVR, Varanasi, IIRR, Hyderabad, IIWBR, Karnal, NIASM, Baramati, NRRI, Cuttack, NIAII, Bangalore and SAUs such as IGKV, Raipur, TNAU, Coimbatore, CGIAR institute such as ICRISAT are established for research projects (8 concept notes/ 12 project proposal submitted), student guidance (four students from IGKV) and germplasm exchange (more than 1600 of various crops including core collections, wild species etc). Brain storming will be conducted including experts and RAC members during this year. It was identified that totally 50 persons (nearly 30 speakers including PC from AICRPs, Scientists from DIHAR,

			Chandigarh, DIBAL, Leh and 20 participants) will be involved in this brain storming session. Expected expenditure of Rs 5 lakhs towards this purpose send to ICAR for approval (Copy of letter is attached as annexure-5)
5	**Research** The committee suggested various priority research areas for future work at the Institute, including novel measures for weed management, allelopathy for disease management, deciphering basic /molecular mechanism of host-pathogen/ insect interactions, bio-control, nanotechnology in pest management, nano-pesticides, fumigants, volatile and acoustic techniques for stored grains, post-harvest and vertebrate pest management, utilizing gene editing technologies such as CRISPR/Cas9, pheromone/ kairomone studies and deployment of remote sensing technology for pest management, development of disease/pest prediction models, determination of factors leading to evolution of pests and pathogens, development of technologies to minimize the adverse effect of climate	A Brain storming may also consider prioritizing the research in the recommended areas of biotic stresses and bio-threat mitigation to counter challenges to crop biosecurity. We may also invite relevant officials/ scientists of DIHAR, Chandigarh and DIBAL, Leh of DRDO, who are also conducting research on 'bio-threat mitigation' of crops.	Suggested institutes will be invited in brain storming. As per this recommendations, new research projects related to development of super donar in rice for BLB, Blast and BPH tolerance, isolation of biotic stress induced promoters, biocontrol (Trichogramma and Bt), gene pool profiling of genetic resources and agroecology have been initiated at the institute in project mode. Training on techniques like CRISPR, Nanotechnology, remote sensing are required (list of identified laboratories attached as Annexure 6) However the ICAR may expedite the placement of expert scientific manpower to cover these all aspects.

	change on biotic stresses of plants.		
6	**Human Resource Development** Considering the urgent need of the country to develop quality human resource for managing biotic stresses, which are evolving in alarming proportion, the Council is advised to encourage NIBSM in developing MoUs with the centres of excellence in different areas of biotic stress in the country and abroad for joint post-graduate and doctoral programmes.	Under existing Umbrella MOUs with countries having advanced crop bio-security systems like that in Australia and USA, NIBSM may explore and prepare work plan with relevant Institutes.	Prospective National and international institutes have been identified for collaboration. Details attached as Annexure 7
		NIBSM may identify relevant areas of biotic stresses and bio-threat mitigation for specialized trainings in areas of nanotechnology, robotics, genomics, diagnostics and detection, smart application technologies, etc. List of Labs/countries with names of scientists requiring specialized training may be prepared and sent to ADG (HRM) through SMD.	Priority areas identified and after getting necessary approval of EFC and HQ, the programme shall be executed (Annexure 6) List is attached as Annexure 6 and proposal will be submitted to the Council.

14. A report on the status of various O & M reforms:

Implementation of FMS-PMS system

The NIBSM completed the installation of the software and staff-training by IBM during January 2015. All current institute activities are operated through this system since then.

Registration of PERMISNET

The NIBSM has registered in October 2014 in the PERMISNET of IASRI. Suitable skill-orientation and training have also been given to its scientists.

Wi-fi network connectivity

The NIBSM strived hard to put in place high-speed wi-fi connectivity.

Implementation of NIBSM new website

- Implementation of MIS-FMS system at NIBSM Establishment of E-Connectivity (Telephone and Internet connectivity).
- NIBSM became member of Consortium of E-Resources in Agriculture (CERA) and J-Gate.
- The new web page of National Institute of Biotic Stress Management, Raipur was designed and implemented in July 2015 on web address www.nibsm.org.in.
- The new web page is designed to provide the information about the institute, schools, staff, latest announcements, publication repository and links for various portals related to NARS system namely, KRISHI, CERA and ICAR mail etc. NIBSM.

Establishment of E-Connectivity (Telephone and Internet connectivity)

To provide telephone and internet connectivity at NIBSM, Baronda campus, communication centre with air conditioning facility was established having modern equipments for EPBAX and internet connectivity. The campus is well connected with BSNL broadband connectivity having static IP addresses and became fully operational for global connectivity.

Setup of molecular biology and biotechnology laboratory

To initiate research work in the newly established institute, basic laboratory facilities for microbiology and molecular biology work was created that includes – 20℃ deep freezers and -80℃ ultra low deep freezers, PCR machine, BOD incubator, micro-centrifuge, real-time PCR and gel documentation systems.

Media archive

The institute is in the process of developing media archiving of its activities.

NIBSM publications

The institute has brought out four Annual Reports and Nine Newsletters. In addition, scientists of NIBSM published five research papers, one review paper, 11 abstracts, three training manual, eight extension folders and 10 guest lectures.

Research Papers

1. Kumar, J. 2016. A comparative prelude on wheat rusts in India. *Indian Phytopathology.* 69: 328-339
2. Murali Baskaran, R. K., K. C. Sharma and Jagdish Kumar. 2017. Seasonal and relative abundance of stem-borer and leaf-folder in wet land rice eco-system. *Journal of Entomology and Zoology Studies*. 5(2):879-884.
3. Jeer, M., V. K. Choudhary and Anil Dixit. 2017a. Field efficacy of new pre-mix formulation of Flonicamid 15% + Fipronil 15% WG against major insect pests of Rice. *Journal of Entomology and Zoology Studies* 5(3): 679-685.
4. Jeer, M., V. K. Choudhary and Anil Dixit. 2017b. Effect of pre-mix combination of Acephate and Imidacloprid on insect pests of rice and their natural enemies. *Journal of Entomology and Zoology Studies* 5(3): 1272-1278.
5. Choudhary, M., Choudhary, B.K., Bhoyar,S., Kale, S. B., Chaudhari, S. P., Bera, B. C., Jain, A. and Barbuddhe, S. B. 2017. First isolation of Leclercia adecarboxylata from Animal clinical case. *Letters in Applied Microbiology*. 66: 44-48

Review papers

1. Murali Baskaran, R. K., K. C. Sharma, P. Kaushal, J. Kumar, P. Parthiban, S. Senthil-Nathan and R. W. Mankin. 2017. Role of kairomone in biological control of crop pests-A review. *Physiological and Molecular Plant Pathology*. 101:3-15.

Abstracts

1 Dixit, A. And Choudhary, V.K. 2014. Weed- a biotic constraint in soybean productivity. In: International soybean research conference on mitigating

productivity constrainst in soybean for sustainable agriculture. 22-24 Feb, 2014, held at Indore.

2 Barbuddhe, S. B. 2016. Biotic stress factors: impact and mitigations in poultry health and welfare, Abstract 123-125 pp. In: National Symposium on poultry health and welfare: Riding the wave to the future during October 20-21, 2016, held at ICAR-CCARI, Old Goa.

3 Barbuddhe, S. B., A. D. Pathak, A. V. Raorane, L. Jain, M. Choudhary, N. V. Kurkure and S. P. Chaudhari. 2016. Human brucellosis in India: Systematised review and Meta analysis. Abstract (OS2-1). In: Brucellosis 2016, International Research Conference during November 17-19, 2016 held at New Delhi.

4 Barbuddhe, S., S. V. S. Malik, D. Kalorey and T. Chakraborty. 2016. Epidemiology of listeriosis in Indian subcontinent, Abstract 51p. In: ISOPOL XIX International Symposium on Problems of Listeriosis during June 14-17, 2016 held at Paris.

5 Choudhary, B. K., M. Choudhary and S. B. Barbuddhe. 2016. Fish diseases and its biotic stress management, Abstract 175-181 pp. In: Veterinary Pathology Congress-2016 and National Symposium on "Innovative approaches for Diagnosis and Control of Emerging and Re-emerging Diseases of Livestock, Poultry and Fishes" during November 09-11, 2016 held at College of Veterinary Science and A.H., Anjora, Durg.

6 Choudhary, B. K., M. Choudhary and S. B. Barbuddhe. 2017. Impact of climate change on fisheries nurseries and hatchery of Chhattisgarh, Abstract 245 p. In: XIII Agricultural Science Congress-2017 during February 21-24, 2017 held at University of Agricultural Sciences, Bengaluru.

7 Choudhary, V. K. 2016. Biotic Stresses in crops with special reference to weed management, Extended Summary 480-484 pp. In: Session of Abiotic and biotic stress (weeds) management at 4th International Agronomy Congress on "Agronomy for Sustainable Management of Natural Resources, Environment, Energy and Livelihood Security to Achieve Zero Hunger Challenge" during 22nd -26th November 22-26, 2016 held at New Delhi.

8 Jain, L., V. Kumar, S. Chaturvedi, G. Roy, S. B. Barbuddhe and M. Choudhary. 2016. Seroprevalence of brucellosis in bovines of Chattisgarh region, Abstract 174 p. In: Brucellosis 2016, International Conference November 17-19, 2016 held at NASC complex, New Delhi, India.

9 Jain, L., V. Kumar, S. Chaturvedi, G. Roy, S. B. Barbuddhe and M. Choudhary. 2017. Seroprevalence of leptospirosis in bovines of Chhattisgarh region, Abstract 184 p. In: National symposium on "Challenges in animal health for higher productivity and income to farmers" on February 10-12, 2017 held at

Nagpur.

10 Kumar, V., L. Jain and S. Chaturvedi. 2017. Exploring endophytic microbes in Rice (*Oryza sativa L.*) for enhanced crop nutrition and biotic stress management, Abstract 56 p. In: National Conference on Emerging Trends in Agricultural Sciences and its Impact on Sustainable Livelihood, during February 25-26, 2017 held at Shobhit University, Meerut.

11 Mallikarjuna, J. 2017. A first report of rice root-knot nematode, *Meloidogyne graminicola* in rice (*Oryza sativa* L.) from Chhattisgarh, Abstract 73 p. In: National symposium on Climate smart agriculture for Nematode management during January 11-13, 2017, held at ICAR-Central Coastal Agricultural Research Institute, GOA.

12 Sivalingam, P. N., K. C. Sharma, S. K. Jain and V. K. Choudhary. 2016. Prevalence of begomoviral diseases in crop plants of Chhattisgarh state in India, Abstract 96 p. In: Proceedings of 8th International Geminivirus Symposium & 6th International ssDNA Comparative Virology Workshop during November 7-10, 2016 held at New Delhi.

Training Manuals

1. Barbuddhe, S. B., N. V. Kurkure, V. Kumar, L. Jain, S. Kale, S. Bhoyar, S. P. Chaudhari and D. B. Rawool. 2017. ISO methods for detection of *Listeria monocytogenes* and introduction to PFGE analysis, 67p.
2. Barbuddhe, S. B., V. Kumar, L. Jain, D. B. Rawool, N. B. Kurkure, S. Kale and L. R. Chatod. 2016. Training Manual on "Methods for detection of food-borne pathogens from food and clinical samples with special reference to *Listeria monocyte-genes*", 61p.
3. Barbuddhe, S.B., Kurkure, N.V., Chaudhari, SP., Poharkar, K.V and Kale, S.B 2015. Training manual for National Workshop on "Molecular subtyping of microbes using Pulse Field Gel Electrophoresis".

Extension Folders

1. अनिल दीक्षित एवं व्ही.के. चौधरी 2014 धान के प्रमुख खरपतवार एवं उनका प्रबंधन विस्तार पत्रिका क्र.–1, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।
2. अनिल दीक्षित, व्ही.के. चौधरी एवं मल्लिकार्जुन 2014 धान के कीटों का समेकित विस्तार पत्रिका क्र.–2, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।
3. अनिल दीक्षित एवं व्ही.के. चौधरी 2014 गेहूँ की उन्नत खेती एवं खरपतवार नियंत्रण विस्तार पत्रिका क्र.–3, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।

4. अनिल दीक्षित, व्ही.के. चौधरी एवं मल्लिकार्जुन 2014 दलहनी फसलों में फलीछेदक कीट प्रबंधन विस्तार पत्रिका क्र.–4, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।
5. अनिल दीक्षित एवं व्ही.के. चौधरी 2014 फसलों में खरपतवार प्रबंधन विस्तार पत्रिका क्र.–5, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।
6. अनिल दीक्षित एवं व्ही.के. चौधरी 2014 सब्जियों में खरपतवार प्रबंधन विस्तार पत्रिका क्र.–6, राष्ट्रीय जैविक स्ट्रैस प्रबंधन संस्थान, रायपुर (छ.ग.)।
7. अनिल दीक्षित एवं विजय कुमार चौधरी, 2016– सब्जियों में खरपतवार प्रबंधन।
8. के.सी.शर्मा एवं आर.के.मुरली बास्करन, 2016– फेरोमोन प्रपंच एक प्रभावी हथियार द्वारा धान में पीला तना छेदक कीट का कम लागत पर प्रबंधन।
9. संजय कुमार जैन, विजय कुमार चौधरी, पंकज कौशल एवं जगदीश कुमार, 2016– छत्तीसगढ़ में धान की फसल के प्रमुख रोग एवं उनका प्रबंधन।
10. अनिल दीक्षित एवं विजय कुमार चौधरी, 2016– कांस का समन्वित नियंत्रण।
11. अनिल दीक्षित, विजय कुमार चौधरी एवं मल्लिकार्जुना जे., 2016– धान के नाशीकीटों का समन्वित प्रबंधन।
12. विजय कुमार चौधरी एवं अनिल दीक्षित, 2016– धान की फसल में समेकित खरपतवार प्रबंधन।
13. ममता चौधरी, एस.बी.बारबुद्धे एवं लता जैन, 2016– दुधारू पशुओं के प्रमुख संक्रामक रोग एवं उनके निराकरण।
14. विनोद कुमार चौधरी, ममता चौधरी, एस.बी.बारबुद्धे एवं विजय कुमार चौधरी, 2016– समेकित मतस्य पालन में मछलियों के प्रमुख रोग, लक्षण एवं प्रबंधन।

Repository Deposition

1. Barbuddhe, S. B. 2016. New species of *Listeria, Listeria goanensis* has been registered at Microbial Culture Collection (MCC), NCCS, Pune with accession No. 3285 and at VTCC, Hisar with accession No. VTCCBAA864 (32 accessions).
2. Kumar, V., L. Jain, S. Chaturvedi, S. K. Jain and P. Kaushal. 2017. Isolation and characterization of bacterial endophytes from Rice (*Oryza sativa* L.) https://www.ncbi.nlm.nih.gov/Genbank/update.html
3. Kumar, V., L. Jain, S. Chaturvedi, S. K. Jain and P. Kaushal. 2017. *Bacillus stratosphericus* strain NIBSM_OsG4 16S ribosomal RNA gene, partial sequence. Accession No: KY962816 available at: https://submit.ncbi.nlm.nih.gov/subs/genbank/? search=SUB2594421
4. Jain, S. K., Vinay Kumar, Lata Jain, P. Kaushal deposited one isolate of *Sclerotium rolfsii* in each of rice (NIBSMPPF-1; 8218), wheat (NIBSMPPF-2;

8219) and chickpea (NIBSMPPF-3; 8220) in ITCC during 2017

5. Kumar, V., L. Jain, S. Chaturvedi, S. K. Jain and P. Kaushal deposited 20 bacterial endophytes from pigeonpea (*Cajanus cajan* L.) and nine bacterial endophytes from lathyrus (*Lathyrus sativus* L.) in Genbank, National Center for Biotechnology Information (NCBI) during 2017, https://www.ncbi.nlm.nih.gov/Genbank/update.html

Guest Lectures/Radio Talk

1. Anil Dixit. 2016. A lecture on Role of weed management in quality seed production under PPV & FRA to farmers on August 22, 2016, organized by KVK, Rajnandgaon and College of Horticulture, IGKV, Raipur
2. Choudhary, V. K. 2016. Radio talk on 'Dhaan phasal me kharpatwar Niyantran' on July 17, 2016.
3. Mooventhan, P. 2016. Presented the country paper (India) and ICAR (NARS) paper at "Innovative Agricultural Extension Systems to Improve Farm Productivity and Income" during 25 - 29 July 2016 at Manila, Philippines, sponsored by Asian Productivity Organization (APO), Tokyo, Japan and implemented by DAP, Pasig City, Philippines.
4. Mooventhan, P. 2016. Delivered a lecture on Interactive e-knowledge tools at mExtension: "all-in-one" Mobile Phones for Agricultural Extension on September 15, 2016 at Agricultural College and Research Institute, Madurai, TNAU, Tamil Nadu.
5. Kumar. V. 2017. Presented A lecture on "Introduction to molecular techniques for detection of food-borne pathogens" in the workshop on "ISO methods for detection of *Listeria monocytogenes* and introduction to PFGE analysis" during March 16-18, 2017 held at Nagpur Veterinary College, Nagpur.
6. Sharma, K. C. 2017. A lecture on Major insect pests of Chhattisgarh and their management to Agricultural Input Dealers on January 04, 2017, organized by State Agriculture Management and Extension Training Institute (SAMETI), Raipur.
7. Sivalingam, P. N. 2017. A lecture on Diseases of important agricultural crops and their management to Agricultural Input Dealers on January 04, 2017, organized by State Agriculture Management and Extension Training Institute (SAMETI), Raipur.
8. Anil Dixit. 2017. A lecture on Integrated weed management for managing biotic stress to farmers on March 03, 2017, organized by Central Integrated Pest Management Centre, Raipur

9. Anil Dixit. 2017. A lecture on Integrated weed management for pulses production to farmers on March 28, 2017, organized by KVK, Rajnandgaon and College of Horticulture, IGKV, Raipur
10. Sivalingam, P. N. 2017. A lecture on scientific research paper writing to under graduate and post graduate students of biotechnology on April 13, 2017 at Amity Institute of Biotechnology, Raipur.

NIBSM Library

The institute has established CERA connectivity and has commenced utilizing this service. The institute library has been commenced. The procurement of scientific books and journals are in progress. The periodicals and other general publications are also initiated. Special attention on the procurement of scientific books in national language is given. The ICAR journals are subscribed.

STAFF AMENITIES

15. Facilities available for staff including housing in campus, travel office, education facilities for children, etc.:

The above column is not applicable right now as all scientific and non-scientific staffs are residing at Raipur.

16. Participation of scientific staff in National and International Conferences (give details and problems and suggestions for the future)

1 Barbuddhe, S. B. 2016. Attended 24th meeting of ICAR Regional Committee No. VII during September 08-09, 2016 held at the International Centre, Goa.
2 Barbuddhe, S. B. 2016. Attended National workshop to formulate National Action Plan on Antimicrobial Resistance during December 05, 2016, organized by Food and Agricultural Organization, New Delhi.
3 Choudhary, B. K. 2017. Attended a National workshop on "ISO Methods for detection of *Listeria monocytogenes* and introduction to PFGE analysis" held at Nagpur Veterinary College organised under the ageis of Translation Centre for Molecular Epidemiology of Listeria monocytogens, during March 16-18, 2017, sponsored by DBT organised by ICAR-NIBSM, Raipur and Nagpur Veterinary College, Nagpur.
4 Choudhary, M. 2017. Attended a National workshop on "ISO Methods for

detection of *Listeria monocytogenes* and introduction to PFGE analysis" held at Nagpur Veterinary College organised under the ageis of Translation Centre for Molecular Epidemiology of Listeria monocytogens, during March 16-18, 2017, sponsored by DBT organised by ICAR-NIBSM, Raipur and Nagpur Veterinary College, Nagpur.

5 Choudhary, M., S. B. Barbuddhe, B. K. Choudhary and J. Lata. 2016. The first report of concurrent infections of Contagious Ecthyma and Blue Tongue in Goats of Balod district in Chhattisgarh. In: Veterinary Pathology Congress-2016 and National Symposium on "Innovative approaches for Diagnosis and Control of Emerging and Re-emerging Diseases of Livestock, Poultry and Fishes" during November 09-11, 2016, held at College of Veterinary Science and A.H., Anjora, Durg.

6 Kumar, V. 2016. Attended Workshop for the Nodal Officers of the Public Authority related to RTI Online Portal of DoP&T, RTI Request/Application & Appeal Management System (RTI-MIS) at ICAR Institutes on October 21, 2016 held at NASC Complex, New Delhi.

7 Kumar, V. 2017. Attended National Conference on Intervention of Climatic Change in Sustainable Development of Agriculture, Food and Nutrition Security and its Amelioration during March 24-25, 2017 held at Swami Vivekanand Subharti University, Meerut.

8 Kumar, V. 2017. Attended 2nd Workshop of Nodal Officers of KRISHI-Knowledge Based Resources Information Systems Hub for Innovations in Agriculture (Management of ICAR Research Data Repository for Knowledge Management initiative during January 24-25, 2017 held at NASC Complex, New Delhi.

9 Kumar, V., Y. M. Shukla, R. S. Fougat, L. Jain and C. G. Joshi. 2017. Attended Differential expression of defence and pathogenesis related genes in response to downy mildew stress condition in Isabgol (*Plantago ovata* Forsk), In: National Conference on Intervention of Climatic Change in Sustainable Development of Agriculture, Food and Nutrition Security during March 24-25, 2017 held at Swami Vivekananda Subharti University, Meerut.

10 Kumar. V. 2017. Attended National Conference on Emerging Trends in Agricultural Sciences and its Impact on Sustainable Livelihood on February 25-26, 2017 held at Shobhit University, Meerut.

11 Mallikarjuna, J. 2017. Attended XIII Annual Group meeting of AICRP Nematodes during February 24-25, 2017 held at Indian Statistical Institute, Kolkata.

12 Mooventhan, P. 2017. Attended XIII Agricultural Science Congress – 2017

during February 21-24, 2017 held at UAS, GKVK, Bengaluru.

13 Murali Baskaran, R. K. 2016. Attended ICAR-DRMR 23rd Group Meeting on Rapeseed-Mustard Research during August 5-7, 2016 held at Pandit Deen Dayal Upadhaya Pashu Chikitsa Vigyan Vishwa Vidhyalaya Evam Go Anusandhan Sansthan, Mathura.

14 Murali Baskaran, R. K. 2017. Attended Two-day workshop on 'Farmer FIRST Programme' during January 08-09, 2017 held at NIBSM, Raipur.

Problems and Suggestions by the Scientists

Mr. Yogesh M. Yele undergone a training entitled "New Frontiers in biotic stress management for doubling farmers income". Training was organized by ICAR- National Institute of Biotic Stress Management, Raipur during the period September11-20, 2017. Further, he expressed that training was very helpful for overall understanding about the new era techniques which can be used for sustainable pest management. No such problems were faced during the training. Training duration could have been increased and practical parts should be included in training.

Dr. Sridhar undergone a training entitled "Identification, mass production and utilization of parasitoids, predators and entomopathogens for sustainable insect pest management" December 4-10, 2017 to be held ICAR-NBAIR, Bengaluru.Further, he expressed that hands-on training on parasitoid identification (slide preparation, mounting could have been highlighted)

Dr. P. Mooventhan, attended the training course on "Innovative Agricultural Extension Systems to Improve Farm Productivity and Income" from 25 - 29 July 2016 at Manila, Philippines, sponsored by Asian Productivity Organization (APO), Tokyo, Japan and implemented by DAP, Pasig City, Philippines. He has presented the country paper (India) and ICAR (NARS) details at Development Academy of the Philippines (DAP). There were twenty-six delegates invited from fourteen countries representing Cambodia, China ROC, Fiji, India, Indonesia, IR Iran, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam. There were two delegates from India; Dr. P. Mooventhan represented the Indian Council of Agricultural Research in the above said event. To his credit, he was awarded for achieving best performance in post training evaluation exam of the above said training course. Further, he expressed that duration of training period maybe increased.

17. Sports, recreational research and vocational health facilities to the staff

S. No.	Year	Name of Sports	Participants
1	**2013-14** 16-20 September, 2014 (NBSS & LUP, Nagpur)	1. Chess, Badminton 2. Chess 3. Badminton 4. Badminton 5. Football, Badminton, Carom 6. Table Tennis	Dr. Anil Dixit, Chief De Mission Dr. Mallikarjuna J. Dr. V.K. Choudhary Dr. S.B. Barbuddhe Sh. Saguni Paswan Mr. Vinayak Bhiwapurkar
2	**2014-15** 7-11 December, 2015 (DWR, Jabalpur)	1. Badminton 2. Carom 3. Discuss Throw & Golf 4. Chess & Carom 5. Volley Ball & Badminton 6. Chess 7. Table Tennis 8. Carom & Badminton	Dr Anil Dixit, Chief De Mission Dr. S.K. Jain Dr. K.C. Sharma Dr. V.K. Choudhary Dr. P. Mooventhan Dr. Mallikarjuna J. Sh. V.D. Bhiwapurkar Sh. Saguni Paswan
3	**2015-16** 8-12 November, 2016 (IARI, New Delhi)	1. Badminton 2. Chess 3. Badminton 4. Carom, Badminton	Dr. Anil Dixit, Chief De Mission Dr. Mallikarjuna J. Dr. K.C. Sharma Sh. Saguni Paswan
4	**2016-17** 10-13 November 2017 (CIAE, Bhopal)	1. Badminton 2. Chess 3. Badminton 4. Carom, Badminton	Dr. Anil Dixit, Chief De Mission Dr. Mallikarjuna J. Mr. Yogesh Yele Sh. Saguni Paswan

LINKAGE

18. Collaboration with others

a. Local institutions in the area, (educational, research and infrastructural facilities):

S. No.	Participating Institutes	Purpose
1	Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)	Research activities
2	Chhattisgarh Kamdhenu Vishwavidyalaya, Durg (C.G.)	Research activities
3	Nagpur Veterinary College, Nagpur (M.H.)	Research activities

b. National institutes and Agricultural Universities

S. No.	Participating Institutes	Purpose
1	AICRP networks	Nematodes, other crops
2	NRRI, Cuttack	Rice pest repository and characterization, pyramiding and stacking of genes in rice
3	IIVR, Varanasi	Germplasm screening for biotic stress tolerance Interspecific hybridization Developing differentials sets
4	NIASM, Baramati	Stress tolerance/Stress tolerance/(core) germplasm collections Interspecific hybridization Nano-biosensors for stress induced molecules
5	NBPGR, New Delhi	Screening for biotic tolerance in core collections
6	IARI, Pune	Collection of virus and vectors, alternative hosts, molecular virology
7	MANAGE, Hyderabad	m Extension for technology transfer
8	IARI, New Delhi, Navsari Agricultural University, Rajasthan, TNAU, Coimbatore	Introgression of alien genes for enhanced pigeonpea resistance/tolerance to pod borers
9	Indian Institute of Millet Research, Hyderabad	Germplasm screening for biotic stress tolerance in minor millets
10	National Bureau of Agricultural Insect Resources, Bengaluru, Indira Gandhi Krishi Vishwavidhyalaya, Raipur	Microbial and Insect Bio-systematic and Adaptive research

c. International institutions:

S. No.	Participating Institutes	Purpose
1	ICRISAT, Hyderabad	Germplasm Exchange
2	IRRI, Manila, Philippines	Germplasm Exchange

d. Extension and development agencies:

➢ Research-Extension linkages:

The ultimate objective of both research and extension systems is to increase agricultural production. Their roles of generating and transferring technology are complementary. Research institutions need to have information on the problems, technology requirements and socio-economic and ecological environment of producers to formulate research agendas and to set priorities. Formulating a research agenda based on producers' requirements results in technology that will be more acceptable to users; this also leads to research institutions allocating their resources more efficiently. Researchers may also have to interact with producers on a continuing basis during the process of technology generation. Extension services can provide research institutions with information on research requirements and play a mediatory role between farmers and researchers. Extension services require a continuous flow of information from research institutions on new and improved practices. Therefore, an efficient two-way communication process is necessary for generating and transferring technology effectively. The success of the two-way communication is determined mainly by the effectiveness of linkage between research and extension institutions.

➢ Usefulness of extension activities:

The role of extension services is invaluable in teaching farmers how to improve their productivity. Extension is also critical to move research from the lab to the field and to ensure a return on investment in research by translating new knowledge into innovative practices. Extension starts with knowledge management and ends up with human enrichment. Agricultural extension by its nature has an important role in promoting the adoption of new technologies and innovations. Agricultural extension brings about changes through education and communication in farmers attitude, knowledge and skills. The role of agricultural extension involves dissemination of information, building capacity of farmers through the use of a variety of communication methods and help farmers make informed decisions. The extension services can play a crucial role in providing information on sustainable agricultural education. Thus, the role of extension is very important to support sustainable agriculture which is moving from production to a wider set of sustainability. The major usefulness of extension activities is listed below.

Extension

- Uses democratic methods in educating the farmers.
- Helps in adoption of innovations.
- Helps in studying and solving the rural problems.
- Increases farm yields and improve the standard of living of farmers
- Makes good communities better and progressive.
- Contributes to national development programmes

The areas indicating scope of Extension are listed below:

- Increasing efficiency in agricultural production, marketing, distribution and utilization of agricultural inputs and outputs.
- Conservation, development and use of natural resources.
- Proper farm and home management
- Better family living.
- Youth development.
- Leadership development.
- Community and rural development.
- Improving public affairs for all round development.

➢ Suggestions for further improvement:

Extension is more than it used to be. Its function and tasks are increasingly assumed by multiple public and private organizations. In developed countries, and in countries where extension reform has been pursued, pluralistic involvement of extension providers now exists - including non-profit non-governmental organizations (NGOs), for-profit private companies, rural producer organizations (RPOs), private advisers, as well as national, state and municipal extension services. The following suggestions may helpful to improve the extension services.

- Agricultural extension reform requires policy vision and determination, and a nationwide strategy that can be implemented.
- A multisectoral extension network offers an inclusive approach to rural development.
- Reverse the top down attitude of extension agents and managers toward farmer groups in need of food security.

- Strengthen the human resource capacity of poor farmers' organizations.
- Help poor farmers gain access to capital.
- Governments should develop a new and expanded policy agenda for agricultural extension and communication for rural development focusing national attention on food security and income generation of the rural poor.
- Establish alliances with all sectors.
- A pluralistic institutional framework would mandate that programmes be planned, implemented and evaluated jointly by multisectoral service providers on a location specific basis in cooperation with farmers.
- Enable a private sector of competitive extension providers.
- Public financing is critical at the beginning.
- Competitive and contractual mechanisms are two useful approaches to allocating public funds for agricultural extension.
- Community-driven development funds offer an opportunity for funding extension for agricultural as well as related activities aimed at rural development.
- Create social safety nets.
- Organize a national conference and local workshops involving relevant public sector agencies, NGOs, producer organizations, private sector representatives and commodity groups, as well as donors.
- Adopt a nationwide strategy.
- Promote demand-driven agricultural extension.
- Create agricultural development teams to respond to community-expressed needs.
- Promote capacity building of all advice providers and users.
- Establish and Maintain Links between Policy Makers, Support Services, Small Farmers and Markets.
- Establish a national programme to monitor and evaluate programmes, especially for the purposes of upscaling.

  Promote linkages between institutional and ICT as well as personal networks.

➢ Summary of Annual reports

• Annual Report Executive Summary 2013-2014

The oversight committee on the implementation of the new reservation policy in higher educational institutions chaired by Shri Veerappa Moily recommended the

establishment of National Institute of Biotic Stress Management (NIBSM). The Institute was established at Baronda, Raipur, Chhattisgarh on 7th October, 2012 when its Foundation Stone was laid by Hon'ble Union Minister for Agriculture and Food Processing Industries, Shri Sharad Pawar in the presence of Hon'ble Chief Minister of Chhattisgarh Dr Raman Singh, Dr. Charan Das Mahant, Minister of State for Agriculture and Food Processing Industries, Govt. of India, Minister of Agriculture, Chhattisgarh Govt., Shri Chandra Shekhar Sahu , Dr. S . Ayyappan, Secretary, Department of Agriculture Education and Research & Director General, ICAR and host of senior officials of the ICAR, Indira Gandhi Krishi Vishwavidyalaya and Chhattisgarh government. The Expenditure and Finance Committee chaired by Expenditure Secretary, Ministry of Finance approved its 12th five year plan outlay for 121.10 cr. on 3rd March, 2012 and the Cabinet approval was subsequently granted in May, 2012.

The Chhattisgarh government had handed over 50.179 ha land, the erstwhile Dr. R.H. Richharia Research Station and Instructional Farm, Baronda of the Indira Gandhi Krishi Vishwavidyalaya to NIBSM. The land is fertile and has various edaphic and pedological characteristics that can be utilized in the biotic stress research on crops and animals. The development activity of campus of NIBSM has been initiated. The construction of compound wall with basalt rock of the main campus has been started and the work is expected to be completed by July, 2014. The planning to develop Master Plan of the institute with insight into state of the art facilities are being planned for research platforms in cutting edge areas of inter-disciplinary research in biotic stress management. This Institute shall be headed by Director, who is equivalent in position to the Deputy Director General in ICAR. The NIBSM shall have four schools, viz., Health Management, Health Biology Research, Stress Resistance System Research and Policy Support Research. The Expert Consultation to discuss the way forward of the NIBSM, Raipur was organized on 11th June, 2013 in New Delhi under the Chairmanship Dr. S. Ayyappan, Secretary, DARE and Director General, ICAR to bring out the road map of NIBSM. The participants provided significant suggestions for the future course of NIBSM. NIBSM has signed MoU with Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur for research and teaching. Dr T.P. Rajendran, the then Assistant Director General (Plant Protection) was given additional charge as Officer on Special Duty (OSD) of NIBSM w.e.f. 10th October, 2012 and after his superannuation continued as Officer on Special Duty (OSD). Shri V.D. Bhiwapurkar joined as Administrative Officer. Presently, one principal scientist Dr. Anil Dixit and two scientists namely, Dr. V.K. Choudhary and Dr. Mallikarjuna J., have been posted at NIBSM. The Institute conducted research trials on influence of integrated weed management on productivity and weed dynamics of transplanted rice and comparative performance of recommended rice varieties for weed suppression ability. The Institute carried out rodent management campaign at NIBSM

campus during rabi season. The Institute organized training on "biotic stress management in crops" from 27th February to 3rd March 2014 for the farmers of Nanded district, Maharashtra. The Institute also conducted an outreach programme on weed intensity and crop loss in wheat in selected villages of Kawardha district of Chhattisgarh state. The Institute participated in Krishi Vasant 2014 held at Central Institute of Cotton Research, Nagpur and in Kisan Mela organized by Indira Gandhi Krishi Vishwavidyalaya, Raipur.

- **Annual Report Executive Summary 2014-2015**

The National Institute of Biotic Stress Management (NIBSM) has been strengthened in terms of scientific manpower. It also progressed in terms of completion of land use survey by ICAR-National Bureau of Soil Survey and Land Use Planning that provided major indicators of land use patterns of NIBSM. The campus development was in good vigour with the efforts to appoint a Project Management Consultant through seeking tender bids from public construction companies to develop the Master Plan of the Institute and execute that during the plan period. The institute has received an impetus in integrating animal health with crop health and thereby human health under 'one health plan' of Indian farms in the teeming villages. Biotic stresses caused by weeds in rice-wheat cropping system was studied during 2014-15. The weed density, dry biomass and dominance were significantly influenced by the application of nutrients.

Adaptations of weeds against chemical weed management practices were studied in direct seeded rice. Among the herbicide treatments, bispyribac sodium treated plots @ 10% SL @25 g/ha had the lowest weed density and dry biomass of weeds followed by those treated with fenoxaprop 9.3% EC @60 g/ha and 2, 4-D amine salt 58% SL@500 g/ha. Bispyribac Sodium treated plots were suppressed the wide spectrum of weeds over others.

National Institute of Biotic Stress Management initiated the pilot project on rodent control and zoonotic disease management in the state of Chhattisgarh. Capacity enhancement programmes were organized in three batches for officials from development departments. Rodent management campaigns were organized at four identified villages in Raipur and Dhamtari districts in collaboration with Departments of Animal Husbandry, Agriculture, Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Central Integrated Pest Management Centre, KVK, Dhamtari and All India Network Project on Rodent Control, CAZRI, Jodhpur.

A Centre of Excellence and Innovation in Biotechnology (CoE-IBTC) by Department of Biotechnology, Government of India for "Translational Centre for Molecular Epidemiology of *Listeria monocytogenes*" was transferred to the institute. The central component of this programme is the sequencing of genomes of

representative clonally dominant Listeria strains from India, to identify pathogenic traits associated with disease in livestock and humans. Samples of rodent droppings, sewage grown vegetables and meat were collected for isolation of Listeria. A total of 36 Listeria isolates recovered from human (1) and poultry meat (35) were received for confirmation from institutes in India. The *L.monocytogenes* strains from the national repository have been screened for the tolerance limits at different concentrations of salt, different pH and low temperature. A panel of 104 strains was tested for the salt, pH and low temperature tolerance. A total of 37 strains were found to be tolerant to either of stress tested. The strains which exhibited tolerance to at least one of the stress factor were further analysed and revealed a total of 11 pulsotypes. A novel species of Listeria was isolated and characterized. A repository of Listeria strains has been maintained. Isolates of *L. monocytogenes* from different sources were tested for their cytokine induction ability. The dynamics of gene expression of cytokines, IL1β, IL1α, IL6, IL10, INFγ and TNFα was studied after challenging murine macrophage RAW 264.7 cells with *L. monocytogenes*. All the isolates showed differential expression of cytokines mRNAs.

Abundance of bacterial pathogens in ticks collected from bovines was studied using metagenomic analysis. The ticks were identified as *Rhipicephalus microplus* and *Haemophysalis bispinosa*. The bacteria belonging to family Coxiellaceae (57.69%) followed by Moraxellaceae (32.95%) in one sample, whereas, Borreliaceae (24.24%) followed by Paenibacillaceae (19.51%) were detected in another sample.

The institute has conducted various outreach programmes. Social engineering-based community campaign in villages for rodent management during wheat crop season and subsequent summer season instilled confidence in farmers to grow rabi crops in addition to learn about rodent-borne zoonotic diseases such as Leptospira (rat) fever. The bioefficacy and selectivity of herbicides on rice and wheat was demonstrated in different districts of Chhattisgarh under outreach programme. In another programme, 8-10 days after application of Pretilachlor 6% + Pyrazosulfuron 0.15% GR @ 600+15 g ai/ha on transplanted rice noticed with 56.3-73.1% of weed control efficiency. Application of Clodinafop propargyl 15% + Metsulfuron 1% @ 60+4 g ai/ha at 25 DAS on wheat significantly suppressed the wide spectrum of weeds and noticed the weed suppression from 92-455/m2 to 17-57/m2.

- **Annual Report Executive Summary 2015-2016**

The ICAR-NIBSM is moving forward with 16 scientific personnel including the Joint Director (School of Crop Health Biology Research) cum Director (Acting) and Joint Director (Research) representing various disciplines such as agronomy, entomology, pathology, genetics and plant breeding, biotechnology, extension, animal science and fish and fisheries science. The infrastructure such as laboratory equipments,

renovation of old buildings suitable for laboratory and office purpose, improvement in internet accessibility and website, etc have been established during 2015-16.

During the period of report eight institutionally funded projects have been formulated and approved during first Institute research committee meeting under three research programme (i) Crop loss estimation under biotic stress (ii) Biotic stress and nutrient management of crops and (iii) Policy research.

Experiments on yield loss in rice due to insect, disease and weeds suggest that higher yield was recorded in free of all stresses followed by insect and weed free treatments.

Studies on biotic stresses under crop management practices in rice-wheat cropping system showed that incorporation of dhaincha increased 16.4% of grain yield and 37% suppression of weed growth in rice. There was no effect of dhaincha on weed suppression in wheat. Spraying of bispyribac sodium 10% SL @ 250 ml/ha, pinoxsulum 240SC @ 22.5 g/ha, pretilachlor 6% + pyrazosulfuron ethyl 0.15% GR @ 10 kg/acre (commercial dose) along with one hand weeding were found effective and equal to 2 to 3 hand weeding at 20, 40 and 60 DAT. Pyrazosulfuron-ethyl 10 WP suppresses broad leaved weeds and sedges, pendimethalin 30 EC suppresses the emergence of grasses and some broad leaved weeds, whereas, fenoxaprop-p-ethyl 9.3 EC was found effective on controlling grasses. However, 2-4, D and chlorimuron + metsulfuron were effective against broad leaved weeds and sedges. To control wide range of weeds two hand weeding at 15 and 30 DAT and pyrazosulfuron-ethyl 10WP fb bispribac sodium 10SC were found most effective. Application of clodinofop-propargyl 15% + metsulfuron-methyl 1% gave the wide spectrum weed control without any phyto-toxic appearance in wheat plants.

Studies on biotic stress under crop nutrition regimes in rice-wheat cropping system showed that in rice, weed dominancy followed the inverse trend of species richness and was highest with N125% followed by N100%. N125% and N100% found optimum for crop growth and to suppress the weed flora by smothering effect. The highest rice grain yield (6.5 t/ha) was recorded with N125% followed by N100% (6.2 t/ha), and lowest with N0% (3.0 t/ha). Better crop growth under N100 P60 K40 restricted solar radiation transmission resulting in lowered weed seed germination in rice-wheat system. Weed dry weight and weed diversity followed the trend of highest to lowest from control plots (N0P0K0)>K>P> KP>N>NK>NP>NPK. The highest wheat grain yield harvested with N100P60K40 (2.73 t/ha).

Incidences of insect pest and diseases have been recorded during 2015-16 in the experimental farm of ICAR-NIBSM and farmers' field of Raipur district. During kharif, brown spot (60-70%), leaf blast, sheath blight (10-20%) diseases in rice, phyllody (5-10%), charcoal rot, Alternaria leaf spot diseases in sesamum were recorded. During rabi,

brown rust in wheat (low to moderate severity) was observed during the dough stage of the crop, while in the very late-sown wheat (January sown) it was observed with high severity (>80S) at anthesis stage under irrigated condition on cultivar GW273. In chickpea, Fusarium wilt and root rot were the main diseases observed with moderate intensities. High incidence (94%) of leaf crinkle disease followed by 82 % of veinal necrosis and 44 % of yellow mosaic disease of green gram, leaf curl disease in Lathyrus (>93%), tomato (67%), chilli (78%), papaya (8%) and 97 % of ring spot disease of papaya were observed in farmers' field in Raipur district. Incidence of yellow stem borer in rice (5-10%) and pink stem borer in wheat (>15%) were also recorded. The average number of whitefly recorded per green gram plant was 7.9, average population of thrips and leaf hopper on pigeon pea was 10 per flower and 18 per three leaves, respectively.

Bio-efficacy evaluation of "Lancer gold" (Acephate 50% + Imidachloprid 1.8% sp) and new molecule, "UPI 1810" against insect pests of rice showed that Lancer gold (600 + 21.6 g a.i./ha) was found effective against yellow stem borer and leaf folder whereas UPI 1810 (75 + 75 g a.i./ha) effective against brown plant hopper and green leaf hopper. Similarly, UPH 814 @ 2000 g/ha is effective against most of the weeds in direct seeded rice when it was applied at 6-8 DAS and resulted higher yield.

Isolation and characterization of endophytes in pigeon pea was done by cultural and DNA sequencing. Preliminary findings suggested that *Fusarium fujikuroi, Daldinia eschscolzii, Cochliobolus miyabeanus, Macrophomina intermedia* and Gibberella species etc were the fungal and *Pseudomonas spp*, *Rhodococus spp*. etc. were bacterial endophytes present in pigeon pea.

Attempts have been made on identification of microbes associated with reproductive biotic stresses of bovine. Out of 374 serum samples, collected from Rajnandgaon, Dhamtari, Kanker, Sarguja, Raigarh and Durg districts of Chhattisgarh, revealed seroprevalence for brucellosis, leptospirosis and infectious bovine rhinotracheitis was found to be 14.17%, 59.09% and 63.9%, respectively as identified by ELISA and PCR techniques. Nearly 400 serum samples from cattle and buffaloes from different districts of Chhattisgarh were also collected for the estimation of antibody titre against haemorrhagic septicaemia from cattle and buffalos.

In ecological and serological studies of vector-borne zoonotic infections, it was revealed that out of 334 samples (227 from bovines, 89 from humans and 18 from rodents), 30 samples from cattle and 9 samples from humans were positive for leptospirosis, 41 samples from bovines were positive for Q fever as identified utilizing PCR. Metagenomic analysis of ticks revealed higher amount of microflora belonging to the family Coxiellaceae.

Morphological alteration under stress inferred that filament formation could be the one of the mechanisms to overcome the salt stressed environment in Listeria

monocytogenes causing Listerisis. Differential gene expression profiling of L. monocytogenes under stress conditions revealed that the lmo1602 (general stress response gene) and sigB (regulation of virulence and stress related genes) found to be highly up-regulated followed by lmo1601, lmo2748, lmo1416, lmo1642, lmo1284 and lmo0515 involved in general stress response, osmotic stress response and sigma factor regulator gene. Whole genome sequencing of five Listeria isolates is in process.

Survey was conducted on collection of Indian major carps to understand the prevalence of Aeromonas hydrophila from integrated fish farming system of Raipur Districts and adjoining areas. On the basis of pathological and molecular characterization, A. hydrophila was identified as the most common cause of bacterial hemorrhagic septicaemia in fishes.

During the year 2015-16 was mainly focused on establishing infrastructures and reorienting research programmes. Initial research emphasis would be given on generation of data base of biotic stress on crops, livestock and fisheries followed by prioritisation and formulation of research projects on regional and national important biotic stresses to evaluate suitable management strategies for alleviation economic losses caused by them.

- **Annual Report Executive Summary 2016-2017**

The ICAR-NIBSM progressed during 2016-17 with the scientific manpower including two Joint Directors, JD (School of Crop Health Biology Research) and JD (Research) and 14 scientists belonging to various disciplines including Agronomy, Entomology, Pathology, Agricultural bio-technology, Extension, Veterinary, and Fish and fisheries to achieve stupendous twin mandate. A total of 10 institute and three externally funded projects, formulated in a programme mode, covering mandate have been handled by the scientists and of results emanated are summarised below.

More than half-a-dozen monocot and dicot weeds are causing sizable yield loss in low land and direct seeded rice. Some of the practices including the evaluation of new herbicide molecules, nutrient and space management and in situ ploughing of Sesbania were tested to manage the weed flora. Field demonstrations on the application of Pretilachlore 6% + Pyrazosulfuron 0.15% on 5 to 7 days after transplanting of low land rice at Dhamtari, Bilaspur and Raipur district of Chhattisgarh arrested the growth of various weeds by 70 to 90%, besides compensating the yield by 40 to 50% and adoption by 60%.

The weed suppression was highest in Swarna rice, applied with N125 and recommended doses of P&K which recorded the low relative density of broad leaved weeds (29.1 to 44.4%), grasses (23.1 to 51.2%) and sedges (19.8 to 34.4%) along with highest yield of 6.43 t/ha as against 3.6 t/ha in N0. The low land rice grown in situ

Sesbania incorporated fields took lesser time (30%) to establish, coupled with fertilizer and water savings by 27.5 and 40.3%, respectively. Sesbania incorporation also enhanced the grain yield (20.3%) and straw yield (7.1%) by suppressing weed population by 58.7%.

The highest weed control efficiency was recorded with three hand weeding (20, 40 and 60 DAS) followed by two hand weeding (20 and 40 DAS) over the control. Among the herbicides, pendimethalin was effective in suppressing weeds in direct seeded rice, followed by penoxsulam, and pendimethalin fb bispyribac sodium.

In the estimation of yield loss caused by biotic stresses in low land rice, two cultivars (Mahamaya and Swarna) which were kept free from pest, disease and weeds recorded the highest grain yield (6.69 t/ha) while it was 5.64 t/ha in control plots with all biotic stresses. Maximum yield loss was attributed to the presence of weeds.

Out of 50 rice germplasm screened for root-knot nematode, 17 were susceptible while 33 were highly susceptible. None of the germplasm of pigeonpea, mungbean and urdbean was resistant to M. incognita. In chickpea, six germplasm lines were identified as resistant and 63 were susceptible to root-knot nematode. Wheat variety, WH147 and germplasm RWP 2015-15 were found to be resistant against pink stem borer under field condition. Wheat plots applied with K60 + Foliar Si @ 4 ml/l recorded minimum white ear (14%) caused by pink stem-borer.

Seasonal and relative abundance of stem-borer and leaf-folder in low land rice was studied to optimize the time of release of *Trichogramma spp*. for the management of two pests. First catch of female of yellow stem-borer in light trap appeared during 1st week of August 2016 (31st MSW) which caused 1.1% dead-heart, thereafter reached the 1st peak during 3rd week of August 2016 (33rd MSW) and 2nd peak during 4th week of August 2016 (35th MSW) which caused the dead heart, respectively of 3.60 and 3.83%. Leaf-folder damage was low throughout the crop period. Relative humidity and rainfall were positively correlated with trap catches while maximum (26.0 to 29.3°C) and minimum (17.4 to 25.5°C) temperature were positively correlated to damage caused by two insects. Host insects produce characteristic hydro-carbons, fatty acids and proteins which stimulate natural enemies to intensify their search in the near vicinity of the host. An array of chemicals like saturated fatty acid (n-hexadecanoic acid) and certain alkanes (decane, tridecane, tetradecane, octadecane, eicosane, hexatriacontane, tritetracontane, tetratetra-contane) from hexane extract of yellow stem-borer females and β-pinene, α-pinene and caryophyllene from yellow stem-borer damaged plant were detected through GC-MS analysis.

Preliminary information based on the intensive survey in 14 districts of Chhattisgarh including, Raipur, Durg, Bemetara, Kabirdham, Bilaspur Baloda Bazar, Janjgir-Champa, Raigarh, Masamund, Korba, Koriya, Surajpur, Sarbuja, Jashpur of

Chhattisgarh indicated that among the diseases caused by different viruses, Begomovirus are predominant to cause huge economic losses in mungbean, dolichus, pigeonpea, bhendi, sponge gourd, bitter gourd etc, transmitted by whitefly (*Bemesia tabaci*).

Endophytes are microorganisms which live symbiotically with almost all varieties of plant and in turn helping the plant in a number of ways. A total of 32 bacterial endophytes isolated from pigeonpea and lathyrus were identified, characterised and deposited at NCBI, USA. Endophytic bacteria were found in all parts of rice plant with a significantly higher density in the root, stem and leaves. 16S ribosomal RNA gene sequences of 32 bacterial endophytes were submitted and accessioned at NCBI.

Studies on the vector borne zoonotic infections in Chhattisgarh revealed that nineteen samples from goats were positive for Q fever as identified through PCR analysis. None of the rodent and human samples was positive for Q fever and leptospirosis when tested by ELISA and latex agglutination test. Morphological alteration under stress inferred that filament formation could be the one of the mechanisms to overcome the salt stressed environment in *Listeria monocytogenes* causing Listeriosis. Differential gene expression profiling of *L. monocytogenes* under stress condition revealed that the lmo1602 gene (similar to general stress protein) showed the highest fold change of 4.96, followed by the sigB (Regulation of virulence and stress-response genes) with 4.26 fold change and the lmo0515 (may involve in general stress response) with 3.68 fold change. Another three genes, the lmo1416 (may involve in high salt stress response), the lmo2748 (similar to YdaG stress protein in Bacillus involved in acid, osmotic stress response) and lmo0889 (Stress of low temperature, osmotic pressure, alcohol and acid) showed >2 fold change. Two genes namely, lmo2461 and lmo0211 were found to be down-regulated, which are known to be cold stress response and high salt stress response, respectively.

Overall prevalence of Haemorrhagic septicaemia in cattle and buffaloes in Chhattisgarh state was recorded to be 44% while morbidity and mortality rate were 13.85 and 7.27%, respectively during the rainy season of 2016. Among the reproductive biotic stresses in bovine of Chhattisgarh, 7.67% seropervalence of brucellosis and 17.75% Brucella infection using bcsp31 gene based PCR were noticed. The prevalence of leptospirosis was not noticed in the serum samples collected from Jagdalpur while it prevailed in the samples collected from Dhamtari, Kanker, Rajnandgaon, Durg and Raigarh. A seroprevalence of 62.07% for the disease, rhinotracheitis was noticed in the serum samples collected from Jashpur and Raipur.

The immune responses of Indian carps to biotic stresses indicated that the cumulative prevalence of Aeromonas spp. was 87% followed by *Escherichia spp*. represented 8% and other strains belonging to *Citrobacter spp*., *Enterobacter spp*.,

Pseudomonas putida, *Klebsiella pneumonia*, *Flavobacterium*, *Alcaligens* and *Roultella ornithinolytica* by 5%, respectively as confirmed by MALDI-TOF MS analysis.

A consolidated interview schedule developed to explore the socio-economic profiling, crop farming details, chemical usage pattern, information need and social issues of farming community. Documentary on mass production of bio control agents (Trichogramma), weedy rice and pheromone technology completed to produce the bilingual instructional videos as content generation activity to prepare the Interactive Educational Multimedia Module.

In Farmer FIRST Programme, Rapid Rural Appraisal (RRA) techniques and surveys were used and field level situation explored. Technological gaps, research problem identification and prioritization done with the target group. Totally, ten capacity building programmes were conducted under FFP and 1084 farmers got benefitted from the cluster of five villages.

The ICAR-NIBSM moved a step ahead by involving in few new initiatives including the data base on national level status of biotic stress and emerging biotic stress, insect bio-diversity in Baronda farm, establishment of linkages with 10 institutes to work on biotic stress management with novelty and procuring and assembling of core germplasms/ entire germplasm and/or alien species in pigeonpea, chickpea, lathyrus, pearlmillet, maize, minor millets, *Vigna spp*. and brinjal.

The final recommendations:

The First Quinquennial Review Team (QRT) meeting of the ICAR- National Institute of Biotic Stress Management, Raipur was held on 24-25th September 2018. The QRT was headed by Dr. Dr S.M.Paul Khurana, Ex-VC, RDVV Jabalpur & Ex Director ICAR-CPRI, Shimla with following members; Dr. V.S.Thakur, Ex VC, Solan, Dr T.P.Trivedi, Ex Director DKMA, Dr. P.S.Naik, Ex Director IIVR Varanasi, Dr. Rajesh K. Rana, ATARI Ludhiana and Dr. Anil Dixit, ICAR-NIBSM as a Member Secretary.

In the beginning the Chairman, QRT inaugurated the renovated Training hall cum Library by the gracious presence of the QRT members.

Dr Anil Dixit, Member Secretary welcomed the QRT and highlighted the importance of Quinquennial Reviews (QRs) to provide a mechanism of transparency and accountability to the Governing Body of the ICAR. He briefed about the visits undertook by the QRT to various laboratories/institutes in the country engaged with research on abiotic & biotic stresses in agriculture, especially those working and rated as the model in the related field before recommending the guidelines to be adopted to devise the future technical programme of ICAR-NIBSM, Raipur.

Dr J. Kumar, Director (Acting), explained briefly the developments of the institute including budget utilization, staff position, and construction work at NIBSM.

Dr P. Kaushal Joint Director (Research) presented the research highlights of ICAR-NIBSM, Raipur.

The QRT interacted with individual scientist about their research programme and expectations from the institute.

Dr. S.M. Paul Khurana, Chairperson, in his opening remarks mentioned that ICAR-NIBSM Raipur established as deemed to be University in the area of plant protection research (insects, disease, weeds and nematodes). He emphasized that biotic stresses directly influence the farm productivity for farm prosperity and commercial profitability and therefore, this institute has to play a vital role academically and practically in achieving the excellence. Better linkages and networking should be identified through suitable research programmes in achieving the objectives. The experts emphasized to strengthen the research programme, core competencies among scientists and filling up of staff position to speed up the progress of this institute. The experts visited the research farm and laboratories.

The following points/recommendations emerged during the QRT meet held at Raipur 24-25th September 2018:

Research and Teaching

The institute shall undertake basic and strategic research to provide tools to combat

biotic stresses that occur in the current times as also for those that can arise in future so as to afflict farm profitability.

The institute should work in a systems approach involving plant protection discipline as whole rather than working on an individual commodity basis.

Research on the preemptive, causative as well as epidemiological aspects of biotic stresses in crops using available data base converging genomics/proteomics technologies, bioinformatics, biodiversity, biosecurity assessment to enable plant protection development.

Development of pest distribution map. The GIS based mapping with AICRP data from crop and Plant protection institutes

Development of pest and pathogen study based on cropping system approach.

Development of pest plant interaction forecasting system.

Identify the crops of National importance and develop strategies for their pest management after thoroughly undertaking research gap analysis in Indian NARS and research priorities thereof.

Develop a network programme with a mission mode approach to utilize the germplasm of major crops for identifying sources of resistance and QTLs/genes/alleles using the phenomics and genomics tools.

The linkages and networking may be developed with National and international organizations to meet the set objectives.

Inter-linkages with Directorate of Plant quarantines and NBPGR is important for the institute like NIBSM, Raipur.

KVK's may be utilized for the fine tuning of IPM.

The teaching at NIBSM must be started at the earliest in collaboration with Regional Agricultural Universities & IARI.

Experimental & Research priorities, must be followed up on War footing, as given in the recommendations, to help resolve the National/Regional problems on top priority without further lapse of time.

General

The work focus should be made on the basis of applicability of the science. Therefore, work culture and scientific temperament are important.

NIBSM should come out with matrix with other institutes so that duplication may be avoided. Priority should be fixed for technology development.

Weather based alerts may be issued and linkages developed with Indian Meteorological Department for modeling work.

The work of NIBSM may be adhered to academic and practical approach in achieving the excellence for the stakeholders.

NIBSM has to be a front runner in terms of competency and infrastructure development.

The proposed /approved cadre strength by the RAC must be filled up immediately so that work related to research and education may further be taken up uninterrupted involving the expertise in the created sectional setup. The administrative responsibility given to scientists should be withdrawn and filled those vacant positions immediately for smooth functioning of the institute. Meanwhile the administrative responsibility may be rotated among existing scientists so that work load is shared on equal basis. Regular incumbents including Director must be there to run the Institute in a logical manner.

The following points emerged during the visits of QRT at ICAR-CPRI,Shimla, ICAR-NIASM,Baramati and DRDO-DIHAR, Leh:

Keeping in view the modern trends of research especially in the area of plant protection as reflected in the mandate of CPRI, the QRT visited the different divisions of ICAR-CPRI, Shimla namely crop production, crop protection, crop improvement and interacted with the scientists at ICAR-CPRI.

QRT recommends to install the following facilities of ICAR-CPRI, Shimla at ICAR-NIBSM Raipur also:

Molecular characterization, detection and management of plant pathogens.

Diagnosis and detection of viruses in field samples, tissue cultured materials, and germplasm using ELISA, RT-PCR, NASH, Immuno Electron Microscopy (IEM), and Real Time PCR.

QRT team was also impressed with the various facilities especially the Phonemics' and VIGS (Virus induced gene silencing) Labs at ICAR-NIASM, Baramati. A plan must be worked out for developing the same kind of facility at ICAR-NIBSM, Raipur to which the Chairman and the members also agreed. Hence, the QRT strongly recommends that VIGS facility should be created at NIBSM, while the phenotypic screening may be undertaken in a collaborative mode with NIASM, Baramati.

QRT is of strong opinion that a study on biotic stresses in flowers also must be carried out in collaboration with NIBSM, Raipur and DFR, Pune.

The QRT visited the model farm developed at ICAR-NIASM, Baramati and appreciated well equipped fully developed model research farm for demonstrating soil and water conservation technologies for conducting multi-disciplinary and multi-commodity basic and strategic research on abiotic stresses. The same kind of development is also expected at ICAR-NIBSM, Raipur.

The purpose of visiting by the QRT to DIHAR, Leh the strategic importance of Ladakh due to its geopolitical location between China and Pakistan and possible threat to transboundary pest attack.

QRT of ICAR-NIBSM Raipur was also impressed with the various facilities like advanced farming (Hydroponics technology) for Vegetable production, green house technology for high altitude and scientific museum. A plan must be worked out for installing the same kind of museum facility in the area of plant protection at ICAR-NIBSM, Raipur in which all the members also agreed. The QRT hopes that biotic and abiotic study in collaboration with DIHAR and NIBSM, may be worked out.

Overall the QRT taken a note of that institute is in infancy but growing up with bright scientists are on roll. Nevertheless, its mandate and objectives are not easy to achieve quickly in view of poor facility made available so far.

Dr. Anil Dixit Member Secretary coordinated and proposed the vote of thanks to the Chair for the QRT meetings held at Raipur and visits of ICAR and Defence institutes at CPRI-Shimla, NIASM, Baramati and DIHAR,Leh.

ICAR- NATIONAL INSTITUTE OF BIOTIC STRESS MANAGEMENT

BARONDA, RAIPUR (C.G.)

Proceedings of QRT meeting of ICAR – NIBSM, Raipur

Date of meeting: 02.05.2018

Venue: Chamber of DDG (CS), Krishi Bhawan, ICAR – New Delhi

Meeting was attended by the following:

Dr. S.M. Paul Khurana – Chairman, QRT, ICAR – NIBSM, Raipur

Dr. A.K. Singh – DDG (CS), Crops Science, ICAR , New Delhi

Dr. P.K. Chakrabarty – ADG (PP&B), ICAR, New Delhi

Dr. Jagdish Kumar – Director (Acting), ICAR - NIBSM, Raipur

Dr. Anil Dixit – Principal Scientist and Member Secretary, QRT, ICAR – NIBSM, Raipur

Meeting started with the introductory remarks of Dr. P.K. Chakrabarty, ADG (PP&B). A brief account of institute was presented on the establishment, objective and mandate of the institute. ADG (PP&B) mentioned about the revised mandate of the institute with a focus on research addressing "basic ,strategic and adaptive research in crop plants " rather than "basic, strategic and adaptive research in agriculture" as was proposed in the cabinet approval of the institute. ADG (PP&B) also emphasised that in the present context of needed plant protection in India, the invasive species have been comprehended to play role of "biological terror" across the borders and need to be actively pursued in the mandate of the institute. It was agreed by all the participants that QRT must advise the institute to include projects in their technical programme particularly addressing the threat of invasive species looming large on sustaining Indian agriculture in near future. A proposition was made that QRT must pay a visit to bordering areas, interact with Indian organizations already engaged with agricultural research (SAUs and Defence establishments such as DRDO etc.) and come out with a strategy to tackle the anticipated threat of invasive species.

The DDG(CS) appraised the house that with limited resource and given mandate the review may be made. Looking in to mandate and constraint whatever targets are achieved must be appreciated. Based on the required cadre strength the review of staff position may be taken place.

10/5/18.

The ADG(PP) appreciated the efforts being taken by the NIBSM for the growth and development. The sufficient money has been allocated indifferent heads and among the newly established institutes NIBSM has made satisfactory progress.

Dr. Jagdish Kumar, Director (Acting) informed that construction of two college buildings and hostels is in full swing and will be handed over by the CPWD within one year and to make these building functional, it is of utmost importance to prepare the course curriculum of post graduate degrees to be awarded by the NIBSM as a "deemed to be university". QRT chairman was requested for his advice to chalk out the educational programme of the institute. The Chairman, QRT informed the house that course curriculum in the area of Plant Protection may be made in the line of other Asian countries, Canada, USA and Australia. He also apprised that workshop/brain storming may be conducted with QRT/RAC in future. The DDG(CS) is of the opinion that being a new establishment and to get the new directions from QRT, the QRT Chairman may visits some of the relevant establishment for further direction and guidance.

It was also proposed that for strengthening the programme and directions to a national institute like NIBSM of deemed university status in the area of plant protection, model biotechnology laboratories in the ICAR system must be visited by the QRT before recommending the research mandate of the institute which must emphasise use of modern frontier tools of science already in operation/established in the proposed institutes. Two ICAR laboratories viz. NIASM, Baramati and CPRI, Shimla were recommended for such visits which was agreed upon by the DDG (CS). DDG(CS) also suggested that meeting may be held sometime to ensure the possible collaboration with DRDO.

It was also decided that QRT meeting in the campus of ICAR – NIBSM, Raipur may be conducted w.e.f the month of July, 2018. But before formal meeting at Raipur QRT members must visit along with Director (Acting) and Member Secretary, the following institutes:

1. DRDO, Leh, Laddakh
2. ICAR-CPRI, Shimla
3. ICAR- NIASM,Baramati

The visits to these institutes may be undertaken in the month of June-July 2018.

Meeting ended with formal vote of thanks

10/5/18

Prof. SM Paul Khurana
Chairman,QRT

Anil Dixit
Member-Secretary

Glimpses of NIBSM Campus Development

Glimpses of NIBSM Campus Development

QRT Visit to Shimla (1st-3rd June, 2018)

QRT Visit to Baramati (9-10th July, 2018)


कृषि विज्ञान

QRT Visit to Leh (27-30th August, 2018)

Final Visit of QRT to Raipur (24-25th September, 2018)

NIBSM Old Building

NIBSM New Building