ICAR-IASRI

Annual Report

2018-19

DIAMOND JUBILEE YEAR 1959-2019

DATA ENTRY SOFTWARE

Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Program under MIDH

प्रशिक्षण प्रबंधन सूचना प्रणाली
Training Management Information System (TMIS)
(मानव संसाधन प्रबंधन एकक - भाकृअनुप)
(Human Resource Management Unit - ICAR)

Reporting Officer · Circulars · Reports · Manual · Dr Shashi Dahiya

ICAR KRISHI GeoPortal

VISTa
Variety Identification System for *Triticum aestivum* (Wheat)

Home | About | Identification | Search | Tutorial | Team

Table: Comparison of the four ARIMA-Intervention models

Model	RMSE

$$\hat{\bar{Y}}_{CAL(AC)} = \frac{1}{N}\sum_{i=1}^{k} d_i y_i^* + \frac{1}{N}\frac{\sum_{i=1}^{k} d_i q_i x_i^* y_i^*}{\sum_{i=1}^{k} d_i q_i x_i^{*2}}\left(X - \sum_{i=1}^{k} d_i x_i^*\right)$$

AICRP on Integrated Farming Systems

On-Farm Farming Systems Research: Online Data Submission and Ap

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PART C | PART D | PART E | PART F | PART G | PART H | PART I | PART J

ICAR - Indian Agricultural Statistics Research Institute

Library Avenue, Pusa, New Delhi - 110012

www.iasri.res.in

ISO 9001:2015 Certified Institute

ISO/IEC 20000 & ISO/IEC 27001 Certified Data Centre

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Contents

Advisors / Directors

Dr. P.V. Sukhatme	September 1940 – July 1951
Dr. V.G. Panse	August 1951 – March 1966
Dr. G.R. Seth	April 1966 – October 1969
Dr. Daroga Singh	November 1969 – May 1971
Dr. M.N. Das (A)	June 1971 – October 1973
Dr. Daroga Singh	November 1973 – September 1981
Dr. Prem Narain	October 1981 – February 1992
Dr. S.K. Raheja (A)	February 1992 – November 1992
Dr. R.K. Pandey (A)	December 1992 – May 1994
Dr. P.N. Bhat (A)	June 1994 – July 1994
Dr. O.P. Kathuria	August 1994 – May 1995
Dr. R.K. Pandey (A)	June 1995 – January 1996
Dr. Bal B.P.S. Goel	January 1996 – October 1997
Dr. S.D. Sharma	October 1997 – August 2008
Dr. V.K. Bhatia	August 2008 – February 2013
Dr. U.C. Sud	March 2013 – 31 July 2017
Dr. A.K. Choubey (A).....	01 August 2017 – 21 Jan 2018
Dr. L.M. Bhar (A).....	22 Jan 2018 onwards

Vision

Statistics and Informatics for enriching the quality of Agricultural Research

Mission

To undertake research, education and training in Agricultural Statistics, Computer Application and Bioinformatics for Agricultural Research

Mandate

- To undertake research, education and training in agricultural statistics, computer applications in agriculture and agricultural bioinformatics
- To provide advisory/consultancy services / methodological support / computational solutions to NARES/NASS (National Agricultural Research and Education System/ National Agricultural Statistics System)

Preface

It is a matter of immense pleasure and great satisfaction to present the Annual Report 2018-19 of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), an ISO 9001:2015 certified Institute with glorious tradition of carrying out research, teaching and training in the area of Agricultural Statistics and Informatics. This report highlights the research achievements made, new methodologies developed, consultancy services provided, significant methodological and computational support, dissemination of knowledge acquired and human resource development. The scientists, technical personnel, administrative, finance and other staff have put in their best efforts in fulfilling the mandate of the Institute.

During the year, research was carried out under 86 research projects (32 Institute funded, 03 Collaborative, 51 externally funded), one National Fellow Scheme and 07 Consultancy Projects in various thrust areas.

A landmark for the Institute this year is that under FAO funded consultancy mode, three separate sampling methodologies for estimating post-harvest losses of horticultural crops (fruits and vegetables), livestock (meat and milk) and fish (capture and culture fisheries) have been developed. Guidelines for estimating post-harvest losses of horticultural crops (fruits and vegetables) and livestock products (meat and milk) were field tested in Mexico and Zambia respectively. A modified sampling methodology for estimation of area and production of horticultural crops was developed which is efficient, simple, less time consuming and cost effective. In order to strengthen the existing system of generation of Agricultural Statistics, a pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report was completed. An innovative methodology for small area estimation of proportions or counts under an area level spatial version of the generalized linear mixed model that incorporates the sampling information of complex survey design used in survey data has been developed.

The Indian NARS Statistical Computing Portal is being extensively used throughout NARES and helped the researchers in analyzing their data in an effective manner. In ICAR Research Data Repository for Knowledge Management i.e. KRISHI (Knowledge based Resources Information System Hub for Innovations in Agriculture), via ICAR Geo-Portal, visualization of paddy residue burning places in Punjab, Haryana and UP using Satellite Remote Sensing during 01-10-2018-30.11.2018 was made available on daily basis. A series of generalized row-column (GRC) designs for crop and animal experiments balanced for spatial indirect effects have been developed. Construction and analysis of incomplete split-plot designs have also been done.

Crop yield forecasting under Forecasting Agricultural output using Space Agro meteorology and Land based observation (FASAL) scheme has been done for obtaining wheat crop yield forecasts at different growth stages for Delhi region. Technology forecasting of future scenario of Bt technology in Indian agriculture has been done. A new Von-Bertalanffy stochastic differential equation model has been proposed under decreasing stochasticity with respect to unequal carrying capacity in drift and diffusion terms and exact solution has been obtained. Algorithm for combination of Wavelet-Regression and Wavelet-ANN model has been proposed in order to forecast the time series observations.

In the area of statistical genetics, sire and error components following different combinations of distributions viz., normal, beta, Cauchy and t-distribution by four different methods i.e. ANOVA, ML, REML and MIVQUE methods with different parametric values of heritability have been obtained. A statistical approach, based on a composite measure of maximum relevance and minimum redundancy, which is both statistically sound and biologically relevant for informative gene selection has been proposed. Moreover, an innovative statistical approach called Gene Set Analysis with QTLs (GSAQ) for interpreting gene expression data in context of gene sets with traits has been proposed.

Development of model web-server and Mobile App for wheat crop variety identification using throughput SNP genotyping data has been done. This is the world's first of its kind model web server for crop variety identification using >350 Indian wheat varieties and Axiom 35K SNP chip data. Uncovering genomic regions associated with 36 agro-morphological traits in Indian spring wheat using genome-wide association study (GWAS) was also done. For exploring the epigenetic control of heat stress responses in

wheat for characterizing the regulatory networks associated with thermo-tolerance, construction of Gene Regulatory Network (GRN) of heat responsive genes using Weighted Gene Co-expression Network Analysis (WGCNA) and identification of hub genes in subnetworks have been done. A comprehensive database called "RiceMetaSysB" of rice blast and bacterial leaf blight disease responsive genes in rice has been developed. Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea has been done. For computational and analytical solutions for high-throughput biological data, the SNP genotyping data of 1762 swamp buffaloes for three traits: fat, protein and milk yield from NBAGR, Karnal has been received and GWAS was performed. High throughput Phenomics-Data Analysis Platform (HtP-DAP) has been designed and developed to support the analysis of large-scale image data sets of crop plants captured by different camera systems. In order to elucidate the mechanism of Pashmina fibre development via an OMICS approach, the binary alignment map (bam) files of the Pashmina goat transcriptome were analyzed. Mango (Amrapali) genome assembly has been completed and completeness of mango genome assembly was evaluated using BUSCO (Benchmarking Universal Single Copy Orthologous) approach and its result revealed 91.4% completeness of assembly. Development of non-linear model for multi-trait genomic selection has been done using multi-variate least absolute shrinkage and selection (MLASSO) technique along with kernel technique. In addition, development of a software named Genomic Selection Tool (GST) has been developed for web platform for single-trait and multi-trait genomic selection. A platform on integrated genomics warehouse has been developed using open source software tools.

ICAR-Data Centre (DC) at our institute is consistently stepping up with industry standard practice with ISO:27001 & ISO:20000 certification and is serving ICAR institutes to enrich Digital India initiative. Honourable Minister of Agriculture and Farmer Welfare Shri Radha Mohan Singh launched online Training Management Information System (TMIS) and Foreign Visit Management System (FVMS) during the VCs and Directors' Conference on 31st of January 2019. Krishi Vigyan Kendra Knowledge Network or KVK Portal and KVK Mobile App have been developed to disseminate knowledge and information from KVKs to farmers. Farmer FIRST Programme (FFP) Portal has been developed which provides basic and detailed information of all projects under this programme. The ICAR-ERP system (http://icarerp.iasri.res.in) has been customized with new functionalities and reports. New institute website has been redesigned, revamped and redeveloped on a new open source platform. It follows the Guidelines for Indian Government Websites.

During the year, 14 training programmes (Five under Centre of Advanced Faculty Training, one Winter School, three training programmes under HRM and five other training programmes) were organized in which 234 participants were imparted training. During the year, a total of 18 students {3 Ph.D. (Agricultural Statistics), 7 M.Sc. (Agricultural Statistics), 4 M.Sc. (Computer Application), 1 Ph.D. (Bioinformatics) and 3 M.Sc. (Bioinformatics)} got their respective degrees.

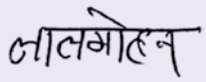
During 2018-19, the Institute has published 155 research papers in National and International refereed Journals along with more than 100 other publications. I am happy to share that scientists of the Institute has received twelve copyrights during this year.

Our scientists have brought laurels to the institute by way of bagging a number of prestigious awards ranging from Panjabrao Deshmukh Outstanding Woman Scientist Award-2017 of ICAR; Fellow, National Academy of Agricultural Sciences; Best Teacher Award in Agricultural Higher Education 2018-19 from ICAR-IARI, New Delhi; Fellow of Indian Society of Agricultural Statistics – 2018; Recognition Award for outstanding contributions in the field of Social Sciences for the Biennium 2017-2018 from the National Academy of Agricultural Sciences, New Delhi; Dr. G.R. Seth Young Scientist Award 2018 by Indian Society of Agricultural Statistics; Dr. M.N. Das Memorial Young Scientist Award 2019 of Society for Statistics, Computers and Applications; many best paper awards etc. During the period under report, scientists were deputed on different assignments to Myanmar, Tanzania, Mexico, Zambia, USA, Nepal and Canada.

I would like to express my gratitude to Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR) for his invaluable guidance, encouragement and support. I am grateful to Dr. N.S. Rathore, DDG (Agricultural Education), ICAR; Dr. P.S. Pandey, ADG (EP&HS), ICAR and Dr. G. Venkateshwarlu, ADG (EQA&R), ICAR for their constant direction, inspiration and support. My sincere appreciation are to all Heads of Divisions, scientists and other staff of the Institute for their devotion, whole-hearted support and cooperation in carrying out various functions and activities of the Institute. The services of the PME

Cell in compiling and timely publication of the Annual Report are highly appreciated. I wish to express my sincere thanks to all my colleagues in PME Cell, in particular Dr. Ramasubramanian V., the present PME In-charge and also former PME In-charge Dr. Ajit for all the efforts and coordinating various activities. The sincere efforts of all members of Editorial Committee are praiseworthy.

I am hopeful that the scientists in NARES/NASS will find this publication quite informative and useful and will be immensely benefitted from the information contained in it. I look forward to any suggestions and comments for its improvement.



(L.M. Bhar)
Director (A)

Milestones

1930	• Statistical Section created under ICAR
1940	• Activities of the Section increased with appointment of Dr. PV Sukhatme
1945	• Re-organisation of Statistical Section into Statistical Branch as a centre for research and training in the field of Agricultural Statistics
1949	• Re-named as Statistical Wing of ICAR
1952	• Activities of Statistical Wing further expanded and diversified with the recommendations of FAO experts, Dr. Frank Yates and Dr. DJ Finney
1955	• Statistical Wing moved to its present campus
1956	• Collaboration with AICRP initiated
1959	• Re-designated as Institute of Agricultural Research Statistics (IARS)
1964	• Installation of IBM 1620 Model-II Electronic Computer
	• Signing of MOU with IARI, New Delhi to start new courses for M.Sc. and Ph.D. degree in Agricultural Statistics
1970	• Status of a full fledged Institute in the ICAR system, headed by Director
1977	• Three storeyed Computer Centre Building inaugurated
	• Installation of third generation computer system, Burroughs B-4700
1978	• Re-named as Indian Agricultural Statistics Research Institute (IASRI)
1983	• Identified as Centre of Advanced Studies in Agricultural Statistics and Computer Applications under the aegis of the United Nations Development Programme (UNDP)
1985–86	• New Course leading to M.Sc. degree in Computer Application in Agriculture initiated
1989	• Commercialization of SPAR 1.0
1991	• Burroughs B-4700 system replaced by a Super Mini COSMOS LAN Server
1992	• Administration-cum-Training Block of the Institute inaugurated
1993–94	• M.Sc. degree in Computer Application in Agriculture changed to M.Sc. in Computer Application
1995	• Centre of Advanced Studies in Agricultural Statistics & Computer Application established by Education Division, ICAR
1996	• Establishment of Remote Sensing & GIS lab with latest software facilities
	• Outside funded projects initiated
1997	• Senior Certificate Course in 'Agricultural Statistics and Computing' revived
	• Establishment of modern computer laboratories
	• First software in India for generation of design along with its randomised layout SPBD release 1.0
1998	• Four Divisions of the Institute re-named as Sample Survey, Design of Experiments, Biometrics and Computer Applications
	• Revolving Fund Scheme on Short Term Training Programme in Information Technology initiated
	• Training programmes in Statistics for non-statisticians in National Agricultural Research System initiated
1999	• Strengthening of LAN & Intranet with Fibre optics & UTP cabling
	• Substantial growth in outside funded projects and training programmes
2000	• Two Divisions re-named as Division of Forecasting Techniques and Division of Econometrics
2001	• Data Warehousing activities (INARIS project under NATP) initiated
2002	• Development of PIMSNET (Project Information Management System on Internet) for NATP
2003	• Establishment of National Information System on Long-term Fertilizer Experiments funded by AP Cess Fund
	• Development of PERMISnet (A software for Online Information on Personnel Management in ICAR System)
	• First indigenously developed software on windows platform Statistical Package for Factorial Experiments (SPFE) 1.0 released
2004	• National Information System on Agricultural Education (NISAGENET) Project launched
	• Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited
	• E-Library Services initiated
2005	• Statistical Package for Augmented Designs (SPAD) and Statistical Package for Agricultural Research (SPAR) 2.0 released
	• Design Resources Server with an aim to provide E-advisory in NARS initiated
2006	• Organisation of International Conference on Statistics and Informatics in Agricultural Research
2007	• Establishment of Agricultural Bioinformatics Laboratory (ABL)
2008	• Software for Survey Data Analysis (SSDA) 1.0 released
2009	• Golden Jubilee Celebration Year of the Institute

	• Strengthening Statistical Computing for NARS initiated
	• Expert System on Wheat Crop Management launched
	• International Training Hostel inaugurated
2010	• Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR initiated
	• Division of Biometrics re-named as Division of Biometrics and Statistical Modelling
	• Division of Forecasting Techniques and Division of Econometrics merged to form Division of Forecasting and Econometrics Techniques
	• A new centre namely Centre for Agricultural Bioinformatics [CABin] created
2011	• Maize AgriDaksh and Expert System on Seed Spices launched
	• Indian NARS Statistical Computing Portal initiated
	• M.Sc. degree in Bioinformatics initiated
2012	• Software for Survey Data Analysis (SSDA) 2.0 released
	• Division of Biometrics and Statistical Modelling re-named as Division of Statistical Genetics
	• Division of Forecasting & Econometrics Techniques re-named as Division of Forecasting & Agricultural Systems Modeling
	• Development of Management Information System (MIS) including Financial Management System (FMS) in ICAR initiated
	• Half-Yearly Progress Monitoring (HYPM) System in ICAR implemented
	• Sample Survey Resources Server initiated
2013	• High Performance Computing (HPC) System for Biological Computing established
	• Ph.D. degree in Computer Application initiated
	• Certified as ISO 9001:2008 (Quality Management System) Institute
2014	• Advanced Supercomputing Hub for OMICS Knowledge in Agriculture (ASHOKA) inaugurated
	• ICAR-ERP system implemented
	• Ph.D. degree in Bioinformatics initiated
	• IASRI Campus Wi-Fi enabled
	• ICAR Data Centre, Unified Communication and Web Hosting Services for ICAR started
	• FAO Sponsored Study under the Global Strategy for Improvement of Agricultural Statistics initiated
2015	• KRISHI (http://krishi.icar.gov.in/) Knowledge based Resources Information Systems Hub for Innovations in agriculture portal has been launched as a centralized data repository system of ICAR.
	• ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH (Mission for Integrated Development of Horticulture).
	• ICAR Data Centre established at IASRI acquired the certification for ISO/IEC 20000 and ISO/IEC 27001 for IT-service management and information security legislation respectively.
2016	• KVK-Portal (Krishi Vigyan Kendra Knowledge Network) and Mobile Application (http://kvk.icar.gov.in/) developed and launched
	• MAPI (http://sample.iasri.res.in/ssrs/android.html/) Mobile Assisted Personal Interview- An android application developed
	• Developed sampling methodologies for estimation of crop area and yield under mixed and continuous cropping for different situations prevailing in different countries and field tested in the three identified countries by the FAO, one each in Asia-Pacific, Africa and Latin America/ Caribbean region, i.e. Indonesia, Rwanda and Jamaica respectively.
	• Developed methodology for estimation of area and production of Horticultural crops, tested and validated in four states. The methodology will be implemented at national level.
	• Developed Personnel Management System, for managing the cadre strength and transfer of the scientific staff and implemented in ICAR.
2017	• Suitable sampling methodology (aligned with existing Input Survey of Agriculture Census) for estimation of private foodgrain stock and post-harvest losses at farm level has been developed.
	• Guidelines for estimating post-harvest losses of horticultural crops (fruits and vegetables), livestock (meat and milk) and fish (capture and culture fisheries)/fish products have been developed and will be tested in the two countries (Namibia and Mexico).
	• Produced Poverty map of spatial inequality in distribution of poverty incidence in different districts of Bihar State.
2018	• Education Portal-ICAR (https://education.icar.gov.in) developed and launched.
	• Mobile Apps: Pashu Prajanan (Animal Reproduction) and Sukar Palan (Pig Farming) developed in collaboration with ICAR-IVRI.
2019	• Webserver and Mobile App, VIS*Ta* (Variety Identification System of *Triticum aestivum*): World's first of its kind; Training Management Information System (TMIS) for ICAR; Developed three sampling methodologies for estimating post-harvest losses of horticultural crops (fruits and vegetables), livestock (meat and milk) and fish (capture and culture fisheries)

ORGANOGRAM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INSTITUTE MANAGEMENT COMMITTEE
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EQUIPMENT MAINTENANCE UNIT
AUDIT SECTION
ACCOUNTS SECTION

1

Executive Summary

The Indian NARS Statistical Computing Portal is being extensively used throughout NARES and helped the researchers in analyzing their data in an effective manner. Based on the user logged information, the total number of logged in users from Indian NARES during April 01, 2018- March 31, 2019 are 95,098 which is on an average more than 260 logged in per day. The Design Resources Server (www.iasri.res.in/design) has been strengthened by adding the links of online generation of efficient incomplete block designs for two-factor incomplete factorial experiments with levels of factors £4 and block size ≤10. During April 01, 2018 to March 31, 2019, Google Analytics gave 10,902 page views of this server across 432 cities of 87 countries. Information System on AICRP on Farm Implements and Machinery and AICRP on Post Harvest Engineering and Technology have also been developed.

In ICAR Research Data Repository for Knowledge Management i.e. KRISHI (Knowledge based Resources Information System Hub for Innovations in Agriculture), through Interportal Harvester, unified search is ready for 26 repositories for 4,57,312 records at http://krishi.icar.gov.in/ohs-2.3.1/index.php/browse. ICAR publication and data inventory repository has been enriched through populating data by Nodal Officers and other researchers. 16400 publications and **410** datasets have been submitted from 107 Institutes. Technology Repository has been implemented with keyword based search facility. At present 427 from 28 Institutes technologies are available in public domain. Moreover, via ICAR Geo-Portal, visualization of paddy residue burning places in Punjab, Haryana and UP using Satellite Remote Sensing during 01-10-2018 to 30.11.2018 was made available on daily basis. Thus, KRISHI Portal has attracted more than 1,02,000 page views since May 2015 across more than 626 cities of 105 countries. Publication and Data inventory repository is indexed in BASE (Bielefeld Academic Search Engine); Google Scholar and Directory of Open Access repositories. Since May 2017, from ICAR Publication and Data Inventory Repository, there are more than 3,00,000 downloads that includes documents fetched through computer programme by other sites and more than 39,400 page views (19,700 reported earlier) across 200 cities of 40 countries.

Planning, designing and analysis of experiments planned On Stations under AICRP on Integrated Farming System (IFS) is an ongoing activity. The process for developing web based database application for statistical analysis of Experiment named “Intensification and diversification of cropping sequence based on high value crops” and Experiment named “Permanent plot experiment on integrated nutrient management in rice-wheat cropping sequence” using JSP programming language as front-end and SQL server as back-end has been initiated that would considerably reduce the time gap between actual data collection and data submission to our institute for further statistical analysis.

Some investigations on trend resistant row-column designs have been done. Such designs under two sources of heterogeneity have been studied when the observations are correlated. The condition for a design under two sources of heterogeneity to be trend free when observations are correlated has also been obtained.

A series of generalized row-column (GRC) designs for crop and animal experiments balanced for spatial indirect effects have been developed. A catalogue

and SAS macro for generating the developed GRC designs balanced has been prepared.

In the study on designs involving three-way and four-way genetic crosses for crop and animal breeding programmes, a new, efficient and cost effective series of designs involving three-way crosses for breeding experiments has been introduced and general expressions of information matrices, eigenvalues, variance factors, efficiency factor and degree of fractionation have been derived. A new model for experimental designs involving tetra-allele crosses that incorporates both general combining ability (gca) and specific combining ability (sca) has been defined.

Construction and analysis of incomplete split-plot designs have been done for the three situations viz., when the sub-plots are incomplete, when the main-plots are incomplete and when both the whole plots and sub-plots are incomplete along with analyzing data and implementing the analysis method in a software module. These methodologies have also been included as part of a web application so that they can be used by researchers and experimenters.

Construction of orthogonal and nested orthogonal Latin hypercube designs have been done. Among other things, a general procedure of obtaining construction methods of orthogonal and nearly orthogonal space filling Latin Hypercube Designs has been done.

Crop yield forecasting under Forecasting Agricultural output using Space Agro meteorology and Land based observation (FASAL) scheme has been done for obtaining crop yield forecasts at different growth stages of wheat crop for Delhi region. The model used maximum and minimum temperature, rainfall, morning and evening relative humidity during crop growing period using generated weather indices as regressors in model. LASSO technique was also used for variable selection.

Technology forecasting of future scenario of Bt technology in Indian agriculture has been done.

In this study, genetic algorithm based optimization technique has been employed for parameters estimation of ARIMA-Intervention models by considering all India cotton yield with the intervention being introduction of Bt Cotton variety in year 2002.

A new Von-Bertalanffy stochastic differential equation model has been proposed under decreasing stochasticity with respect to unequal carrying capacity in drift and diffusion terms and exact solution has been obtained.

Trend in Climatic Variability (2011-16) of maximum temperature, minimum temperature and rainfall in 23 locations covered under rice, tomato, groundnut and pigeon pea have been computed using both parametric and nonparametric techniques. Impact of climatic variability on rice insect pests across six agro-climatic zones in Kharif season was analyzed. Algorithm for combination of Wavelet-Regression and Wavelet-ANN model has been proposed in order to forecast the time series observations.

The monthly wholesale price of onion collected and compiled form AGMARKNET for major markets of India were used for cointegration analysis. Johansen cointegration approach has been applied for finding market integration both horizontal as well as vertical. It has been observed that the speed of adjustment in prices is highest in Lasangaon market for Onion.

Three separate sampling methodologies for estimating post-harvest losses of horticultural crops (fruits and vegetables), livestock (meat and milk) and fish (capture and culture fisheries) have been developed. Guidelines for estimating post-harvest losses of horticultural crops (fruits and vegetables) and livestock products (meat and milk) were field tested in Mexico and Zambia respectively. FAO, Rome has appreciated the efforts done by our institute for successful conduct and on-time completion during a short span of time both the studies.

A modified sampling methodology for estimation of area and production of horticultural crops was developed which is efficient, simple, less time consuming and cost effective. The developed methodology was validated in six states of the country. This survey based methodology is capable of providing district level estimates for all the districts in the State along with estimates at State and National level. This methodology provides reliable estimates of area and production for all major fruit and vegetable crops at district level using common sampling design based on an integrated survey. In addition to the traditional method of data collection, an attempt was made to use Computer Assisted Personal Interviewing (CAPI), a survey solution software for data collection developed by World Bank.

In order to strengthen the existing system of generation of Agricultural Statistics, a pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report was completed.

An innovative methodology for small area estimation of proportions or counts under an area level spatial version of the generalized linear mixed model that incorporates the sampling information of complex survey design used in survey data has been developed.

Methodology for obtaining calibration estimators of population mean and ratio has been developed under Adaptive Cluster Sampling (ACS). On testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Madhya Pradesh & Haryana states, area and production estimates of fruits and vegetables for all the surveyed districts of these states were found to be reliable.

In the area of statistical genetics, sire and error components following different combinations of distributions viz., normal, beta, Cauchy and t-distribution with different heritability values and estimate of heritability and Root Mean Squared Error (RMSE) values obtained by four different methods i.e. ANOVA, ML, REML and MIVQUE methods with different parametric values of heritability have been obtained. A statistical approach, based on a composite measure of maximum relevance and minimum redundancy, which is both statistically sound and biologically relevant for informative gene selection has been proposed. Moreover, an innovative statistical approach called Gene Set Analysis with QTLs (GSAQ) for interpreting gene expression data in context of gene sets with traits has been proposed.

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For studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids, a series of experiments involving whole genome re-sequencing, transcriptome and methylome were conducted in a sub-tropical genotype HKI1105 under drought stress condition to understand the regulation of drought tolerant genes at different functional level. The RNASeq assay of the control and drought stressed root and shoot samples revealed differentially expressed genes operating in various stress pathways.

A comprehensive database called "RiceMetaSysB" of rice blast and bacterial leaf blight disease responsive genes in rice has been developed. This database provides facility to the users such as retrieval of candidate genes using different search options like genotypes, tissue, and developmental stage of the host, strain, hours/days post-inoculation, physical position and SSR marker information.

Development of model web-server and Mobile App for wheat crop variety identification using throughput SNP genotyping data has been done. This is the world's first of its kind model web server for crop variety identification using >350 Indian wheat varieties and Axiom 35 K SNP chip data.

Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea has been done by first identifying miRNA from small RNA libraries of isogenic male fertile and sterile lines.

For deciphering genetic variation in the carbohydrate metabolism of farmed rohu fish families,

liver specific microRNAs were identified in farmed carp (Labeo bata) fed with starch diet.

For computational and analytical solutions for high-throughput biological data, the SNP genotyping data of 1762 swamp buffaloes for three traits: fat, protein and milk yield from NBAGR, Karnal has been received. The genome-wide association study (GWAS) was performed on GBS data using SUPER (Settlement of MLM Under Progressively Exclusive Relationship), MLMM (multi-locus mixed model), FarmCPU (Fixed and random model Circulating Probability Unification) and Bayesian models along with the MLM available in GAPIT.

High throughput Phenomics-Data Analysis Platform (HtP-DAP) has been designed and developed to support the analysis of large-scale image data sets of crop plants captured by different camera systems. It aims to bridge the gaps by integrating different approaches to data analysis and data mining.

In order to elucidate the mechanism of Pashmina fibre development via an OMICS approach, the binary alignment map (bam) files of the Pashmina goat transcriptome were analyzed by SAM tools and GATK for detection of SNPs between goats having white, black and brown hair follicles. The chromosome wise distribution of SNPs was obtained for these three goat samples using in-house scripts. An information system containing the above information was developed for the scientists involved in the goat improvement programme.

Mango genome assembly has been completed by whole genome sequencing and chromosome wise assembly of Indian mango Amrapali. Genome finishing work has been completed using marker based anchoring of super scaffold to get pseudomolecule. In order to evaluate completeness of mango genome assembly BUSCO (benchmarking universal Single Copy Orthologous) approach was used and its result revealed 91.4% completeness of assembly

De novo transcriptome assembly and evaluation statistics of coriander have been done. A total of 39.8 GB single end reads of two extreme genotypes of coriander, i.e., resistant and susceptible raw transcriptome data were generated using Illumina HiSeq 2000.

Development of non-linear model for multi-trait genomic selection has been done using multi-variate least absolute shrinkage and selection (MLASSO) technique along with kernel technique. The proposed method has been termed as "kernelized multivariate LASSO". In addition, development of a software named Genomic Selection Tool (GST) has been developed for web platform for single-trait and multi-trait genomic selection.

Development of web server for phenotype and genotype analysis for cattle breeding management is being done. The collected sample data on cattle was standardized to develop a database. For designing the database, registration, disposal, pedigree, health, semen collection, service, calving, milk production, feeding table have been created and integrated using MYSQL.

A platform on integrated genomics warehouse has been developed. For this, the system architecture for genomic data warehouse has been developed using open source software tools. Pentaho data integration (PDI) was used for development of ETL process and workflow by utilizing core data integration (ETL) engine and easy to use GUI for development of workflows.

ICAR-DC (Data Centre) at our institute is consistently stepping up with industry standard practice with ISO:27001 & ISO:20000 certification and hybrid technologies of Hyper Converged Infrastructure, GPU Servers for AI, Blades, Racks, Cyber Security, Webhosting Manger (cPanel, Plesk), EMS etc. ICAR-DC with 850 core computes, 300TB storage and 112 website/portals, e-office and email system are serving ICAR's institutes to enrich Digital INDIA initiative in the field of agricultural research & education.

Honourable Minister of Agriculture and Farmer Welfare Shri Radha Mohan Singh launched online Training Management Information System (TMIS) and Foreign Visit Management System (FVMS) during the VCs and Directors' Conference on 31st of January 2019.

'Krishi Vigyan Kendra Knowledge Network' or KVK Portal (https://kvk.icar.gov.in/) and KVK Mobile App have been developed to disseminate knowledge and information from KVKs to farmers. The significant achievements in the year 2018-19 were effective monitoring and management of Krishi Kalyan Abhiyan (KKA) along with other events through the system. Module for Direct Benefit Transfer (DBT) under Agricultural Extension Scheme was developed and implemented. System was effectively used for e-governance of different phases of Krishi Kalyan Abhiyan (KKA).

Education Portal-ICAR (https://education.icar.gov.in) is being used as a single window platform for providing vital education information/announcements/event schedules/e-learning resources from Agricultural Universities across the country to the rural youth in an easy and fast way on their doorsteps.

IVRI-Artificial Insemination App has been developed. The app is targeted to impart knowledge and skills to Graduating Veterinarians, Field Veterinary Officers and Paravets about Artificial Insemination (AI) in cattle and buffaloes. Landlly Pig App has been developed. This App is targeted to provide information on newly developed Pig variety-Landlly to the UG and PG students of Veterinary Sciences, Veterinary professionals and Entrepreneurs. IVRI-Dairy Manager App has been developed jointly with ICAR-IVRI and ICAR-NDRI.

Farmer FIRST Programme (FFP) Portal (https://ffp.icar.gov.in/) has been developed which provides basic and detailed information of all projects under this programme. This portal acts as an interface between Farmers and Scientists for knowledge dissemination. ICAR-ATARIs can monitor their respective FFP activities. It is single window platform for collection of images, videos, trainings, activities and interventions under FFP projects.

ICAR-IASRI has developed Personnel Management Information System has been designed, developed and implemented across ICAR. The system has been developed using n-tier architecture of web development using .NET technology for application layer and MS SQL Server as database layer. The system is accessible at http://pms.icar.gov.in.

The ICAR-ERP system (http://icarerp.iasri.res.in) has been customized with new functionalities and reports. New employee ids of total 135 newly recruited scientist (including their basic and service detail) and 72 FMS new users have been created.

Post Graduate School Education, Academic Management System (AMS) has been developed and has been implemented at the following five locations: ICAR-IARI, New Delhi; ICAR-NDRI, Karnal; ICAR-CIFE, Mumbai; ICAR-IVRI, Bareilly; CAU Imphal. In addition, the deployment and implementation has been started at RP CAU, Bihar. The AMS is available to students, faculty members, scientists and administrative staff of the respective institutes.

Smart India Hackathon (SIH) 2019 is a nationwide initiative to provide students a platform to solve some of pressing problems we face in our daily lives, and thus inculcate a culture of product innovation and a mindset of problem solving. SIH is an initiative by Ministry of HRD, AICTE, Persistent Systems, i4c and Rambhau Mhalgi Prabodhini. ICAR-IASRI took the lead in coordinating the event. Scientists from ICAR-IARI, ICAR-NIAP, ICAR-IIRR, ICAR-CIBA were also involved since the beginning and till the completion of the event.

New website of the institute has been redesigned, revamped and redeveloped on a new open source platform. It follows the Guidelines for Indian Government Websites. The open source technologies Wordpress, PHP and MySQL have been used for the development new website. Many new features and information have been added into the site to make it more comprehensive and informative. The overall look and feel of the website has been enhanced. The site is available in both English and Hindi languages. The site has been hosted on a new and secure domain: https://iasri.icar.gov.in/. It can also be accessed by clicking on the old website domain.

2

Introduction

ICAR-Indian Agricultural Statistics Research Institute (IASRI) is a pioneer and premier Institute of Indian Council of Agricultural Research (ICAR) undertaking research, teaching and training in Agricultural Statistics, Computer Application and Bioinformatics. Ever since its inception way back in 1930, as small Statistical Section of the then Imperial Council of Agricultural Research, the Institute has grown in stature and made its presence felt both nationally and internationally. ICAR-IASRI has been mainly responsible for conducting research in Agricultural Statistics and Informatics to bridge the gaps in the existing knowledge. It has also been providing education/ training in Agricultural Statistics and Informatics to develop trained manpower in the country. The research and education is used in improving the quality and meeting the challenges of agricultural research in newer emerging areas. The Institute has been awarded an ISO 9001:2015 certificate in the year 2018. ICAR Data Centre established at ICAR-IASRI acquired the certification for ISO/IEC 20000 & ISO/IEC 27001 in October, 2015. ISO 20000:2011 & ISO 27001:2013. External Surveillance Audit was successfully completed at ICAR Data Centre on September 19, 2016 and it was recommended for continuation of the ISO 20000-1:2011 & ISO 27001:2013 standard by the BSI.

- ICAR Data Centre has been continuously providing the Unified Communication (Email, Audio, Video, Web conference etc.) and Webhosting service to ICAR and its Institutes.
- The Institute has used the power of Statistics, as a science, blended judiciously with Informatics and has contributed significantly in improving the quality of Agricultural Research. To convert this vision into a reality, the Institute has set for itself a mission to undertake research, teaching and training in Agricultural Statistics and Informatics so that these efforts culminate into improved quality of agricultural research and also meet the challenges of agricultural research in newer emerging areas. The present main thrust of the Institute is to conduct basic, applied, adaptive, strategic and anticipatory research in Agricultural Statistics and Informatics, to develop trained manpower and to disseminate knowledge and information produced so as to meet the methodological challenges of agricultural research in the country.
- The Institute has made its presence felt in the National Agricultural Research and Education System (NARES). The Institute feels proud to have established the first supercomputing hub for Indian Agriculture, ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture). Linkages have been established with all National Agricultural Research organizations for strengthening statistical computing. For providing service oriented computing for the users, Indian NARS Statistical Computing portal has been developed. Appropriate statistical techniques have been developed and recommended to researchers through advisory services. The Institute is also becoming progressively a repository of information on agricultural research data with the establishment of a Data Centre. The Institute also occupies a place of pride in the National Agricultural Statistics System (NASS) and has made several important contributions in strengthening NASS, which has a direct impact on the national policies. The

Institute has contributed significantly by providing excellent human resource to NARES in the country in the disciplines of Agricultural Statistics and Informatics for meeting the challenges of Agricultural Research in the newer emerging areas. Conducting post graduate teaching and in-service courses in Agricultural Statistics, Computer Application and Bioinformatics for human resource development is an important activity.

- The Institute has made some outstanding & useful contributions to research in Agricultural Statistics and Informatics in the fields like Design of Experiments, Statistical Genetics, Forecasting Techniques, Statistical Modelling, Sample Surveys, Econometrics, Computer Applications in Agriculture, Software Development, Agricultural Bioinformatics etc. The Institute has conducted basic and original research on many topics of interest and has published number of papers in national and international journals of repute. The Institute has been providing and continues to provide support to the NARES by way of analyzing voluminous data using advanced and appropriate analytical techniques. It has also been very actively pursuing advisory services that have enabled to enrich the quality of agricultural research in the NARES. Besides, many projects funded by Government and Public Sector agencies like Department of Science and Technology, Directorate of Economics and Statistics, Ministry of Agriculture, Planning Commission, Ministry of Statistics and Programme Implementation (MoS&PI), Coconut Development Board have been undertaken. Some of these projects were taken on request from several Government agencies and others were awarded through competitive bidding. This has helped the Institute in resource generation as well. The Institute works in close collaboration with NARES organizations and` many projects are being run in collaboration with All India Co-ordinated Research Projects and ICAR Institutes. Further linkages with the CGIAR organizations such as CIMMYT, IRRI and ICARDA have been developed. The institute has been recently awarded a study by Food and Agriculture Organization (FAO) under the Global Strategy to Improve Agricultural and Rural Statistics on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping.

Significant Research Achievements

A brief discussion on the research achievements of the Institute in different areas of Agricultural Statistics and Informatics are outlined below.

Design of Experiments

- The Institute has made many notable contributions in both basic research and innovative applications of the theory of statistical designs and analysis of experimental data. Some of the areas are:
- Designs for single factor experiments which include variance balanced, efficiency balanced, and partially efficiency balanced designs; designs for tests versus control(s) comparisons; designs for multi-response experiments; crossover designs; designs with nested structures; neighbour balanced designs; optimality and robustness aspects of designs.
- Designs for multi-factor experiments which include confounded designs for symmetrical and asymmetrical factorials; block designs with factorial structure; response surface designs, mixture experiments for single and multifactor experiments; orthogonal main effect plans; orthogonal arrays; supersaturated designs.
- Designs for bioassays; designs for microarray experiments and designs for agroforestry experiments.
- Diagnostics in designed field experiments.
- Computer aided construction of efficient designs for various experimental settings; etc.
- For dissemination and e-advisory on designed experiments, developed a Design Resources Server (www.iasri.res.in/design) which is being viewed throughout the globe and used extensively in NARES.
- Web solutions for generation of experimental designs and online analysis of experimental data for different experimental settings.
- The scientists of the Institute participate actively in planning and designing of experiments in the NARES and have also involved themselves in the analysis of experimental data.
- Basic research work carried out on balanced incomplete block designs, partially balanced incomplete block designs, group divisible designs, α-designs, reinforced α-designs,

square and rectangular designs, nested designs, augmented designs, extended group divisible designs, factorial experiments, response surface designs, experiments with mixtures etc. have been adopted widely by the experimenters in NARES.

- Designs for factorial experiments such as response surface designs and experiments with
- mixtures have been used for food processing and value addition experiments; soil test crop response correlation experiments; experiments with fixed quantity of inputs and ready to serve fruit beverage experiments; etc.
- Analytical techniques based on mixed effects models and biplot developed for the analysis of data generated from Farmers Participatory Trials for resource conservation agriculture have been used by rice-wheat consortium for Indo-Gangetic plains for drawing statistically valid conclusions.
- Analytical techniques for the analysis of data from the experiments conducted to study the post harvest storage behaviour of the perishable commodities like fruits and vegetables are being widely used in NARES.
- Planning, designing and analysis of data relating to experiments under AICRPs on (i) Integrated Farming System (IFS); (ii) Long Term Fertilizer Experiments (LTFE); (iii) Soil Test Crop Response Correlation (STCR); (iv) Rapeseed and Mustard; (v) Sorghum; (vi) Wheat and Barley and (vii) Vegetable Crops.

Sample Surveys

The subject of sampling techniques helps in providing the methodology for obtaining precise estimators of parameters of interest. The Institute is involved in evolving suitable sample survey techniques for estimation of various parameters of interest relating to crops, livestock, fishery, forestry, horticulture, perishable commodities like flowers, vegetables and allied fields.

- Significant contributions have been made in theoretical aspects of sample surveys like successive sampling, systematic sampling, cluster sampling, sampling on successive occasions, sampling with varying probabilities, controlled selection, balanced sampling plans, ranked set sampling, nonsampling errors, analysis of complex surveys, various methods of estimation such as ratio, regression and product methods of estimation, use of combinatorics in sample surveys and of late small area estimation as well as use of calibration approach in developing improved estimators.
- The methodology for General Crop Estimation Surveys (GCES), cost of cultivation studies for principal food crops, cash crops and horticultural crops, Integrated Sample Surveys (ISS) for livestock products estimation, fruits and vegetable survey are being adopted throughout the country and many Asian and African countries.
- Methodology based on small area estimation technique for National Agricultural Insurance Scheme, also called Rashtriya Krishi Bima Yojana, suggested by the Institute has been pilot tested in the country.
- The sample survey methodology for imported fertilizer quality assessment, estimation of fish catch from marine and inland resources, flower production estimation, area and production of horticultural crops estimation, etc. has been developed and passed on to the user agencies.
- Integrated methodology for estimation of multiple crop area of different crops in North Eastern Hilly Regions using Remote Sensing data has been developed.
- Sampling methodology for estimation of post-harvest losses has been successfully adopted in AICRP on Post-Harvest Technology for Assessment of Post-Harvest Losses of Crops/ Commodities.
- Reappraisal of sampling methodologies, evaluation and impact assessment studies like studies to make an assessment of Integrated Area Development programmes, High Yielding Varieties programmes, Dairy Improvement programmes, Evaluation of cotton production estimation methodology etc. have been undertaken. Most of the methodologies developed are being adopted for estimation of respective commodities by the concerned state departments.
- Institute is regularly publishing the Agricultural Research Data Book since 1996. It contains information pertaining to agricultural research, education and other related aspects compiled from different sources.
- For providing e-advisory and e-learning in sample surveys, initiated a Sample Survey Resources

- Server (http://js.iasri.res.in/ssrs/) which also provides calculator for sample size determination for population mean and population proportion among other material.
- MAPI (http://sample.iasri.res.in/ssrs/android. html/) Mobile Assisted Personal Interview- An android application namely MAPI has been developed for survey data collection
- Sampling methodologies for estimation of crop area and yield under mixed and continuous cropping have been developed for different situations prevailing in different countries. The developed methodology has been field tested in the three identified countries by the FAO, one each in Asia-Pacific, Africa and Latin America/ Caribbean region, i.e. Indonesia, Rwanda and Jamaica respectively.
- Methodology for estimation of area and production of Horticultural crops has been developed, tested and validated in four states of the Country.
- Suitable sampling methodology (aligned with existing Input Survey of Agriculture Census) for estimation of private food grain stock and post-harvest losses at farm level has been developed.
- Guidelines for estimating post-harvest losses of horticultural crops (fruits and vegetables), livestock (meat and milk) and fish (capture and culture fisheries) / fish products have been developed and will be tested in the two countries.

Statistical Genetics and Genomics

- The Institute has made significant contributions in statistical genetics/ genomics for improved and precise estimation of genetic parameters, classificatory analysis and genetic divergence etc.
- Developed procedures for estimation of genetic parameters; construction of selection indices; studying G × E interactions; progeny testing and sire evaluations; detection of QTLs, classification of genotypes using molecular marker data, etc.
- The modification in the procedure of estimation of genetic parameters has been suggested for incorporating the effect of unbalancedness, presence of outliers, aberrant observations and non-normality of data sets.
- Procedures for studying genotype environment and QTL environments interactions have been used for the analysis of data generated from crop improvement programmes.
- The research work on construction of selection indices, progeny testing and sire evaluation have been used for animal improvement programmes
- The Institute has initiated research in the newer emerging area of statistical genomics such as rice genome functional elements information system; comparative genomics and whole genome association analysis. The establishment of a National Agricultural Bioinformatics Grid (NABG) is a landmark in this direction.
- A number of databases and web services have been developed which include pigeonpea
- microsatellite database, buffalo microsatellite database, genome sequence submission portal, biocomputing portal, livestock EST database, insect barcode database, tomato microsatellite database, goat microsatellite database.
- Supercomputing facility (High Performance Computing System) has been established for biological computing and bioinformatics

Statistical Modelling and Forecasting for Biological Phenomena

- Statistical modelling of biological phenomena is carried out by using linear and non-linear models, non-parametric regression, structural time series, fuzzy regression, neural network and machine learning approaches.
- Developed models for pre-harvest forecasting of crop yields using data on weather parameters; agricultural inputs; plant characters and farmers' appraisal.
- Models have been developed using weather and growth indices based regression models, discriminant function approach, markov chain approach, bayesian approach, within year growth models and artificial neural network approach.
- Methodologies for forewarning important pests and diseases of different crops have been
- developed which enable the farmers to use plant protection measures judiciously and save cost on unnecessary sprays.
- Methodology developed for forecasting based on weather variables and agricultural inputs was used by Space Application Centre, Ahmedabad to obtain the forecast of wheat yield at national

level with only 3% deviation from the observed one.

- Models developed for forewarning of aphids in mustard crop were used by Directorate of Rapeseed and Mustard Research, Bharatpur to provide forewarning to farmers which enabled them to optimize plant protection measures. and save resources on unnecessary sprays consecutively for three years.
- Forecasting of volatile data has been attempted through non-linear time series models. Such models were developed for forecasting onion price, marine products export, lac export, etc.
- Non-linear statistical models were developed for aphid population growth and plant diseases. Modelling and forecasting of India's marine fish production was carried out using wavelet methodology. The models developed have potential applications in long term projections of food grain production, aphid population, marine fish production, etc.
- The Technology Forecasting methods such as scenario creation, Delphi survey and cross-impact analysis, technology road-mapping, analytic hierarchy process (AHP) etc. have been employed in various sub-domains of agriculture.
- Created a web solution for estimation of compound growth rate and several other resources.

The Institute has made significant contributions in understanding the complex economic relationship of the factors like transportation, marketing, storage, processing facilities; constraints in the transfer of new farm technology to the farmers field under different agro-climatic conditions of the country.

- Some of the important contributions of the Institute are measurement of indemnity and premium rates under crop revenue insurance, production efficiency and resource use, impact of micro-irrigation, technological dualism/ technological change, return to investment in fisheries research and technical efficiency of fishery farms, the impact of technological interventions, price spread and market integration, price volatility and a study on the dietary pattern of rural households

Information & Communication Technology

ICAR-IASRI is pioneer in introducing computer culture in agricultural research and human resource development in information technology in the ICAR. The Institute has the capability of development of Information Systems, Decision Support Systems and Expert Systems. These systems are helpful in taking the technologies developed to the doorsteps of the farmers.

- The Institute has developed information system for designed experiments which includes agricultural field experiments, animal experiments and long term fertilizer experiments conducted in NARES as research data repositories.
- A comprehensive Personnel Management Information System Network (PERMISnet) has been implemented for the ICAR for manpower planning, administrative decision making, and monitoring. A Project Information and Management System Network (PIMSnet) was developed and implemented for concurrent monitoring and evaluation of projects. This is being developed as a Project Information and Management System for all ICAR projects. A National Information System on Agricultural Education Network in India (NISAGENET) has been designed, developed and implemented so as to maintain and update the data regularly on parameters related to agricultural education in India.
- Online Management System for Post Graduate Education has been developed and implemented for PG School, IARI, New Delhi. The Institute has taken a lead in the development of Expert Systems on wheat crop, maize crop and seed spices. AgriDaksh has been developed for facilitating the development of expert systems for other crops.
- Web based software for Half Yearly Progress Monitoring (HYPM) of scientists in ICAR
- (http://hypm.iasri.res.in) has been developed and implemented for online submission of data regarding the proposed targets and the achievements for the half yearly period. It enables to monitor online progress of the scientists, manpower status, research projects, prioritized activities and salient research achievements at institute/SMD/ICAR level.
- Strengthened Statistical Computing facilities in NARS, helped in capacity building in the usage of high end statistical computing and developed Indian NARS Statistical Computing Portal for providing service oriented computing to the researchers of NARES, which has paved the

way for publishing agricultural research in high impact factor journals.

- A number of software and web solutions have been developed for the agricultural research workers: Statistical Package for Agricultural Research (SPAR) 2.0, Statistical Package for Block Designs (SPBD) 1.0, Statistical Package for Factorial Experiments (SPFE) 1.0, Statistical Package for Augmented Designs (SPAD) 1.0, Software for Survey Data Analysis (SSDA) 1.0, Statistical Package for Animal Breeding (SPAB) 2.1, Online Analysis of Block Designs, Web Generation and Analysis of Partial Diallel Crosses, Web Generation of Designs Balanced for Indirect Effects of Treatments etc.
- A Vortal has been designed and developed to facilitate online management of all training programs [Centre for Advanced Faculty Training (CAFT), Summer-Winter Schools (SWS) and Short Courses (21/10 days duration)] under Capacity Building Program (CBP) sponsored by Agricultural Education Division, ICAR.
- For providing transparency in day to day work of the ICAR/Institute, ICAR-ERP system has been implemented with the Financial Management, Project Management, Material Management, Human Resource Management and Payroll System modules. The system is hosted on IASRI website and can be accessed through URL http://icarerp.iasri.res.in. It can also be visited through http://www.iasri.res.in/misfms/.

Human Resource Development

- One of the thrust areas of the Institute is to develop trained manpower in the country in the disciplines of Agricultural Statistics and Informatics for meeting the challenges of agricultural research in the newer emerging areas
- The Institute conducts degree courses leading to M.Sc. and Ph.D. in Agricultural Statistics,
- Computer Application and Bioinformatics in collaboration with Indian Agricultural Research Institute (IARI), New Delhi.
- The Institute is functioning as a Centre of Advanced Studies in Agricultural Statistics
- and Computer Application (CAS) re-named as Centre of Advanced Faculty Training (CAFT). Under this programme, the Institute organizes training programmes on various topics of interest for the benefit of scientists of NARES. These training programmes cover specialized topics of agricultural sciences.
- The Institute conducts the Senior Certificate Course in Agricultural Statistics and Computing. This course is of six months duration and lays more emphasis on statistical computing using statistical software. The course is divided into two modules viz. (i) Statistical Methods and Official Agricultural Statistics, and (ii) Use of Computers in Agricultural Research, of three months duration each.
- There is another form of training course, which are tailor made courses and are demand driven. The coverage in these courses is need based and the courses are organized for specific organizations from where the demand is received. The Institute has conducted such programmes for Indian Council of Forestry Research, Indian Statistical Service probationers, State Department of Agriculture and senior officers of Central Statistical Office and many other organizations.
- The Institute has also conducted several international training programmes on request
- from FAO, particularly for African, Asian and Latin American countries.
- The Institute has broadened the horizon of capacity building by opening its doors to he
- international organizations and agro-based private sector. The Institute has conducted training programmes for the scientists/research personnel of CGIAR organizations such as ICARDA, AARDO, Rice-Wheat Consortium for Indo-Gangetic plains, Government Officials from Afghanistan etc..

Infrastructural Development

As the activities of the Institute have expanded in all directions, the infrastructure facilities are also expanding. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic Computer in 1964. A third generation computer Burroughs B-4700 system was installed in March 1977 and then replaced in 1991 by a Super Mini COSMOS-486 LAN Server with more than hundred nodes consisting of PC/ AT's, PC/XT's and dumb terminals all in a LAN environment. Later, COSMOS-486 LAN Server was replaced by a PENTIUM-90 LAN Server having state-of-art technology with UNIX operating system.

Computer laboratories equipped with PCs, terminals and printers, etc. had been set up in each of the six Scientific Divisions as well as in the Administrative Wing of the Institute.

Keeping pace with the emerging technologies in the area of Information Technology (IT), the computing infrastructure have been constantly upgraded/ replaced with newer platforms and versions. The computing environment in the Institute has latest computing and audio visual equipments i.e. High Performance Computing having 144 cores Intel HPC cluster, rack mount & redundant SMPS servers, workstations, desktops, laptops, netbooks, documents printing & scanning, DVD duplicator, visualiser and wireless multimedia projectors etc.

The Institute is also well equipped with 100 MBps bandwidth fiber optics backbone wired and wireless networking campus. The first supercomputing hub for Indian Agriculture ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) established at IASRI, was dedicated to the Nation on 15 January 2014. In order to provide access to this advanced computing facility to researchers, a National Bio- Computing Portal has been launched through which authenticated users will be able to perform their biological data analysis. This portal consists of number of computational biology and agricultural bioinformatics software/workflow/ pipelines which will be able to automate routine biological analytics in seamless manner. This super-computing hub consists of hybrid architecture with high performance computing having (i) 256 nodes Linux cluster with two masters, 3072 cores and 38 Tera Flops computing, (ii) 16 nodes windows cluster with one master, (iii) 16 nodes GPU cluster with one master with 192 CPUs + 8192 GPUs and (iv) SMP based machine with 1.5 TB RAM. Also, this hub has approximately 1.5 Peta Byte storage divided into three different types of storage architecture i.e. Network Attached Storage (NAS), Parallel File System (PFS) and Archival. This hub also consists of super-computing systems (16 node Linux cluster with one master and 40 TB storage) at National Bureaux of Plant Genetic Resources (NBPGR) New Delhi, National Bureaux of Animal Genetic Resources (NBAGR) Karnal, National Bureaux of Fish Genetic Resources (NBFGR) Lucknow, National Bureaux of Agriculturally Important Microbes (NBAIM) Mau and National Bureaux of Agriculturally Important Insects (NBAII), Bangalore which forms a National Agricultural Bioinformatics Grid in the country.

There are various labs in the Institute for dedicated services like ARIS lab for training, Statistical computing lab, Student lab and Centre of Advanced Study lab. An Agricultural Bioinformatics Lab (ABL) fully equipped with software and hardware to study crop and animal biology with the latest statistical and computational tools was also established. Business Intelligence Server has also been installed for statistical computing for NARES. A laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory is equipped with latest state-of-art technologies like computer hardware and peripherals, Global Positioning System (GPS), software like ERMapper, PCARC/INFO, Microstation 95, Geomedia Professional, ARC/INFO Workstation and ERDAS Imagine with the funds received through two AP Cess Fund projects. This computing facility has further been strengthened with the procurement of ARC-GIS software. Some of the important available software are SAS 9.2, 9.3, 9.4 JMP 8.0, 9.0, 10.0 JMP Genomics 4.0, 5.1, 6.0, SAS BI Server 4.2, SPSS, SYSTAT, GENSTAT, Data warehouse software – Cognos, SPSS clementine, MS Office 2007, Linux OS, MS Visual Studio.net, MS-SQL Server, Microsoft SQL DBMS, Microsoft Exchange 2013, Microsoft Lync 2013, Unix based AIX Operating System, Oracle, Oracle Fusion Middleware 12C, Oracle ERP Release 12.1.3, Macro-Media, E-views, STATISTICA Neural Networks, Gauss Software, Minitab 14, Maple 9.5, Matlab, Web Statistica, Lingo Super, Discovery Studio, CLC Bio, SAS Modules of Text Mining and Data Management & Integration, ArcGIS among others.

A laboratory has been created in the Computer Division to facilitate training. The laboratory is equipped with 25 desktop computers with digital board. It has centralized AC facility. Another video-conferencing lab has been setup to facilitate video-conferencing. Network Operating Centers (NOC) have been created in the ground and second floor of the computer center building to manage the computing infrastructure and services. Auditorium of the institute has been renovated with latest infrastructure.

Local Area Network of IASRI has been strengthened with state of art Ethernet Passive Optical Network (EPON) with 344 nodes. The technology has triple play service Data, Video and Voice with modular planning. The networking services at IASRI have been further strengthened. The entire IASRI campus is Wi-Fi enabled with a high speed internet connection to allow the staff and students to access the internet no-matter wherever they are. The coverage of Wi-Fi

is not only restricted to labs but also extends to all the areas including library, auditorium and hostels.

The Institute's domain service like Primary and Secondary DNS, Domain (iasri.res.in) Website (http://www.iasri.res.in), Live E-mail services, more than 462 network nodes and number of various Online Information Systems are being developed and maintained by the Institute.

ICAR Data Centre was inaugurated by Union Minister of Agriculture and Farmers' Welfares at IASRI on 21st December, 2016. About 80 website have been launched in Data Centre.

Krishi Vigyan Kendra Knowledge Network Portal and KVK Mobile APP (http://kvk.icar.gov.in) have been developed to disseminate knowledge and information from KVKs to farmers. KVK Portal was launched on 8th July 2016 and KVK Mobile APP was launched on 21st December, 2016 by the Union Minister of Agriculture and Farmers Welfare.

Honourable Union Minister of Agriculture and Farmers' Welfare released the Education portal of ICAR along with two Mobile Apps namely Pashu Prajanan (Animal Reproduction) and Shukar Palan (Pig Farming) in the Conference of Vice Chancellor of Agricultural Universities and Directors of ICAR Institutes on 8th March, 2018 at NAAS Complex, Pusa, New Delhi. Mobile Apps Pashu Prajanan and Shukar Palan have been developed in collaboration with ICAR-IVRI and is available on Google Play Store. Four copyrights have been obtained for Animal Reproduction and Pig Farming mobile apps for different languages.

The Library of ICAR-IASRI is considered as a well known and specialized library in terms of its resources in the form of print and electronic format in the field of agricultural statistics, computer applications, bioinformatics and allied sciences. It is recognized as one of the regional libraries under NARES with best IT agricultural library under ICAR system. During the XI Plan period, the library has undergone changes in terms of its resources. It has strengthened the resource base in terms of core foreign journals. With procurement of online and CD-ROM bibliographical databases the awareness for the use of databases has increased and users are able to access scientific information in the field of their interest quickly by clicking of a button. All housekeeping activities of the library have been computerized and bar-coded and all bonafide library users have been issued electronic membership cards and all Ph.D. and M.Sc. Thesis have been digitized and given access to users through LAN. Library of the Institute got associated with CERA in terms of electronic document delivery services. The library reading room has been renovated with 5 split air conditioners to provide congenial environment for readers. All library users were given training to access on-line services available in the library.

ICT Infrastructure and Unified Messaging and Web Hosting facilities have been created. The facilities provide email solution for all employees of ICAR with features of unified messaging at desktop of users. Web hosting environment facilitates use of website/ applications developed by ICAR institutes.

There are three well-furnished hostels, viz. Panse Hostel-cum-Guest House, Sukhatme Hostel and International Training Hostel to cater to the residential requirements of the trainees and students.

Organizational Set-up

The Institute is having six Divisions, one Unit and three Cells to undertake research, training, consultancy, documentation and dissemination of scientific output.

Divisions

- Design of Experiments
- Statistical Genetics
- Forecasting and Agricultural Systems Modeling
- Sample Surveys
- Computer Applications
- Centre for Agricultural Bioinformatics [CABin]

Unit

- Institute Technology Management Unit (ITMU)

Cells

- Prioritization, Monitoring and Evaluation (PME) Cell
- Training Administration Cell (TAC)
- Consultancy Processing Cell (CPC)

Financial Statement

The Institute was able to ensure optimal utilization of funds available in the budget. The actual utilization of the budget is furnished below:

Expenditure Statement (detailed) (Rs. in Lakhs)

Head	RE 2018-19 (Institute+CABin+SCSP)	Total Expenditure 2018-19	Total Closing Balance (Institute+CABin+SCSP)
Works			
A. Land			
B. Building			
i. Office building			
ii. Residential building	8.00000	8.00000	0.00
iii. Minor Works	3.00000	3.00000	0.00
Equipments	13.30000	6.85660	6.44340
Information Technology	22.00000	21.88116	0.11884
Library Books and Journals	44.70000	44.69260	0.00740
Vehicles & Vessels			
Livestock			
Furniture & fixtures	5.00000	4.53326	0.46674
Others			
Total – CAPITAL (Grants for creation of Capital Assets)	96.00000	88.96362	7.03638
Establishment Expenses(Salaries)			
i. Establishment Charges	3125.00000	3122.35170	2.64830
ii. Wages			
iii. Overtime Allowance			
Total – Establishment Expenses (Grant in Aid - Salaries)	3125.00000	3122.35170	2.64830
Pension & Other Retirement Benefits	1038.00000	1036.24902	1.75098
T.A.			
A. Domestic TA / Transfer TA	26.80000	26.65161	0.14839
B. Foreign TA			
Total – Traveling Allowance	26.80000	26.65161	0.14839
Research & Operatinal Expenses			
A. Research Expenses	284.00000	282.43469	1.56531
B. Operational Expenses	208.50000	206.26422	2.23578
Total - Research & Operational Expenses	492.50000	488.69891	3.80109
Administrative Expenses			
A. Infrastructure	446.20000	444.41741	1.78259
B. Communication	2.00000	1.99556	0.04440
C.Repair & Maintenance			

Head	RE 2018-19 (Institute+CABin+SCSP)	Total Expenditure 2018-19	Total Closing Balance (Institute+CABin+SCSP)
i. Equipments,Vehicles & Others	269.80000	265.66908	4.13092
ii. Office building	27.50000	27.38977	0.11023
iii.Residential building	44.00000	43.44918	0.55082
iv. Minor Works	22.00000	21.65938	0.34062
D. Others (excluding TA)	190.58000	184.42337	6.15663
Total - Administrative Expenses	1002.08000	989.00375	13.07625
Miscellaneous Expenses			
A. HRD	16.00000	15.39065	0.60935
B. Other Items (Fellowships, Scholarships etc.)	74.80000	74.74970	0.05030
C. Publicity & Exhibitions			
D. Guest House – Maintenance			
E. Other Miscellaneous	601.82000	601.82000	0.00
Total - Miscellaneous Expenses	692.62000	691.96035	0.65965
Total --Grants in Aid - General	3252.00000	3232.56364	19.43636
Grand Total (Capital + Establishment+General)	6473.00000	6443.87896	29.12104
Loans and Advances	0.00	0.00	0.00
		(Rs. In Lakhs)	
Swachh Bharat Mission		0.00098	

Resource Generation (2018-19) (Rs. in Lakhs)

1	Licence fee	16.91942
2	Interest earned on loans & advances	0.77133
3	Receipts from schemes	22.23160
4	Application fee from candidates	0.13000
5	Training	0.50000
6	Institutional Charges	16.71802
7	Miscellaneous Receipts	8.85572
	TOTAL	66.12609

Staff position (as on 31 March 2019)

Manpower	Sanctioned posts	Filled posts
Director	1	0
Scientific	130	68
Technical	174	53
Administrative	84	64
Auxiliary	14	07
SSS	78	27
Total	481	219

3

Research Achievements

Programme 1: Development and Analysis of Experimental Designs for Agricultural Systems Research

ICAR-Research Data Repository for Knowledge Management as KRISHI (Knowledge Based Resource Information System Hub for Innovations in Agriculture) Under ICAR Headquarters Plan Scheme

KRISHI (Knowledge Based Resource Information System Hub for Innovations in Agriculture) portal is serving as a gateway to enhance visibility of digital outputs of ICAR to stakeholders. The salient achievements are given subsequently.

- ICAR **Mobile Apps:** Developed workflow based application for submission of links of Mobile Apps. Search facility based on keyword, SMD, Institute and language has also been provided. All fields/data in Mobile Apps link were prepared as Web Services through JSON. At present links of a total of **215** (85 reported earlier) **mobile Apps** (ICAR: 133; SAU/CAU: 37; KVK: 24 and Other Govt. Agencies: 21) are available in this application.
- **Video/Audio Gallery:** Developed workflow based application for submission of links of Mobile Apps. Search facility based on keyword, SMD, Institute and language with drop-down filter has also been provided using Angular JS. Links of **1337** videos (539 reported earlier) and 54 Audios (52 earlier) are also available. The gallery was released by Deputy Director General (Agricultural Education), ICAR on December 04, 2018 (Fig. 3.1).

Fig. 3.1: Webpage for ICAR Video Gallery

- **Inter Portal Harvester:** In order to bring various agricultural research publications collected by various organizations within as well as outside of ICAR, strengthened Inter Portal Harvester (http://krishi.icar.gov.in/ohs-2.3.1/index.php/browse) by adding one more resource. At present more than **4,57,321** (**4,00,427** reported earlier**)**records from 26 repositories (2 repositories added during the period) are available for unified search.
- **Publication and Data Inventory Repository:** The repository has been enriched through populating data by Nodal officers and other researchers. **16400** (4990 reported earlier) publications and **410** (291 reported earlier) datasets have been submitted from **107** Institutes (106 Reported earlier). **1060** researchers (309 reported earlier) other than Nodal officers have registered themselves as

submitters. Added a new collection AICRP on Home Science Publication under Agriculture-Education community and CIWA Community with collection authorization and item template setting. Following modifications/updates were made in the application: (i) Added Report page for number of files uploaded along with each publication. (ii) Added LDAP authentication for all researchers from NARS; (iii) Added a new category 'Training Manual' under Publication Type; (iv) Updated embargo condition text message for item submission in input form and (v) Added reports on pending item count by Reviewer and Approved item count by reviewer for administrator; (vi) Updated input-form for Publication connection for Multiple Language selection. Added the reports on downloads from this repository.

- **Technology Repository:** Technology Repository has been updated by adding (i) a keyword based search facility, (ii) selection based reports module; (iii) converting general reports into AngularJS-JSON with URL; (iv) optimising the code of application for submission of Technology and report generation through a single page and (v) implementing the facility of maintaining history/ trail of add/update in technology with date, time and e-mail in the workflow process. **28 i**nstitutes have initiated uploading the Technologies / proven technologies.At present **427** (11reported earlier) technologies are available in public domain and **87** (4 reported earlier) are in the workflow process. The repository was launched by Secretary DARE and DG, ICAR on December 04, 2018 (Fig. 3.2).

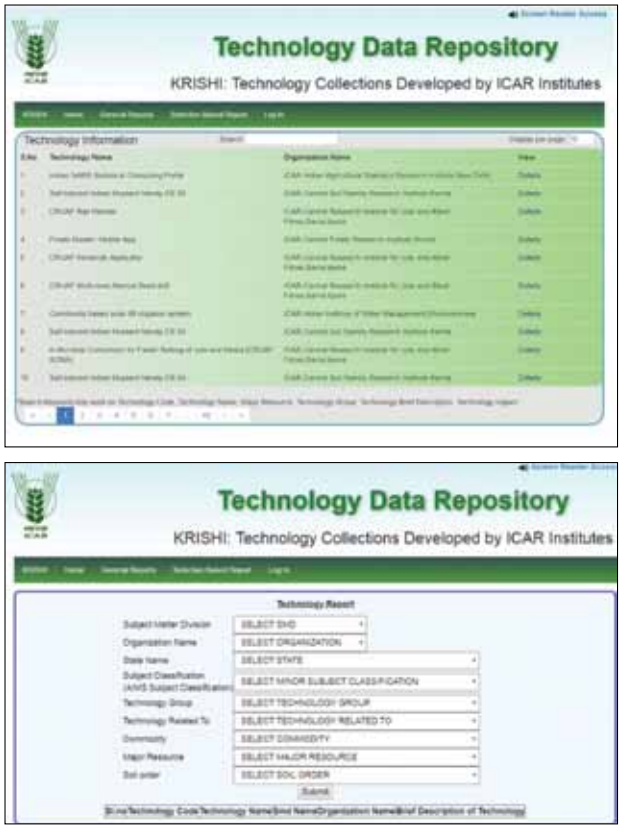


Fig. 3.2: Display pages for ICAR technology repository (generation of general and section based reports)

- **Unit Level Data Repository**
  - **Content Management System AICRP Websites:** Based on information received from stakeholders, developed and strengthened websites for **14** AICRPs with uniform formatting and contents using Content Management System and different level user authentications. Among these 14, **04** are developed for new AICRPs: (i) AICRP on Post Harvest Engineering & Technology, Ludhiana; (ii) AICRP on Weed Management, Jabalpur; (iii) AICRP on Ergonomics and Safety in Agriculture; (iv) AICRP on Plastics in Agriculture (Fig. 3.3 & 3.4).

Fig. 3.3: Webpage for AICRP on post harvest engineering and technology

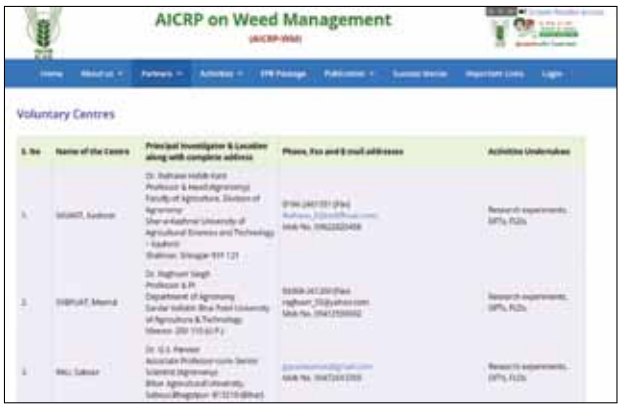


Fig. 3.4: Webpage for AICRP on weed management (display for partner centres)

- **Experimental Data Repository:** Developed Prototype for Information System for All-India Coordinated Research Projects to plan and design experiments, generate data, analyse and prepare reports of AICRP experiments. It also helps in creation of research data repository and standardization of analysis and reporting of experiments. Prototypes have been developed for 02 observational studies. Following information systems have been developed and launched: (i) Information System for AICRP on PHET: The Information System was released by Dr. N. Kumar, Vice-Chancellor, TNAU, Coimbatore during 34th Annual Workshop of AICRP on PHET organized at Tamil Nadu Agricultural University, Coimbatore on March 12, 2019; (ii) Information System for AICRP on FIM: Information system was released on December 04, 2018 by DDG (Agricultural Engineering) during III National Workshop of Officer Incharge data management. Information System on AICRP on Fruits; LTFE; Weed management; Integrated water management; Management of salt affected soils and use of saline water agriculture; Poultry; Castor, Safflower, Sunflower are being customized.
- **Observational Data Repository:** Workflow based application for centre creation and uploading data on weather parameters through custom input forms has been developed. Strengthened the application for harvesting/scrapping of daily weather data from (i) ICAR-IARI, New Delhi; (ii) ICAR-VPKAS, Almora; weekly weather data from (iii) ICAR-CRIJAF, Barrackpore and added the following Institutes (iv) ICAR-VPKAS, Almora; (v) ICAR-CCARI, Goa; (vi) ICAR-CSSRI, Karnal; (vii) ICAR-NIASM, Baramati and (vii) ICAR-IISWC, Dehradun.

- **ICAR Geo-Portal:** Strengthened geo-portal by adding new layers of (i) Soil degradation, Rabi Maize suitability area; Kharif maize suitability area; (ii) Bioclimatic Zones of India developed by ICAR-NBSS&LUP, Nagpur. Also added layers of (i) Vegetation condition index; (ii) Temperature condition index, (iii) NDVI deviation and (iv) Evaporative stress index as a first step of synchronization with CREAMS (Consortium for Research on Agro-ecosystem Monitoring and Modelling from Space), ICAR-IARI, New Delhi. Developed the application of PGR-Clim in collaboration with ICAR-NBPGR, New Delhi and is made available at https://geokrishi.icar.gov.in/icargeoportal. Also depicted points of Camel Population in Different States and locations of Camel Animal Welfare organized. The maps for points of residue burning in Punjab, Haryana and UP are uploaded for Monitoring Paddy Residue Burning in North India using Satellite Remote Sensing for October 01, 2018-November 30, 2018 on daily basis (Fig. 3.5 & 3.6).

Fig. 3.5: PGR-Clim

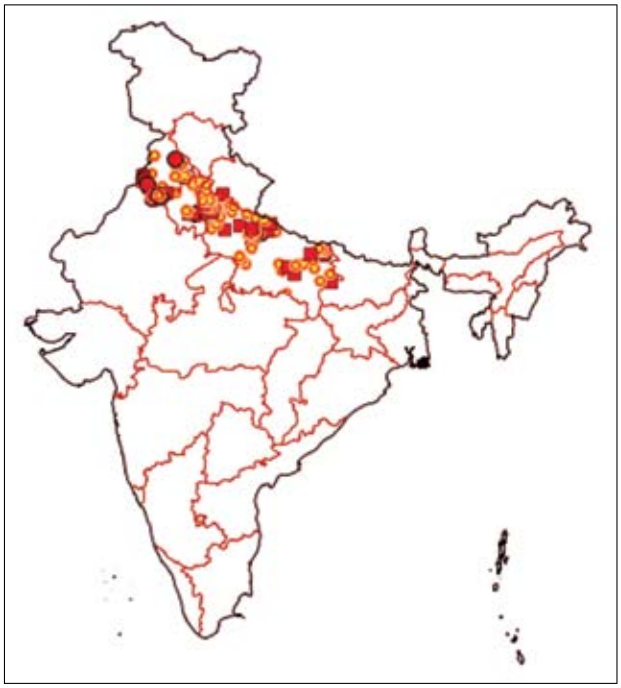


Fig. 3.6: Visualization of paddy residue burning points in Haryana, Punjab and Uttar Pradesh as on November 29, 2019

- **Dashboard for Monitoring:** A Dashboard has been created to monitor the progress of submissions to various repositories by ICAR institutes. This monitoring mechanism allows progress under different headings such as SMD-wise/Institute-wise progress. It includes graphic displays related to distribution for (a) Video/Audio (by SMD), (b) Video/Audio Gallery (by Language); (c) Publications submitted (by SMD); (d) Technology submitted count (by

SMD and Soil order); (e) Technology submitted by Institutes; (f) Inter-Portal Harvester (Daily Harvested Article) and (g) Inter-Portal Harvester (Source-wise records harvested).The portal was also made secure by TLS security.

- **Master Database:** Master database tables have been created for Subject Matter Division; Organization Type; Organization; Regional Station; AICRP; State; District; Zone; Agro-Ecological Region; Agro-Ecological Sub Region; Languages; Subject Classification (AIMS); Subject Sub Classification(AIMS); Major Resource; Commodity; Commodity Name; Commodity Type; Soil Great Group; Soil Great Sub Group; Soil Order; Soil Sub Order. An application has been written to update data in these master tables by Administrator. An application has also been written to make these ICAR Master Records available in form of web-services, e.g. JSON or XML (Fig. 3.7).

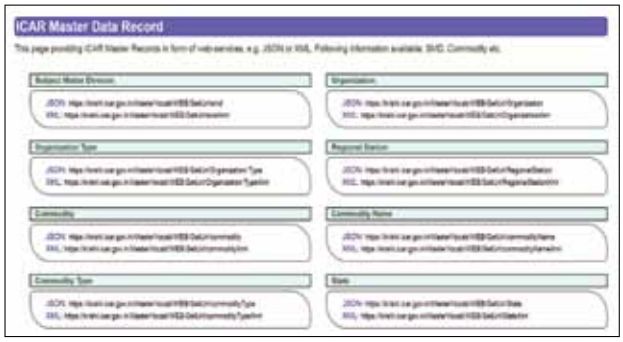


Fig. 3.7: Webpage for master tables in JSON/XML

- **Single Sign On:**First time in ICAR web applications, User Authentications are done in KRISHI Data repository using ICAR Email credentials, thereby removing multiple usernames and passwords. The same is now being tried in other applications as well, leading to Single-Sign for Centralized applications.
- **Policy Initiative:** (i) Quality Research Data Acquisition Guidelines were approved by the competent authority on 30.08.2018 and circulated to all on September 07, 2018 and are also made available at https://krishi.icar.gov.in/PDF/Final_Quality_Research_Data_Acquisition_Guidelines_ICAR.pdf; (ii) Council issued an officer order F.No. 13/55/2018-Cdn. Tech. dated September 07, 2018 regarding uploading data in Central Publication and Data Inventory Repository and Technology Repository.
- **Visibility**: KRISHI Portal has attracted more than **1,02,000**(62,000 reported earlier) page views since May 2015 across more than **626** cities of **105** countries. Publication and Data inventory repository is indexed in**BASE (**Bielefeld Academic Search Engine); **Google Scholar and Directory of Open Access repositories**. Since May 2017, from ICAR Publication and Data Inventory Repository, there are more than **3,00,000** (1,45,000 **reported earlier)** downloads that includes documents fetched through computer programme by other sites and more than **39,400** page views (19,700 reported earlier) across **200** cities of**40** countries.

Planning, designing and analysis of experiments planned On Stations under AICRP on Integrated Farming System (IFS)

The on-stations research experiments under All India Coordinated Research Project on Integrated Farming Systems (IFS) are being planned and conducted under four types of research programmes viz. (i) development of new cropping systems; (ii) nutrient management in cropping systems; (iii) development of system based management practices and (iv) maximum yield research. These experiments are conducted using Randomized Complete Block (RCB) design, Factorial RCB design, split plot design, strip plot design, $3^2 \times 2$ balanced confounded factorial experiments and split-split plot design. Data of 170 experiments for the year 2015- 16 have been received and analysis work for all the experiments has been completed. Results have been tabulated in the form of summary tables and sent to the respective scientist- in-charge of the cooperating centres.

Four tier user authentication architecture using Asp.net platform and Java language for which MS Access Database has been used. This logic has been integrated in “Information System on Designed Experiments” has been created (Fig.3.8). The process for developing web based database application for statistical analysis of Experiment 1(a): Intensification and diversification of cropping sequence based on high value crops and Experiment 2(a): Permanent plot experiment on integrated nutrient management in rice-wheat cropping sequence using JSP programming language as front-end and SQL server as back-end is being finalized that would considerably reduces the time gap between actual data collection and data submission to our institute for further statistical analysis. One can successfully perform the data entry, analysis and generate report of 1(a) experiment. Data entry in combined analysis

and its analysis has been done for kharif season. For other seasons, modules are under progress and report generation of combined analysis is also under progress. JSP for the front end and SQL server 2012 for back end has been used for the purpose. Various validations have been put so that there should be less error. The website contains the data entry for experiment 1(a) and combined analysis. Analysis and report generation of experiment 1(a) has been completed. The website has included the module of combined analysis for kharif season. Report generation for combined analysis is in progress. Now there is option available for changing the password of the user. A syntax/SAS code for the experiment under missing plot technique has been developed.

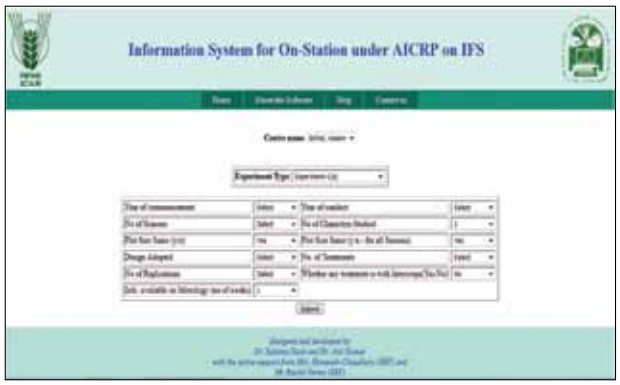


Fig. 3.8: Web page for information system for on-station pertaining to Experiment 1(a) for one centre

Some investigations on trend resistant row-column designs

Designs under two sources of heterogeneity are useful for situations where there may be evidences of two sources of variability apart from the treatment applied to the experimental material. In agricultural experiments, response may be affected by systematic trend. Thus, trend component should be incorporated into the model under two sources of heterogeneity. Further, it may be the case that the observations may be correlated. Thus, this should also be taken into account for designs under two sources of heterogeneity incorporating trend component. Trend resistant designs under two sources of heterogeneity have been studied when the observations are correlated. The information matrix for a design under two sources of heterogeneity incorporating trend component when observations are mutually dependent or correlated has been obtained. The condition for a design under two sources of heterogeneity to be trend free when observations are correlated has also been obtained. Since, Latin square designs are trend free designs under two sources of heterogeneity, the efficiencies of Latin square designs when observations are correlated have been calculated for different number of parametric combinations and for different values of correlation by considering both AR(1) and Nearest Neighbour (NN) correlation structure. It has been observed that, for AR (1) correlation structure, the efficiencies remain high although decreases as the magnitude of the correlation increases and also as the number of treatments vis-a-vis total number of observations increases. However, for NN correlation structure, the efficiencies decrease sharply as the values of the correlation increase in the positive direction from 0.4.

SAS macro for generation of incomplete row-wise trend free designs under two-source of heterogeneity when treatment number is a prime has been developed (Fig.3.9).

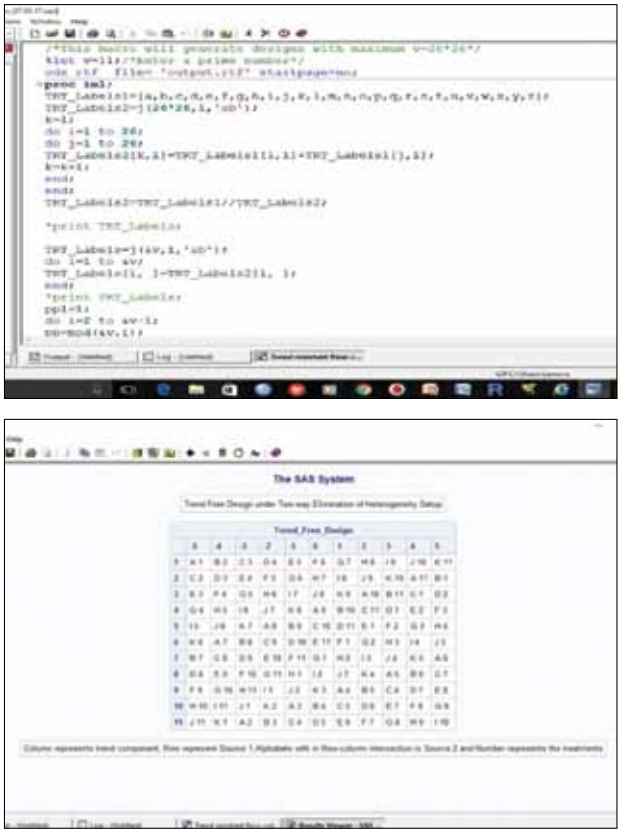


Fig. 3.9: SAS macro for generation of incomplete row-wise trend free designs under two-source of heterogeneity when treatment number is a prime

SAS macro for the generation of incomplete row-wise trend free designs under two-source of heterogeneity partially balanced for neighbour effects when treatment number is a prime has been developed (Fig. 3.10).

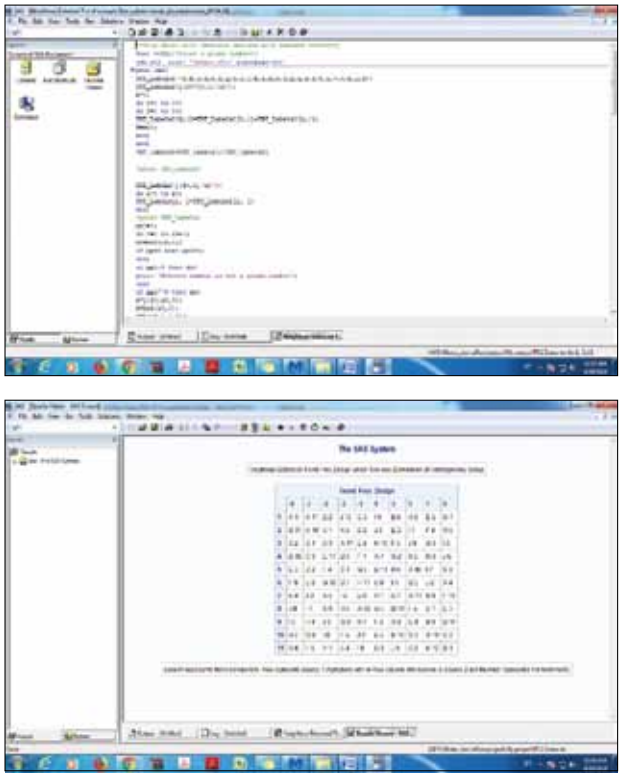


Fig. 3.10: SAS macro for generation of incomplete row-wise trend free designs under two-source of heterogeneity partially balanced for neighbour effects when treatment number is a prime

Generalized row-column designs for crop and animal experiments

When there is cross classified variation in the experimental units, then Row-Column (RC) designs are useful for such experimental situations. These designs are used to control variability in field and animal experiments. Most of the row-column designs developed in the literature have one unit corresponding to the intersection of each row and column. However, when the number of treatments is large with limited experimental resources, Generalized Row-Column (GRC) designs are used. GRC design is an arrangement of v treatments in p rows and q columns such that the intersection of each row and column (cell) consists of more than one unit (k). In case of a GRC design there is more number of units in a cell and the treatment applied to one experimental unit in a cell may affect the response on neighbouring unit in the same cell. A series of GRC designs balanced for spatial indirect effects have been developed with parameters of the developed designs as v (odd), p = v, q = v-1, k = s(2 ≤ s ≤v-1), r= s(v-1) and μ=2(s-1). The joint information matrix for estimating the contrast pertaining to direct and neighbour effects has been derived for the developed series. The information matrix for estimating the contrast for direct treatment effects has also been derived. A catalogue of developed series of GRC designs balanced for spatial indirect effects is prepared. SAS macro for generating a classes of GRC designs balanced for spatial indirect effects has been developed. Computer modules for generating a classes of GRC designs along with their randomized layout have been developed. Methods of construction of Partial Diallel Crosses (PDC) using a classes of GRC designs with parameter v=2s (s>2), p=s, q=s and k= 2 have been obtained. The parameters of the developed PDC plan will be n (no of lines/genotypes) = v, N (no of crosses) = s2 and f (degree of fractionation) = s/(2s-1).

Designs involving three-way and four-way genetic crosses for crop and animal breeding programmes

Plant and animal hybrids are increasingly gaining popularity among the breeders as well as in industrial sector. The increased performance of hybrids over the parents in terms of vigour and yield potential is the basic reason for this gain in popularity. Now, among various types of hybrids two-way (diallel) cross hybrids are the simplest and easily manageable. However three-way (triallel) cross hybrids and four-way (tetra-allele) cross hybrids are genetically more viable, stable and consistent in performance than two-way cross hybrids. Breeders are much interested to know about the specific combining ability (sca) effects along with the general combining ability (gca) effects. Since higher order mating designs like three-way and four-way crosses are useful in exploiting the epistatic gene action, developing small and efficient three-way and four-way cross designs will not only attract the breeders to use them but the information obtained on the higher order sca effects may also help to improve the quantitative traits which are of economical as well as nutritional importance in crops and animals.

A new, efficient and cost effective series of designs involving three-way crosses for breeding experiments has been introduced and general expressions of information matrices, eigenvalues, variance factors, efficiency factor and degree of fractionation have been derived. The developed series has small degree of fractionation and high efficiency factor making them cost effective and suitable for scarce resource conditions.

A new model for experimental designs involving tetra-allele crosses that incorporates both gca and sca has been defined. Optimality aspects of such designs have been discussed incorporating sca

effect in the model. Orthogonality conditions have been derived for block designs ensuring estimation of contrasts among the gca effects, after eliminating the nuisance factors, independently from sca effects.

Incomplete split-plot designs: Construction and analysis

Split-plot designs are widely used in agricultural experiments where whole plot treatments are applied to larger plots and within each whole plot, all the subplot treatments are applied. There arises certain experimental situations when one cannot apply each of the subplot treatments within each whole plot. In such situations, number of subplot treatments to be applied in each whole plot is less than the total number of subplot treatments. Such types of experimental designs are called as incomplete split-plot designs. In split-plot designs, whole plot treatments are generally applied in randomized complete block designs. Sometimes we may apply whole plot treatments in incomplete block design set up. In some situations, subplot treatments may be combinations of two factors. The analysis methods of incomplete split-plot designs are not readily available in standard statistical packages. The purpose of this project is to address the problem of constructing incomplete split-plot designs for the three situations viz., when the sub-plots are incomplete, when the main-plots are incomplete and when both the whole plots and sub-plots are incomplete along with analyzing data and implementing the analysis method in a software module (Fig.3.11).

Methodology of analysis of incomplete split plot designs which are incomplete at whole plot level and complete at subplot level has been developed. Similarly, methodology of analysis of incomplete split plot designs which are complete at whole plot level and incomplete at subplot level has been developed. A methodology of analysis of incomplete split plot designs which are incomplete both at whole plot level and at subplot level has been developed.

Fig. 3.11: A screenshot of software module for incomplete split-plot designs

These methods have been implemented using R programming language. These methodologies have also been included as part of a web application so that they can be used by researchers and experimenters.

Designing and analysis of On Farm research experiments planned for AICRP on Integrated Farming System (IFS)

As On Farm Research Components (OFR 2) experiments completed collecting data for four years, diversification analysis was carried out. After grouping the data into five ecosystems, data analysis as well as preparation of graphs/charts, for the data pertaining to the year 2015-16, has been undertaken. A summary is given below:

- On-Farm centres classified into five ecosystems *viz*., (i) Semi Arid (ii) Arid (iii) Humid (iv) Sub Humid and (v) Coastal. Data analysis was carried out for Semi Arid ecosystem.
- Four indices viz., Ecological Security Index (ESI) (ii) Economic Efficiency Index (EEI) (iii) Social Equity Index (SEI) and (iv) Sustainable Livelihood Security Index (SLSI) were computed based on 2015-16 data. SLSI is derived from other three indices.
- In total, 280 households were considered for analysis, after data cleaning.
- Logarithmic transformation was used and after the analysis, data was retransformed.
- Paired t-test was used for comparing benchmark vs. improved systems, taking overall 280 observation pairs into consideration. ESI vs. ESI-improved (at 1%), EEI vs. EEI-improved (at 10.04%), SEI vs. SEI-improved (at 1%) were found to be significant while SLSI vs. SLSI-improved did not exhibit significant difference.
- Paired t-test was used for comparing benchmark vs. improved systems, farming system-wise (for those having ³ 10 observations). With Field Crop (FC), Dairy (D), Goat (G) and Poultry (P), for farming system FC+D: ESI vs. ESI-improved (at 1%), EEI vs. EEI-improved (at 1%), SEI vs. SEI-improved (at 1%) and SLSI vs. SLSI-improved (at 10%) were found to be significant. For farming system FC+D+G: ESI vs. ESI-improved (at 5%), SEI vs. SEI-improved (at 10%) and SLSI vs. SLSI-improved (at 5%) were found to be significant. For farming system FC+D+P: ESI vs. ESI-improved (at 10%) and SEI vs. SEI-improved (at 5%) were found to be significant.

For farming system FC+D+G+P: all indices were found to be significant.

- Paired t-test was used for comparing benchmark vs. improved systems, component-wise. For single component system: SEI vs. SEI-improved (at 5%) and SLSI vs. SLSI-improved (at 5%) were found to be significant. For two-components system: ESI vs. ESI-improved (at 1%), EEI vs. EEI-improved (at 1%), SEI vs. SEI-improved (at 1%) and SLSI vs. SLSI-improved (at 10%) were found to be significant. For three-components system: ESI vs. ESI-improved (at 5%) was found to be significant. For four-components system: EEI vs. EEI-improved (at 10%) and SEI vs. SEI-improved (at 10%) were found to be significant. Q-Q plot difference was also shown.
- One way ANOVA was performed for testing the significance of various types of farming systems (12 were there in total) with respect to each index. Duncen's Multiple Range Test (DMRT) was carried out for finding out the best performing farming system among nine farming systems (having more than one observation). It also helped in grouping various farming systems in terms of performance based on index values. EEI-improved (at 5%) was found to be statistically significant and FC+D+G performed best among all.
- Again, one way ANOVA was performed for testing the significance of indices in terms of various component combinations (4 were there in total, viz., single, two, three and four components). DMRT was carried out for finding out the best performing component combination among these four. None of the indices were statistically significant using benchmark data whereas ESI-improved (at 5%), EEI-improved (at 5%), SLSI-improved (at 10.31%) were found to be significant. Four-component, two-components and three components performed best for ESI-improved, EEI-improved and SLSI-improved respectively.
- Pie-charts were prepared farming system-wise and component-wise to demonstrate the distribution various types.
- Scatter plots were prepared for each significantly performing index vs. SLSI farming system wise (³ 10 observations) and component-wise.
- Correlation coefficient was computed and its significance was tested to check whether there is any significant association between these indices and SLSI-improved. Further, to know more about the contribution of each component to SLSI-improved, regression was fitted by considering SLSI as dependent variable and ESI-improved, EEI-improved and SEI-improved as independent variables.

Few new modules *viz*., (i) Green House Gases and (ii) Farming System (FS) -Typology and (iii) Help of the software "AICRP on Integrated Farming Systems On-farm Farming Systems Research: Online Data Entry and Analysis" have been designed and developed. Software for online data (collected from households/ farmers identified) entry of OFR 2 experiments and user manual were released in the V Biennial Workshop of AICRP on IFS organized at University of Agricultural Sciences, GKVK campus, Bengaluru during 20-22 December, 2018 (Fig. 3.12 & 3.13).

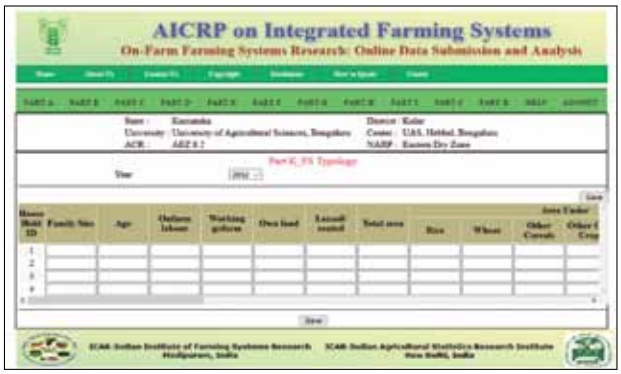


Fig. 3.12: A screenshot on Farming System topology in "AICRP on Integrated Farming Systems On-farm Farming Systems Research: Online Data Entry and Analysis" Software

Fig. 3.13: A screenshot of Help page in "AICRP on Integrated Farming Systems On-farm Farming Systems Research: Online Data Entry and Analysis" Software

Planning, designing and analysis of data relating to experiments for AICRP on long term fertilizer experiments

Long term fertilizer experiments are conducted every year at 17 cooperative centres during Kharif and Rabi seasons for specific crops at specific centres. The experimenters record grain yield,

macro and micro nutrients uptake by the crops and soil parameters. During 2018-19, data analysis of Parbhani centre for 2016-17 for Kharif and Rabi season has been completed and analysis results have been sent to centre in-charge in specified format. Data of Barrackpore centre for 2014-15 and 2015-16 for Pre-Kharif, Kharif and Rabi seasons have been analyzed and analysis results sent to centre in-charge. Data analysis of Palampur centre for 2015-16 for Kharif and Rabi season has been done and analysis results sent to centre in charge.

On construction of orthogonal and nested orthogonal Latin hypercube designs

A general procedure for obtaining the Orthogonal Latin Hypercube (OLH) designs for six factors for any permissible number of runs have been obtained. Further, two new series of second order OLH designs for six factors have been given. A Catalogue of orthogonal latin hypercube designs of 1st and 2nd orders with m (≤ 6) factors and n (≤ 20) runs was also presented. A web application has also been developed for online generation of 1st order and 2nd order OLH designs (Fig. 3.14).

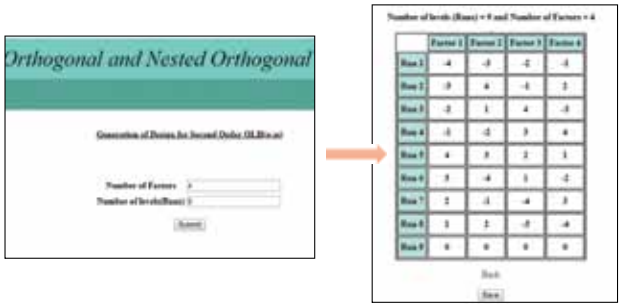


Fig. 3.14: Generation of second order orthogonal Latin hypercube designs via web application

A general procedure of obtaining construction methods of orthogonal and nearly orthogonal space filling Latin Hypercube Designs has been described. A Catalogue of Orthogonal and nearly orthogonal space filling Latin Hypercube Designs with m (≤ 6) factors and n (≤ 20) runs was also presented. A web application has also been developed for online generation of OLH design with good space filling property (Fig.3.15).

Two general methods of constructing Nested Orthogonal Latin Hypercube (NLOH) designs have been developed. First method deals with two layers of NOLH and the second methods deals with three or more layers of NOLH. The methods give many new NOLH designs with fewer number of runs as compared to existing NOLH designs. A Catalogue of NLOH Designs of p(≤ 4) layers with m(≤ 6) factors and

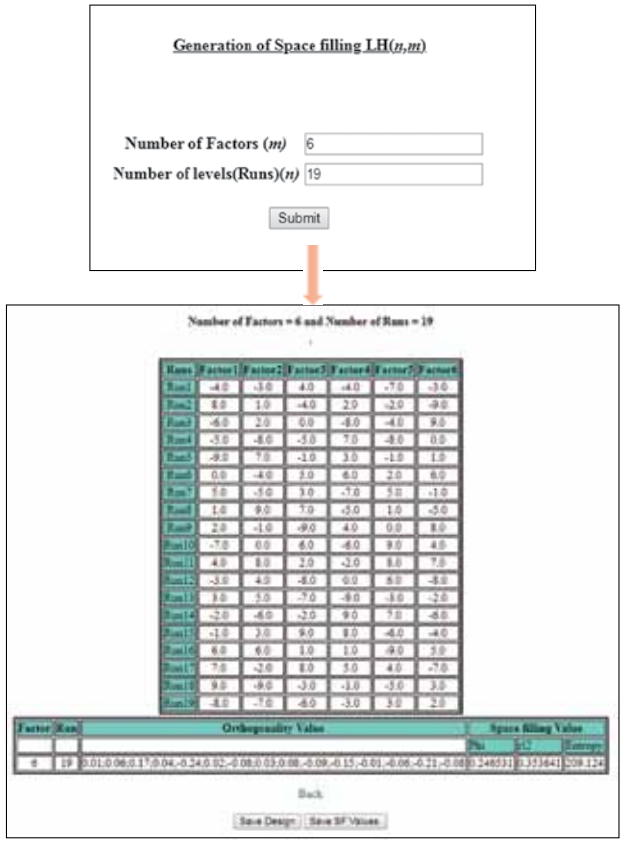


Fig. 3.15: Online generation of space filling Latin hypercube designs via web application

n(< 100) runs was also presented. A web application has also been developed for online generation of NOLH designs (Fig. 3.16). The application has been developed using JSP language and STS (Java) platform. Here, user can get the NOLH by giving the input of either outermost or innermost layer of the design to be generated.

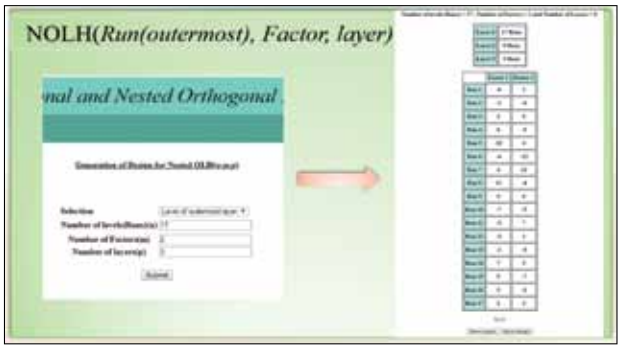


Fig. 3.16: Online generation of nested orthogonal Latin hypercube designs via web application

Analytical procedure for factorial experiments with Logistic and Gompertz error distributions

Factorial experiments are widely used in agriculture and allied sciences. In these experiments there

is an output variable, which is dependent on several controllable or input variables. These input variables are called factors. For each of the factors, there are two or more possible settings known as levels. When the number of levels of all factors is same, it is called symmetrical factorial experiments otherwise asymmetrical factorial experiments. Analysis of variance (ANOVA) procedure in the framework of experimental designs has traditionally been based on assumptions of normality. In practice, however non-normal distributions are more prevalent. So, it is of great interest to study the effect of non-normality on the F statistics used for testing main and interaction effects in ANOVA. In the present investigation, asymmetrical factorial experiments have been considered when errors follow non-normal distributions. Two non-normal distributions have been considered, generalised logistic distribution and other is Gompertz distributions.

Expressions for the estimates of model parameters, contrast of the main effects, interaction effects, sum of squares and F statistics for the analysis of the 2×3×3 factorial experiments have been developed when error follows generalized logistic distribution. Empirical study has also been done to find the F statistic and ANOVA. SAS code has been developed to find the sum of squares and F statistic. Similarly, when error follows Gompertz distribution, these expressions, empirical study and development of SAS code have been done.

Programme 2: Forecasting, Modelling and Simulation Techniques in Biological and Economic Phenomena

Modelling and forecasting of drought index using machine learning techniques

Drought is a complex hydrologic feature of arid and semiarid regions with strong implications on the sustainability of water resources, agriculture and environmental management. Forecasting of drought was performed using Drought Indices (DIs) that are standardized metrics of rainfall, temperature, evapotranspiration etc. DIs or models involving them are used for assessment of occurrence and severity of droughts. DIs were developed for specific regions using specific structures and forms of data input. During the reporting period, monthly rainfall data of Bundelkhand region have been collected from 1901 to 2002. Bundelkhand region has 13 districts of U.P and M.P. and data for each district have been collected separately. The daily rainfall over 41 years (1975 – 2015) for Sagar and Chhatarpur districts of Bundelkhand region was obtained from India Meteorological Department (IMD). Trend analysis of rainfall was performed for these two districts of Bundelkhand region on annual and seasonal data (pre-monsoon from March to May, monsoon from June to September, post-monsoon from October to November, and winter from December to February). The results showed that there was no significant trend in the Sagar and Chhatarpur districts of Bundelkhand region. Forecasting of DI has been performed by using Auto-Regressive Integrated Moving Average (ARIMA), Artificial Neural Network (ANN), Support Vector Machine (SVM) and Extreme Learning Machine (ELM) models. Different performance measures like Mean Absolute Percent Error (MAPE), Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) etc. were used for evaluation of the performance. The results indicated that, in both the districts viz., Sagar and Chhatarpur, ELM model performed better compared to the ARIMA, ANN and SVM models. Development of algorithm of multiple kernel Extreme Learning Machine (MK-ELM) for drought index forecasting has been initiated.

Crop yield forecasting under Forecasting Agricultural output using Space Agro meteorology and Land based observation (FASAL) scheme

During the period under report, modelling was done for crop yield forecasts at different growth stages of wheat crop for Delhi region. The model used maximum and minimum temperature, rainfall, morning and evening relative humidity during crop growing period collected from weather station located at ICAR-IARI, New Delhi. The forecast model was developed using generated weather indices as regressors in model. In order to select significant weather variables affecting the yield of crop, least absolute shrinkage and selection operator (LASSO) as well as stepwise regression methodology were applied. LASSO gave better results as compared to stepwise regression. The R^2 of LASSO and stepwise regression were 0.84 and 0.85, respectively. The Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) of LASSO regression were better than stepwise regression, which leads to improvement of crop yield forecasting. It can be inferred that for the data under consideration, LASSO works better than stepwise regression for variable selection. Further, using the selected variables through LASSO, Bayesian regression model was applied and obtained superior results as compared to the ARIMA

with explanatory variables (ARIMAX) and regression model with weather indices as regressors.

Crop diversification: Pattern, determinants and its impact on nutritional security

Crop diversification is regarded as a major source of growth operating within agricultural sector. Time series data on crop area statistics (for the period 1998-2018) was collected from the Land Use Statistics, Department of Agriculture and Co-operation Network (DACNET), Government of India. Simpson Index of diversification was used to estimate the extent of crop diversification. Estimation of district-wise diversification index is currently under progress. Simultaneously, in order to explore the relation between crop diversification and nutritional status, a normalized malnutrition index was constructed. We have collected district-wise secondary data from NFHS-IV survey for the year 2015-16 for 558 districts (21 states) on six indicators. Indicators included data on under-nutrition among the children under 5 years of age and adults in the age group from 15 to 49 years. Three indicators of child under nutrition were: the percentages of stunted, wasted, and underweight children under 5 years of age. With regard to adult under-nutrition, the percentages of thin men and thin women (BMI less than 18.5 kg/ m^2) in the population and percentage of anaemic women from 15 to 49 years were used. District wise normalized malnutrition index was constructed for 558 districts using average of these normalized indices. Mapping of the estimated malnutrition indices has been initiated.

Prospects of irrigation in India: Trends, determinants, and impact on agricultural productivity

Time series data on state-wise irrigation statistics for the period 1984-2015 was collected from the Land Use Statistics reports of Directorate of Economics and Statistics, Government of India. Trend analysis was carried out for Semi-Arid Tropic (SAT) region covering Andhra Pradesh (undivided), Karnataka and Tamil Nadu. The results revealed that the share of surface water in Net Irrigated Area (NIA) had shrunk across the states over the decades with wide year to year fluctuations. During 1990s, the share of surface water sources in total NIA was highest (70.47%) in Andhra Pradesh and, more or less same (57%) in the states of Karnataka and Tamil Nadu. Over the decades, the highest decline (by 28.64%) was witnessed in Andhra Pradesh followed by Karnataka (19.66%) and Tamil Nadu (17.55%). Surface irrigated area in all the states of interest fell down sharply during 2002 and 2003 which were also drought years. The increase in ground water irrigated area had compensated the loss of surface irrigated area in SAT states. During 1990-2015, the increase in groundwater share was highest (by 28.56%) in Andhra Pradesh followed by Tamil Nadu (22.39%) and Karnataka (20.59%). During 2011-15, the share was highest (60.4%) in Tamil Nadu followed by Andhra Pradesh (54.7%). And, it was lowest (50.6%) in Karnataka. District-wise irrigation statistics was collected from the district-wise land use statistics reports of Government of India. Accordingly, trends in district-wise irrigation coverage and source-wise dynamics of irrigation development were analyzed and mapped for the SAT region. Time series data on public expenditure made on irrigation development was collected for these states from the state finance accounts of Comptroller and Auditor General of India. The expenditure data was deflated using Gross Fixed Capital Formation (GFCF) deflator for the base year 2011 and analysis has been initiated.

Parameter estimation of time series models using Bayesian technique

ARIMA with explanatory variables (ARIMAX) and ARIMAX Generalized Auto-Regressive Conditional Heteroscadasticity (ARIMAX-GARCH) models are very useful and efficient in the present context of time series modelling and forecasting, where the series are volatile in nature and are influenced by other series as well. Agricultural domain being no exception, the use of these two models have immense potential. Hence proper estimation of the parameters of these models is very crucial. The classical estimation technique underlines many assumptions which sometimes at practical situations do not hold, leading to inconsistent parameter estimates. Under such circumstances, the Bayesian parameter estimation technique can be applied successfully to obtain the estimates of the model parameters. During the period under reports development of Bayesian estimation technique for ARIMAX and ARIMAX-GARCH model has been done. Implementation of Bayesian framework to basic ARIMA model was done and compared the forecasting performance with that of the classical estimates of ARIMA using total food-grain production data of India (1990-2015) and obtained superior results for Bayesian ARIMA models. For implementation of the some appropriate R codes were written. Further, we have developed Bayesian estimation technique for ARIMAX model and was fitted to daily time-series data of spot and future prices of Soybean in Indore market from 01st

Jan, 2017 to 31st July, 2018 (https://www.ncdex.com). The developed Bayesian ARIMAX model outperformed the classical ARIMAX model in terms of in-sample performance and parameter estimates. The parameters were estimated precisely with lower standard error in the Bayesian ARIMAX model as compared to the classical ARIMAX model. To test the stability and consistency of the estimates from Bayesian technique were also applied the tests viz. Heidelberger and Welch (1983) and Gelman and Rubin (1992). Both the tests yielded positive results indicating appropriate estimates. Appropriate R codes were written for implementation of the aforesaid model estimation and fitting. Thus the superiority of the developed methodology over the existing one, i.e., Bayesian estimation over the classical one was established.

Tractorization in Semi-Arid Tropic (SAT) India: Determinants and implications

Collection and extraction of data has been done. Data was collected from Village Dynamics of South India (VDSA) published by ICRISAT. After collecting the data, various variables have been identified which influence tractor use in SAT India. After identifying the variables through national and international review we used panel tobit model for both tractor uses and use of animal drawn farm implements has been implemented. Surprisingly, results showed cropping intensity and irrigation intensity are the major factors which influenced tractors use positively and use of tractor drawn implements negatively. There are many other variables too which influenced the tractor use. In panel modeling, both random and fixed effect models have been applied and Hausmen's test was employed to know which of the model was performing well.

Efficiency of micro irrigation in economizing water use in India: Learning from potential and unexplored states

The spread and adoption of micro-irrigation in four states selected namely, Punjab (Unexploited region), Maharashtra, Gujarat and Andhra Pradesh have been studied. This study departs from the usual supply side perspective, which is often presented, and provides a demand side perspective. It seeks to overcome the limitations of irrigation in an engineering oriented research which does not take into account the need, aspiration and experience of the users. It combined and compared the observations across four states of India with varied cropping patterns. The study showed that farmers are motivated to adopt drip irrigation primarily to cope with the scarcity in at least one of three factors of production, namely water, power and labour. They also adopt the technology in pursuit of a rapid growth in incomes, which can be achieved through it. Micro-irrigation appears to give very good results on each of these counts, and therefore the farmers see it as very useful technology. Micro-irrigation reduces the water need per unit of land resulting in and gives a significant saving of water. The survey results showed that farmers use the water saved for variety of purposes including cultivation of new crops and giving more irrigation to other existing crops. Expanding the areas under cultivation/irrigation and non-agricultural use. Though rare, some farmer also does sharing and selling water informally. The study clearly establishes the benefit of the technology for conservation of water and extending its use. The study explored the adoption process beyond technology use to mastering the management of micro-irrigation agriculture and roles of stakeholders.

Role of Research and Development in Indian agriculture: An economic analysis

Knowledge on existing allocation pattern of agricultural research and development expenditure, both sector-wise and region-wise will be used to suggest appropriate distribution form of public fund. Also, the results on sector-wise and region-wise public expenditure pattern will be the input for policy makers in bridging the gaps. Hence collection of time series data on state wise public expenditure made on agricultural research and development is being collected for the period between 2005 and 2017 from the state finance accounts of Comptroller and Auditor General of India has been initiated.

Development of count time-series models for predicting pest dynamics using weather variables

To develop count time-series models for predicting pest dynamics using weather variables on cotton crop, implementation of generalized linear model (GLM) with exogenous variables and integer based Artificial Neural Network (ANN) was done on weekly pest count data from 2008-09 to 2012-13 of different centres. Code has been written for Integer valued auto regressive model with exogenous variable (INARX) Models and model testing is in progress.

Future perspective of Bt technology in Indian agriculture

The most popular time series model is Auto-Regressive Integrated Moving Average (ARIMA) when the data under consideration is linear. However, when the linear time-series under study is disturbed by some external event known as intervention then the forecasting performance of ARIMA model may be affected. However, it can be improved by employing appropriate techniques such as ARIMA-Intervention modeling. There are two kinds of interventions viz. step, pulse. Step intervention occurs at a particular period of time and exists in the subsequent time periods. The effect of step intervention may remain constant over time or it may increase or decrease over time. Pulse intervention occurs only at particular period of time but the effect of such intervention may exists for that particular time period only or may continue to exist in the subsequent time periods. Genetic Algorithm (GA) is stochastic search algorithm inspired by the basic principles of biological evolution and natural selection. GA simulates the evolution of living organisms, where the fittest individual dominates over the weaker ones, by mimicking the biological mechanism of evolution, such as selection, crossover and mutation. GA has been successfully applied to solve optimization problems. In this study, GA optimization technique has been employed for parameters estimation of ARIMA-Intervention models. As a case study, all India cotton yield of with the intervention being introduction of Bt Cotton variety in year 2002 has been considered. Total four models were fitted for the time series data considered. The performance of the models are given in Table 3.1.

Table 3.1: Comparison of the four ARIMA-Intervention models

Model	RMSE
Model-1 (Impact parameter only considered)	36.47
Model-2 (Both impact and slope parameters are considered)	32.18
Model-3 (Impact, slope parameters + three intervention points considered)	22.63
Model-4 (same as Model 3, but parameters estimated by GA approach)	18.53

In addition, various types of intervention data has been simulated. In the simulation process, the autoregressive and moving average parameters were fixed as 0.71 and 0.11 respectively and differencing order as one. The impact parameter was fixed as 104 but the slope parameter instead of the value of 0.18 observed for all-India yield, values were varied as 0, 0.25, 0.5, 0.75 and 0.98 for step and pulse intervention types. As slope parameter is not needed in case of ramp intervention, only one model for ramp intervention has been simulated. In each situation, delay parameter was considered as zero. The eleven different simulated datasets have been fitted employing conventional ARIMA-intervention model as well as genetic algorithm based modified intervention model. The summary of simulation study has been given in Table 3.2.

The performance of the proposed ARIMA-Intervention based GA approach was compared with the conventional ARIMA-Intervention model as well as with the ARIMA model was judged based on RMSE. Based on the results obtained, it can be inferred that the proposed approach performed better

Table 3.2: Summary of simulation study

Intervention type	Slope parameter	RMSE	
		ARIMA-Intervention	GA based ARIMA-Intervention
Step	0.00	32.64	25.62
	0.25	34.37	11.76
	0.50	34.55	22.94
	0.75	28.92	26.27
	0.98	126.74	81.10
Pulse	0.00	42.06	22.40
	0.25	44.25	23.01
	0.50	28.86	22.74
	0.75	62.04	22.23
	0.98	59.46	43.34
Ramp	0.00	141.14	94.41

as compared to conventional ARIMA-Intervention as well as ARIMA in terms of forecasting accuracy for the real as well as simulated time series data considered.

Modelling dynamics of institutional credit to agriculture in India

The adequacy of agricultural credit at grass root level is still unearthed in India. Hence it is very much important to know the influence of major reforms aimed to increase institutional credit to agriculture needs at grassroots level i.e. district. Scheduled Commercial Banks (SCBs) are major lenders towards agriculture sector in India. Hence collection of information on district-wise outstanding credit of SCBs to agriculture is crucial in this regard. During the reporting period, outstanding credit of SCBs to agriculture for the three years viz., 2015-16, 2016-17 and 2017-18 has been extracted from the basic statistical returns of SCBs released by Reserve Bank of India. Further, based on this triennium average, selection of outstanding credit study districts representing all the states of the country has been initiated.

ICT based extension strategies for nutrition sensitive agriculture in the states of UP and Odisha

Multistage stratified random sampling with first-stage sampling units- District, second-stage sampling units- Block/ Village and third-stage sampling units- Farmer/ Respondent has been proposed for data collection. For development of effectiveness Index, modified Analytic Hierarchy Process (AHP) approach has been proposed where pairwise comparison matrices can be obtained at the analysis stage. In addition, development of Mobile App for nutrition sensitive agriculture has been initiated.

Development of methodology for non-parametric modeling of time-series data and its application in agriculture

The performance of Nadaraya-Watson estimator vs. local polynomial estimator with respect to random integrated squared error has been studied by using simulation based on India's foodgrain production. It became evident that local polynomial approach is capable to control the mean integrated squared error of estimation of non-parametric regression value better than that for Nadaraya-Watson estimator. The data has been used for non-parametric modeling of one-step-ahead regression function along with estimation of one-step-ahead conditional variance. The bandwidth has been subjectively chosen to be 10, whereas the regression estimates have been computed at the mid-points of 50 intervals of equal length ranging from minimum to maximum of the observed time-series data. The fitted and all the interval summary were evaluated along with modeling of data using optimum bandwidth. It has been observed that local Polynomial estimator is capable to capture the underlying fluctuations better than its counterpart. Finally, one-step-ahead forecast has been performed for the year 2016-17, where via non-parametric regression it has been found to be 257 along with standard errors are respectively as 6.27 and 6.13 for local polynomial and Nadaraya-Watson. Therefore, lower and upper limits for forecast have been found as intervals respectively as (238.19, 275.81) and (238.61, 275.39) for local polynomial and Nadaraya-Watson estimators. For optimum bandwidth, it has been found that, on the basis of which the prediction interval for 2016-17 has been found to be (239.94, 277.56). To evaluate the performance of optimal bandwidth under state domain non-parametric regression approach, mean square errors has been found to be 89.08, whereas the mean square errors has been found to be respectively 139.33 and 155.28 for local polynomial regression estimation and Nadaraya-Watson estimator with bandwidth value 10. To this end, the trimmed mean has been used to compute mean square value as 89.08. Thus it has been found that optimal bandwidth successfully enables to employ local polynomial regression estimation methodology under state domain to capture underlying fluctuations of data. The optimal bandwidth has been obtained from asymptotic bias and variance expression. Local polynomial modelling under state domain regression has been performed by writing program in SAS and R. The SAS program has been used to simulate nonparametric autoregressive time-series data to compare with Nadaraya Watson estimator.

Stochastic differential equation models and their application to agriculture

A new Von-Bertalanffy stochastic differential equation model has been proposed under decreasing stochasticity with respect to unequal carrying capacity in drift and diffusion term and exact solution has been obtained. Optimal Richards under random diffusion coefficient has been compared with its non-random diffusion term. It is observed that solution of stochastic differential equation is semi martingale which is the sum of continuous local martingale and continuous adapted process of finite variation. Therefore, using Tanaka formula

between semi martingale and local time process, the probabilistic property of amount of time that the process spend in the vicinity of some state at time "*t*" has been studied. Attempt has been made to study multivariate parametric stochastic differential equation growth models and to employ Extended Kalman filter and Wavelet analysis approach for nonparametric modelling and forecasting of stochastic differential equation growth models. Extended stochastic volatility model has been considered to fit the bivariate time-series data under continuous time framework. To this end, closed-form expansion for the log-likelihood function of irreducible multivariate diffusions sampled at discrete time intervals are obtained. Further, the dimension of associated stochastic differential equation of above model has been increased by one to turn the time-inhomogeneous diffusion into time-homogeneous diffusion model.

Study of long memory and periodicities in climate variables in different meteorological subdivisions of India

The power spectral density (PSD) or the power spectrum of a stationary random process has been estimated based on procedures employing the fast Fourier Transform (FFT) (Azad and Narasimha, 2008). For a discrete-time series $x(t)$ with unit time interval the spectral representation is a periodogram defined as $\hat{x}(\omega_k) = \frac{2}{N}\left|\sum_{t=0}^{N-1} x(t) e^{-i\omega_k t}\right|^2$ where $\omega_k = 2\pi k / N$, N is the frequency with is the sample size and $k = 0, 1, \ldots, N/2$. The value of $\hat{x}(\omega_k)$ is a measure of the contribution to the "energy" of x by the frequency ω_k. To test the significance of the peaks obtained in the spectrum, a discrete finite reference time series is necessary. The classical statistical model for such a reference is the first-order autoregressive (AR1) process. $x(t) = \alpha\, x(t-1) + \varepsilon(t)$ whose normalized power spectral density function is $P_k = \frac{1-\alpha^2}{1+\alpha^2 - 2\alpha\cos(2\pi k / N)}$, where $k = 0, 1, \ldots, N/2$ is the frequency index, $t = 1, \ldots, N$ denotes discrete time in units of the sampling interval, $X(0)$ may be taken as 0, α is the lag-1 autocorrelation coefficient.

Wavelets based periodicities in rainfall in different zones of India have been computed. Testing periodicities in annual rainfall in different subdivisions of India has been carried out using the algorithm proposed by Araghi *et al.* (2014).In most of the zones it has been found that there is existence of 2-4 years of periodicity in rainfall except in few where there is periodicity of more than 4 years. The corresponding R code has also been prepared. One R package "WaveletANN" based on combination of Wavelet and ANN has been developed for forecasting the time series based on hybrid Wavelet-ANN model.

Creation of Policy and Strategy Cell (PSC) at ICAR-NIAP for doubling farmers' income in India by 2021-22: Estimating farm income and facilitating the implementation of strategic framework

Monthly WPI of pulses namely Arhar, Gram, Moong, Masur and Urad for the period January, 2005 to March, 2017 were collected from Office of the Economic Adviser, Government of India. Different statistical techniques namely testing stationarity, concept of cointegration, testing for rank of cointegration, vector error correction model (VECM) and Granger causality testing have been used for analyzing the data. Structural break in mean and variance of Wholesale Price Index (WPI) of onion was investigated and it was reported that there are significant structural breaks in both mean and variance of WPI of onion. GARCH model has been applied for forecasting the volatility of onion prices in major markets of India with seasonality as exogenous variable. Price transmission and volatility spill-over effects were studied in major selected onion markets of India for assessing to what extent major markets transmit shocks and volatility to other markets. Vector auto-regression (VAR) and multivariate generalized autoregressive conditional heteroskedasticity (MGARCH, diagonal vector half model) was used to study the price volatility spill-over effects among markets based on weekly price data collected for twelve major onion producers' and consumers' markets selected on the basis of volume of market arrivals of onion. These include Delhi, Mumbai, Chennai and Kolkata as major consumers' markets and Lasalgaon, Pimpalgaon, Pune and Solapur markets in Maharashtra; Bengaluru market in Karnataka; Indore market in Madhya Pradesh; Patna in Bihar; Mahuva market in Gujarat, as major producers' markets. Pimpalgaon and Bengaluru markets influence Indore, Lasalgaon, Mahuva and Patna markets besides their own lagged price changes. Delhi onion prices are influenced by Lasalgaon with high magnitude followed by Bengaluru and Solapur onion prices. There is presence of high volatility persistence in markets; own-volatility shocks are generally larger than the cross-volatility shocks. Thus, market surveillance

coupled with strong market intelligence needs to be given due priority to control for any imperfections, malpractices and providing the advance signals.

Modelling insect pests and diseases under climate change and development of digital tools for pest management

ARIMA as well as Wavelet-ARIMA models have been applied for forecasting of Jassids and Thrips infestation in Andhra Pradesh. The comparative performance of the models was carried out in terms of Root Mean Square Error (RMSE). Trend in maximum temperature, minimum temperature and rainfall in 23 locations covered under rice, tomato, groundnut and pigeon pea have been computed using both parametric and nonparametric techniques. Clustering of homogenous regions with respect to temperature and rainfall are being carried out. The trend in rainfall and temperature are also being investigated using parametric and nonparametric approaches. Impact of climatic variability on rice insect pests across six agroclimatic zones in Kharif season was analyzed. Study of scenario and weather based prediction of severity of early blight *(Alternaria solani Ell.&Mart)* on tomato for five Indian State locations viz., Rajendranagar (Telangana, TS), Bengaluru (Karnataka, KA), Rahuri (Maharashtra, MH), Raipur (Chhattisgarh, CG) and Ludhiana (Punjab, PB) was made using support vector regression (SVR) with its accuracy compared with conventional multiple linear regression (MLR). Early blight mean and maximum severity levels were in the following order: – Bengaluru (KA) >Rajendranagar (TS) >Rahuri (MH) > Raipur (CG) > Ludhiana (PB).

Influence of weather variables on occurrence of spiders across seven locations namely Anantapur (AP), SK Nagar (GJ), Gulbarga (KA), Jabalpur (MP), Rahuri (MH), Vamban (TN), Warangal (TS) was investigated. The weather variables considered were Maximum temperature (MaxT), Minimum temperature (MinT), Relative humidity morning (RHM), Relative humidity evening (RHE), Sunshine hours (SS), Rainfall (RF), Number of rainy days (RD) and Wind speed (WS). Preliminary analysis of spider occurrence with weather variables at lag one indicated significant and negative influence of MaxT, MinT, RHM and SS at Anantapur (AP). For SK Nagar (GJ), all the weather variables under consideration except RF and WS were found to be significant with the occurrence of spiders; amongst them only SS had positive influence and all other variables were having negative influences. At Gulbarga (KA), RHE had significant negative correlation with occurrence of spiders whereas, MaxT, MinT, WS and RD all had positive influences. All the weather variables were found to be positively significant except RHM and SS in determining occurrence of spiders at Jabalpur (MP); RHM and SS had negative influence in this location. At Rahuri (MH), WS was negatively correlated with occurrence of spiders whereas, MinT, RHM, RHE, RF and RD had positive influence. MaxT, RF and WS had negative association and MinT, RHE and SS had positive association with occurrence of spiders at Vamban (TN). At Warangal (TS), MaxT, MinT and RHM had positive correlation whereas SS had negative correlation with the occurrence of spiders.

Algorithm for combination of Wavelet-Regression and Wavelet-ANN model was proposed in order to forecast the time series observations. Using MODWT, the time series data (Spiders occurrence) has been decomposed using Haar wavelet filter. The level of decomposition is chosen to be 5 in order to visualize the local as well as global patterns in the occurrence of spiders across the locations. Comparative assessment of prediction performance of different models namely Multiple Regression, Wavelet-Regression and Wavelet-ANN models was carried out in terms of root mean square error (RMSE) and mean absolute percentage error (MAPE). The result clearly indicated that the Wavelet-ANN model outperformed the usual regression model as well as Wavelet-Regression model. The accuracy of prediction was in the following order:- Wavelet-ANN>Wavelet-Regression>Multiple Regression.

Studying dynamics of market integration and price transmission of agricultural commodities

The study selected seventeen major markets of wheat namely Delhi, Jammu, Amritsar, Ludhiana, Lucknow, Dehradun, Raipur, Ahmedabad, Bhopal, Mumbai, Jaipur, Patna, Bhubaneshwar, Bengaluru, Thiruvananthapuram, Chennai, Hyderabad along with the Maximum, Minimum and Modal prices of wheat. Weekly data on retail and wholesale prices of wheat of above markets for the period January, 2010 to May, 2018 were collected from the Department of Consumer Affairs, Government of India. The study used different statistical methods namely testing stationarity, concept of cointegration, testing for rank of cointegration, vector error correction model (VECM), Granger causality testing and impulse response function. These techniques allow one to quantify the degree of interconnectedness between

the markets. For testing the stationarity of time series data, the tests namely Augmented Dickey-Fuller (ADF) and Phillips-Perron Unit Root test have been applied. Threshold and Momentum Threshold Models have been applied for testing asymmetric cointegration among the markets. It was observed that in Threshold Auto-Regression (TAR) model, Asymmetric Cointegration is present in wholesale and retail price of wheat in the markets namely Ahmedabad, Bengaluru, Bhubaneswar, Hyderabad, Patna Whereas in Momentum TAR (MTAR) model, it is seen that Asymmetric Cointegration was present in most of the markets.

As part of this project, Dr. Ranjit kumar Paul underwent a training on "Advanced Methods for Policy Analysis in the Area of Climate Change and Crop Price Volatility" during 16th August-14th October, 2018 at South Dakota State University, Brookings, USA. The work done during this training is reported subsequently. To model the conditional variance by using univariate GARCH model, seasonal dummy was incorporated in the variance equation but did not result any significant improvement in case of onion price data of major onion markets of India. After fitting the VECM model, the residuals were extracted and tested for possible presence of MGARCH effect. It was observed that the MGARCH effect was significant accordingly, the different variants of MGARCH model were fitted. The spillover effect was computed by fitting MGARCH model. Three variants of MGARCH model namely BEKK, DCC and CCC were fitted. It was also observed that the GARCH terms were larger than the ARCH terms indicating that the present conditional variance is largely dependent on past conditional variance as compared to past squared residuals.

Programme 3: Development of Techniques for Planning and Execution of Surveys and Statistical Applications of GIS and Remote Sensing in Agricultural Systems

Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Programme under MIDH

Our institute has been declared as National Level Agency (NLA) under Mission for Integrated Development of Horticulture (MIDH) for taking up this project funded by Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. Testing and validation of the methodology for estimation of area and production of horticultural crops developed by ICAR-IASRI was carried out in four states of the country namely Andhra Pradesh, Tamil Nadu, Maharashtra and Himachal Pradesh (Fig. 3.17). The proposed sampling design adopted for the survey is stratified multistage random sampling.

During the period under report, scrutiny of data entered and data analysis were completed. Data analysis for all the four states was carried out using data analysis software developed under the project. Output tables for all the four states were prepared. Area and production estimates of fruits and vegetables for all the districts surveyed of all the four states were found to be reliable. Data analysis for the non-surveyed districts of all the four states under the study was carried out using various modeling techniques namely Regression analysis, ARIMA, ARIMAX, PCR and LASSO. Output tables for non-surveyed districts for all the four states were also prepared.

The key features of the developed methodology are:

- The alternative sampling methodology developed by ICAR-IASRI during a previous study was modified and domain estimation approach was used in development of estimation procedure as per the proposed sampling design.
- This survey based methodology is scientific, objective, feasible, cost effective and is capable of providing district level estimates for all the districts in the state along with estimates at state and national level.
- This methodology provides reliable estimates of area and production for all major fruit and vegetable crops at district level using common sampling design based on an integrated survey.
- Suitable models have been used for providing estimates in the non-selected districts of the state and therefore, survey is not required in these districts.
- In addition to the traditional method of data collection, an attempt was made to use Computer Assisted Personal Interviewing (CAPI), a survey solution software for data collection developed by World Bank. For this, an in-house server for receiving the data directly from the field

has been set up and configured at the institute and schedules for data collection have been designed using CAPI.

- Around 365 Field Investigators (FIs) and State officials have been trained in 6 states (Class room as well as Field training of CCE for horticultural crops).

This methodology was validated in six states (including two states under separate studies) of the country and expected to be implemented in all the states of the country in future by Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. This methodology will provide reliable district level estimates of area and production of horticultural crops for all the districts in the State along with estimates at State and National level.

Fig. 3.17: Testing of developed methodology for horticultural crop estimation at A.P.

An Investigation of Causes of Divergence between Official and Trade Estimates of Jute Production

This project is funded by Directorate of Economics & Statistics (DES), Ministry of Agriculture and Farmers Welfare (MoAFW), Govt. of India. The project aims at finding out the causes of divergence between official and JAB estimates of Jute production. Survey (field data collection) relating to official estimates was conducted in all the three states under study namely West Bengal, Assam and Bihar and primary data collection work was completed (Fig 3.18). Supervision of data collection was carried out at regular intervals. Scrutiny of filled-in schedules was done during the field visits and necessary guidance was provided to the state officials and primary workers. Survey of the mills related to trade methodology was conducted. Large, medium and small mills were surveyed in West Bengal. The data collected from the mills were analysed.

Fig. 3.18: Survey of Jute mills in West Bengal

Integrated Sampling Methodology for Crop Yield Estimation using Remote Sensing, Field Surveys and Weather Parameters for Crop Insurance

This project is funded by Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India under which an integrated methodology has been developed in order to optimize the number of Crop Cutting Experiments being conducted under Pradhan Mantri Fasal Bima Yojna (PMFBY).

The crop identified under the study for Kharif 2018-19 season was Cotton. The study was conducted in Buldhana district of Maharastra State during Kharif 2018-19 season. In Maharashtra, the CCEs are conducted at Revenue Circle level only but for the development of methodology, CCEs need to be conducted at Gram Panchayat level. Therefore, a request was made to the State officials to conduct four CCEs in each Gram Panchayat of one taluka of the district in order to do feasibility study. Schedules for data collection were developed and handed over to the agricultural department which in turn were handed over to the enumerators for filling-in the data. Supervision of data collection (conduct of CCEs on Cotton) was also done.

Sentinel-2 remote sensing satellite data for Buldhana district was obtained. The shape file of the district with digitized village boundaries was obtained from MNCFC, New Delhi. Ground truth data was collected for Malkapur taluka. CCE data for Malkapur block as well as rest of the 12 talukas of Buldhana district was obtained and data entry was done.

During Rabi season, the study was conducted for mustard in Murenadistrict of Madhya Pradesh and wheat cropin Barabanki district of Uttar Pradesh. Accordingly, training for Crop Cutting Experiments was imparted to the primary workers, supervisors and other higher officers of the district in Murena and Barabanki. Preliminary data analysis for estimation of

yield of cotton crop for Malkapur taluka of Buldhana district of Maharashtra State has been completed and results were found to be encouraging.

Pilot Study for Developing State Level Estimates of Crop Area and Production on the Basis of Sample Sizes Recommended by Professor Vaidyanathan Committee Report

This project is funded by DES, Ministry of Agriculture and Farmers Welfare (MoAFW), Government of India.The data collection work under the project for all the 4700 villages spread across five states namely Assam, Odisha, Uttar Pradesh, Karnataka and Gujarat was completed and data was received from all the states. To verify the data, several field visits were made to the states. The scrutiny and cleaning of data were completed and analysis of the data has been done.

Robust and Efficient Small Area Estimation Methods for Agricultural and Socio-Economic Surveys and Their Application in Indo-Gangetic Plain

Development of methodology for small area estimation of survey weighted counts was carried out. The empirical predictor under an area level version of the generalized linear mixed model (GLMM) is extensively used in small area estimation (SAE) for counts. However, this approach does not use the sampling weights or clustering information that are essential for valid inference given the informative samples produced by modern complex survey designs. An innovative methodology for SAE was developed that incorporates this sampling information when estimating small area proportions or counts under an area level version of the GLMM. The approach was further extended under a spatial dependent version of the GLMM to account for spatial dependence between the small areas based on a simultaneous auto regressive specification. The mean squared error estimation as well as algorithms for parameter estimation has also been developed. The developed small area estimation method is applied to estimate the extent of household poverty in different districts of the rural part of the State of Uttar Pradesh by linking data from the 2011-12 household consumer expenditure survey collected by the National Sample Survey Office of India, and the 2011 Population Census (Fig. 3.19). Results from this application indicate a substantial gain in precision for the new methods compared

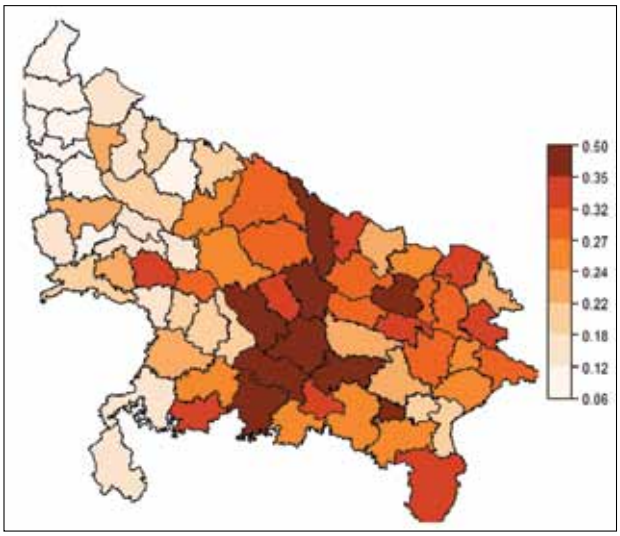


Fig. 3.19: District-wise distribution of rural poverty incidence in the State of Uttar Pradesh generated by SAE method

to the direct survey estimates. The district level estimates of rural poverty incidence produced using the developed method will be useful for various Departments and Ministries in Government of India as well as international organizations for their policy research and strategic planning. They will also be useful for budget allocation and to target welfare interventions by identifying the districts/regions with high rural poverty incidence. This application also provides evidence that SAE can be used as cost effective and efficient approach for generating reliable disaggregate level statistics from existing survey data by combining auxiliary information from different published sources with direct survey estimates.

A novel and efficient methodology for SAE of counts that assumes an area-level version of a nonparametric generalized linear mixed model with a mean structure defined using spatial splines has been developed. The proposed method represents an alternative to other SAE methods based on area level spatial models that are designed for both spatially stationary and spatially non-stationary populations. An estimator for the MSE of the proposed small area predictor as well as an approach for testing the presence of spatial structure in the data have also been developed and both the proposed small area predictor and its MSE estimator have been evaluated via simulation studies. An application to poverty estimation using household consumer expenditure survey data collected by the national sample survey office of India has been considered.

A study on calibration estimators under Adaptive Cluster Sampling

Adaptive Cluster Sampling (ACS) proposed by Thompson (1990), is an efficient method for sampling geographically rare and hidden clustered population. Under this study, following the Calibration Approach (Deville and Särndal, 1992), sampling methodology for obtaining calibration estimators of population mean and ratio under ACS design has been developed where the sampling units bearing a characteristic of interest are sparsely scattered in a geographically distributed population in unknown manners. New sets of calibration weights were obtained by minimizing the Chi-square distance between calibration weights and design weights of Horvitz-Thompson (1952) estimator under ACS design using the method of Lagrange multiplier subject to calibration constraints. The approximate variance and the form of estimate of variance of the proposed calibration estimator have been developed using Särndal *et al.* (1992).

Let, *U*={1,2 ,…,N} be the finite population under consideration. Let *Y* be a variable defined on the population U and taking real values as $y_1, y_2, \ldots, y_N$ and *X* be a linearly related auxiliary variable with real values $x_1, x_2, \ldots, x_N$. Let us assume, population total that $X = \sum_{i=1}^{N} x_i = \sum_{i=1}^{K} x_i^*$ is known, where $x_i^* = \sum_{j \in A_i} x_j$ and *K* is the total number of distinct networks in the population and A_i is defined as the i^{th} network. Let, the study variable y_i be observed for all $i \in s$, where *s* is the set all sampling units obtained by ACS. The parameter to estimate was the population mean of the character under study, $\bar{Y} = \frac{1}{N}\sum_{i=1}^{N} y_i$. Using the well-known Calibration Approach (Deville and Särndal, 1992), attempt was made to improve the Horvitz-Thompson estimator of the population mean under ACS i.e. $\hat{\bar{Y}}_{HT(AC)} = \frac{1}{N}\sum_{i=1}^{k} d_i y_i^*$, where y_i^* is the sum of *y* values for i^{th} network i.e. $y_i^* = \sum_{j \in A_i} y_j$, $d_i = 1/\pi_i'$ are the design weights and $\pi_i' = 1 - \left[\binom{N-m_i}{n_1} \Big/ \binom{N}{n_1}\right]$.

The proposed calibration estimator of population mean under ACS design is given by

$$\hat{\bar{Y}}_{CAL(AC)} = \frac{1}{N}\sum_{i=1}^{k} d_i y_i^* + \frac{1}{N}\frac{\sum_{i=1}^{k} d_i q_i x_i^* y_i^*}{\sum_{i=1}^{k} d_i q_i x_i^{*2}}\left(X - \sum_{i=1}^{k} d_i x_i^*\right).$$

where, $X = \sum_{i=1}^{N} x_i = \sum_{i=1}^{K} x_i^*$ is assumed to be known and $x_i^* = \sum_{j \in A_i} x_j$.

Now, when $q_i = 1$, the proposed calibration estimator simplifies to

$$\hat{\bar{Y}}_{CAL(AC)} = \frac{1}{N}\sum_{i=1}^{k} d_i y_i^* + \frac{1}{N}\frac{\sum_{i=1}^{k} d_i x_i^* y_i^*}{\sum_{i=1}^{k} d_i x_i^{*2}}\left(X - \sum_{i=1}^{k} d_i x_i^*\right).$$

When $q_i = \left(x_i^*\right)^{-1}$, the proposed calibration estimator simplifies to

$$\hat{\bar{Y}}_{CAL(AC)} = \frac{1}{N}\sum_{i=1}^{k} d_i y_i^* + \frac{1}{N}\frac{\sum_{i=1}^{k} d_i y_i^*}{\sum_{i=1}^{k} d_i x_i^*}\left(X - \sum_{i=1}^{k} d_i x_i^*\right) = \frac{\sum_{i=1}^{k} d_i y_i^*}{\sum_{i=1}^{k} d_i x_i^*}\bar{X}.$$

Again, the proposed calibration estimator of population ratio under ACS design is given by

$$\hat{R}_{CAL(AC)} = \frac{\sum_{i=1}^{k} w_{1i} y_i^*}{\sum_{i=1}^{k} w_{2i} z_i^*} = \frac{\sum_{i=1}^{k} d_i y_i^* + \frac{\sum_{i=1}^{k} d_i q_i u_i^* y_i^*}{\sum_{i=1}^{k} d_i q_i u_i^{*2}}\left(U - \sum_{i=1}^{k} d_i u_i^*\right)}{\sum_{i=1}^{k} d_i z_i^* + \frac{\sum_{i=1}^{k} d_i q_i v_i^* z_i^*}{\sum_{i=1}^{k} d_i q_i v_i^{*2}}\left(V - \sum_{i=1}^{k} d_i v_i^*\right)}.$$

Further, a simulation study was carried out in order to study the statistical performance of the proposed calibration estimators with respect to usual Horvitz Thompson estimator under adaptive cluster sampling design. A real dataset on the blue-winged teal bird population given in the often cited Smith *et al*. (1995) has been utilized for the simulation study. In order to study the statistical performance of proposed calibration estimators using the above discussed real dataset, several auxiliary variables that are highly correlated with study variable Y were generated. Monte Carlo simulation was used to draw samples from the enumerated populations. From the study population, a total of 5000 independent samples of above mentioned sizes using ACS design has been selected. From each of these samples, estimates of the proposed calibration estimators of population mean under ACS as well as Horvitz-Thompson estimator were calculated. The

proposed calibration estimators of the population mean as well as ratio under ACS design were found to be performing better than the Horvitz-Thompson estimator (Thompson, 1990) with respect to percent Relative Root Mean Square Error (%RRMSE). The proposed calibration estimator of the population mean considering $q_i = 1$ i.e. $\hat{\bar{Y}}_{CAL(AC),2}$ was found to be the most efficient in estimation of the population mean ($\bar{Y}$), since it gave least %RRMSE.

Two Step Calibration for Estimation of Finite Population Total under Two-Stage Sampling Design

For two-stage sampling design, efficient estimators of population total have been developed using two step calibration approach for the different situations of availability of auxiliary information. In the first situation, it is assumed that population aggregate of auxiliary variable (x) is unavailable at the primary stage unit (psu) level but it is available for additional auxiliary variable (z). In the second situation, it is assumed that information on auxiliary variable (x) is unavailable at the second stage unit (ssu) level but it is known for additional auxiliary variable (z) whereas the last situation assumed that information on auxiliary variable (x) is unavailable at both psu and ssu levels, but it is available for additional auxiliary variable (z). For each situation, the approximate variance and the estimator of variance of the proposed calibration estimator has been developed using Taylor series linearization technique.

Assessment of post-harvest losses in fruits and vegetables and strategies for their reduction in Andaman and Nicobar Islands

This is an institute funded collaborative project with ICAR-Central Islands Agricultural Research Institute (ICAR-CIARI), Port Blair as the Lead Centre and ICAR-IASRI as collaborative Institute. The study is being conducted in three districts namely North and Middle Andaman, South Andaman and Nicobar. Technical guidance especially for primary data collection by actual measurement for fruits and vegetables for different channels were provided. Primary data collection with regard to detailed survey has been completed in all the three districts. In addition, a survey was conducted on 58 families at Calicut, Burmanalla, Chouldari, Wandoor, Guptapara, Manglutan, Ograbraj, Hampfregunj, Memio and Chidiyatapu to reveal the consumption pattern and level of post-harvest losses. The focus was on food losses at the consumer level (other than losses of the inedible share of food, such as pine apple core, mango peel, vegetables peels etc). Questionnaires were designed which includes frequency of purchasing (daily/weekly), food preparation practices at home, at home food consumption practices and away from home.

Construction of Composite Index under Complex Surveys

Under this study, construction of composite index has been initiated using survey weights and auxiliary information which excludes the effect of multicollinearity and incorporates the survey information. The 68th round NSSO data has been acquired and extracted. Bias corrected unweighted regression estimator for population variance covariance matrix has been obtained.

Integrated Sample Survey Solution for major Livestock Products

This project is funded by Animal Husbandry Statistics Division, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India. The main objective of the project is to develop an online system for providing end to end solution for obtaining estimates of major livestock products i.e. milk, meat, egg and wool. It also includes creation and updation of spatial databases related to livestock and creation of thematic maps at state/district level for all the commodities i.e. milk, egg, meat and wool.

Energy audit survey of AICRP on energy in agriculture and agro-based industries: Sampling design and analysis

ICAR-All India Coordinated Research Project (AICRP**)** on “Energy in Agriculture & Agro-based Industries” (ICAR-AICRP on EAAI) is updating the energy audit manual for carrying out energy auditing in production agriculture system and agro-processing (“Energy Management in Agriculture” component). The updating is also required for sampling methodology and data analysis to be carried out by all cooperating centres of the AICRP scheme. Tamil Nadu Agricultural University (TNAU), Coimbatore cooperating centre of ICAR-AICRP on EAAI is coordinating this activity. Our institute is collaborating with ICAR-AICRP on EAAI in sampling design and analysis component. For energy audit survey of sugarcane crop in Tamil Nadu, suitable sampling design including sample size has been finalized. Schedules and instruction manual have

also been developed. Usine these, collection of energy audit survey data in the state of Tamil Nadu by the TNAU, Coimbatore has been initiated.

Programme 4: Development of Statistical Techniques for Genetics/ Computational Biology and Applications of Bioinformatics in Agricultural Research

A study on sequence encoding based approaches for splice site prediction in agricultural species

Performances of eight different sequence encoding schemes i.e., Bayes kernel, density and sparse (DS), distribution of tri-nucleotide and 1st order Markov model (DM), frequency difference distance measure (FDDM), paired-nucleotide frequency difference between true and false sites (FDTF), 1st order Markov model (MM1), combination of both 1st and 2nd order Markov model (MM1+MM2) and 2nd order Markov model (MM2) have been evaluated in respect of predicting donor and acceptor splice sites using five supervised learning methods (ANN, Bagging, Boosting, random forest and SVM). The encoding schemes and machine learning methods were first evaluated in four species i.e., *A. thaliana, C. elegans, D. melanogaster* and *H. sapiens*, and then performances were validated with another four species i.e., *Ciona intestinalis*, *Dictyostelium discoideum*, *Phaeodactylum tricornutum* and *Trypanosoma brucei*. In terms of ROC (receiver-operating- characteristics) and PR (precision-recall) curves, FDTF encoding approach achieved higher accuracy followed by either MM2 or FDDM. Further, SVM was found to achieve higher accuracy (in terms of ROC and PR curves) followed by random forest across encoding schemes and species. In terms of prediction accuracy across species, the SVM-FDTF combination was optimum than other combinations of classifiers and encoding schemes. Besides, we have also assessed the effect of structural features on the accuracy of computational splice site prediction in *A. thaliana*. Improvement in accuracy was observed (for longer sequence motifs) after including structural features as compared to the prediction with sequence-based features alone. Furthermore, improvement was higher while nucleotide dependencies were accounted in sequence-derived features. However, no such improvement was noticed for the dataset with short sequence motifs irrespective of the sequence-derived features utilized. This is the first report as far as computational splice site identification using machine learning method coupled with structural and sequence-derived features is concerned. Based on the proposed association measure, an R-package rrDNA (https://cran.r-project.org/web/packages/corrDNA/index.html) has also been developed and uploaded in R website. The R-codes were developed for all these sequence encoding approaches discussed above. Besides, the codes were also developed to run this program in batch mode.

Gene selection for classification of crop gene expression data

Selection of informative genes from high dimensional gene expression data has emerged as an important research area in genomics. Thus, a statistical approach, *i.e.* Boot-MRMR, based on a composite measure of maximum relevance and minimum redundancy, which is both statistically sound and biologically relevant for informative gene selection has been proposed. For comparative evaluation of the proposed approach, two biological sufficient criteria, *i.e.* Gene Set Enrichment with QTL (GSEQ) and biological similarity score based on Gene Ontology (GO) have been developed. Further, a systematic and rigorous evaluation of the proposed technique with 12 existing gene selection techniques was carried out using five gene expression datasets. This evaluation was based on a broad spectrum of statistically sound (*e.g.* subject classification) and biological relevant (based on QTL and GO) criteria under a multiple criteria decision-making framework. The performance analysis showed that the proposed technique selects informative genes which are more biologically relevant. The proposed technique was also found to be quite competitive with the existing techniques with respect to subject classification and computational time. The results also showed that under the multiple criteria decision-making setup, the proposed technique is best for informative gene selection over the available alternatives.

In plant biology and breeding, analysis of gene sets with trait specific Quantitative Trait Loci (QTL) data are considered as great source for biological knowledge discovery. Therefore, an innovative statistical approach called Gene Set Analysis with QTLs (GSAQ) for interpreting gene expression data in context of gene sets with traits has been proposed. The utility of GSAQ was studied on five different complex abiotic and biotic stress scenarios in rice, which yields specific trait/stress enriched gene sets. Further, the GSAQ approach was more innovative and effective in performing gene set analysis with

underlying QTLs and identifying QTL candidate genes than the existing approach. The GSAQ approach provides a valuable platform for integrating the gene expression data with genetically rich QTL data. Moreover, the proposed GSAQ approach can also be used for other expression data analysis like RNA-seq data analysis, if the reference genome is well annotated.

Estimation of breeding value using generalized estimation equation and Bayesian approach

Empirical work has been carried out on using different distribution of link function and different covariance structure using the mixed model. Data were collected on Chokla sheep maintained at the ICAR-Central Sheep and Wool Research Institute(CSWRI), Avikanagar, Rajasthan, India, under the AICRP on Sheep Improvement over a period of 21 years(1980-2000).The data includes records of 2030 lambs sired by 150 rams and out of 616 dams and born between 1980 and 2000. The traits analyzed were birth weight, weaning weight and post weaning weights at 6,9 and 12 months of age .Posterior heritability mean estimates of variances of random effect and error and deviance information criterion values were calculated using different values of variances of random effect and error. Work is going on using different distributions of link function and different covariance structure using the mixed model. Bayesian analysis was done and posterior for the heritability h^2 was calculated. Different distribution of link functions were assumed, work is going on using the link function Logit i.e. Log [μ/(1- μ)] and also different covariance structures were assumed. Bayesian analysis was done using INLA model and posterior for the heritability h^2 has been calculated.

A dataset collected and studied by Liu *et al*.(2019) has been utilized in our present study. 276 entries of RIL population were derived from the cross between SYN-D × Weebill 1. SYN-D has dark green broad leaves without wax which is synthetic derived hexaploid wheat. Randomized lattice design was used to study the whole design with two replications under four environments. The four environments considered here are (i) drought (2009-2010, D10) (ii) heat (2009-2010, H10) (iii) heat + drought (2011-2012 HD12) and (iv) heat + drought (2012-2013, HD13). Drought stress (D) was applied by normal planting (late November) with significantly reduced irrigation (total water supply < 200 mm); heat stress (H) was applied by late sowing (late February) with supplementary irrigation (total water supply > 700 mm) to avoid the effect of drought; the combined stress (H+D) was applied by delayed planting date (late February) with reduced irrigation (total water supply < 200 mm). The traits under the study are mainly Grain yield m^{-2} (YLD), Thousand grain weight(TGW), Grain number m^{-2}(GM), Days to heading (DTH), Days to anthesis (DTA), Days to maturity (DTM) and Plant height (PH). The dataset was analyzed using Bayesian Mixed model. The estimated heritability of the six characters for the first environment have been calculated and presented (Table 3.3).

Table 3.3: Different characters along with their heritability

Traits	Heritability
Yield	0.52
TGW	0.62
GM2	0.64
DTA	0.48
DTM	0.60
PH	0.56

A study on detection and interpretation of expression quantitative trait loci (eQTL) mapping

Barley data was collected from public domain (NCBI and EBI). The dataset collected is described as follows: Expression level of markers is collected for quantitative resistance to the barley leaf rust pathogen *P. hordei* in the St/Mx population. Agilent barley custom microarray was used to assess transcript abundance in 139 DH lines of the St/Mx population challenged with *P. hordei* having 4286 SNPs and 595754 expressions. Initially, the collected dataset was analyzed using linear model by considering genotypes as binary. P-values were adjusted using FDR (False Discovery Rates). eQTL association at 1% FDR has been considered. Analysis has been initiated assuming a regression equation of gene expression measurement and using Bayesian paradigm where Beta distribution is considered as a prior distribution. iBMQ (An Integrated Hierarchical Bayesian Model for Multivariate eQTL Mapping) model has been applied and Posterior Probability of Association (PPA) calculated. The dataset has also been analyzed using R-qtl package to calculate eQTL genotype probabilities. LOD (Likelihood Odd Ratio) has been calculated. Finally, LOD was compared with the threshold value and eQTLs were considered.

Study on robust estimation of heritability

The random effect model for the one-way classification is-

$y_{ij} = \mu + \alpha_i + e_{ij}$ i=1,2,…,a; j=1,2,…,n.

where, y_{ij} is the observed value of the i[th] class, μ is the general mean, α_i is the effect due to i^{th} sire, e_{ij} is the residual error.

Under the normality assumptions

$$E\left(e_{ij}\right)=0,\ E\left(\alpha_i\right)=0,\ E\left(e_{ij}^2\right)=\sigma_e^2,$$

$$E\left(\alpha_{i\,ij}^2\right)=\alpha_\alpha^2,\ Cov\left(\alpha_i,\alpha_{i'}\right)\neq 0\ \ \forall \mathrm{i}\neq \mathrm{i}',$$

Suppose that sires are independent but within sires, progenies are correlated. Further, assume that the correlated errors follow AR(1) i.e. $e_{ij} = \rho e_i\left(j-1\right)+\eta_{ij}, \eta_{ij} =$ random error components,

where $|\rho|<1, \mathrm{Var}\left(\eta_{\mathrm{ij}}\right)=\dfrac{\sigma_e^2}{1-\rho^2}$ and

$\eta_{ij} \approx IIDN\left(0,1\right)$ $for\ \mathrm{j}>1.$

Generating e_{ij} using the above equation, we can generate the correlated observations $y_{ij}'s$ by using the following modified simulation model: $y_{ij} = \mu + \sigma_s a_i + \sigma_e e_{ij}$. Notations have the same meaning as defined above, and $e_{ij}'s$ are the values generated from above equation.

Sire and error components were generated following different combinations of distributions i.e. Normal, Beta, Cauchy and t-distribution with different heritability values and estimates of heritability and Root Mean Square Error (RMSE) values obtained by four different methods i.e. ANOVA, ML,REML and MIVQUE methods with different parametric values of heritability. From the results, it has been noticed that when correlation values were increased from negative to zero, the RMSE values decrease. If the same were increased from zero to higher values i,e. nearer to +1, it has been noticed that RMSE values increased for all the combinations of distribution. Development of theoretical expression for the estimate of heritability for correlated error in case of observation of same dam has been initiated.

Statistical approach for genome-wide association studies and genomic selection for multiple traits in structured plant and animal population

Genotypic and phenotypic data pertaining to five different crop species has been collected from public domain. Six different data sets (2 Wheat datasets, 3 Maize datasets and 1 Barley dataset) were prepared after collecting them from the publically available literature. R-codes for genomic prediction using G-BLUP and EG-BLUP are being evaluated for single trait genomic prediction in different plant species. Kernel averaging techniques were employed for genomic prediction in a wheat dataset consisting of 599 genotypes and 1479 Dart markers. This technique is seen to be giving more accuracy than different Bayesian approaches such as BayesA, BayesB, BayesC, Bayesian LASSO and Bayesian ridge regression. This analysis is performed in a cross-validation mode. The methods BayesA, BayesB, BayesC, Bayesian LASSO (BL) and Bayesian Ridge Regression (BRR) were employed for genomic prediction in Wheat dataset that comprises 599 genotypes and 1479 DArT markers. The trait of interest is yield in four mega environment i.e., Env-1, Env-2, Env-3 and Env-4. Prediction was made following 10-fold cross validation techniques. It can be seen that BRR achieved highest accuracy in three environments, whereas BL performed better than the others in the third environment. Further, it was observed that genomic prediction accuracies are higher for the first environment and lower for the third environment.

Network project on computational biology and agricultural bioinformatics under two subprojects - Sub-project-1: Exploring the epigenetic control of heat stress responses in wheat for characterizing the regulatory networks associated with thermo-tolerance

Construction of Gene Regulatory Network (GRN) of heat responsive genes using Weighted Gene Co-expression Network Analysis (WGCNA) and identification of hub genes in subnetworks has been done. Heat stress is one of the most alarming threats that global warming is bringing with time. It already has started to reflect its impact in the form of decreased crop yield. A functional understanding of the various genes involved in the heat stress is required with the ultimate aim to secure global food

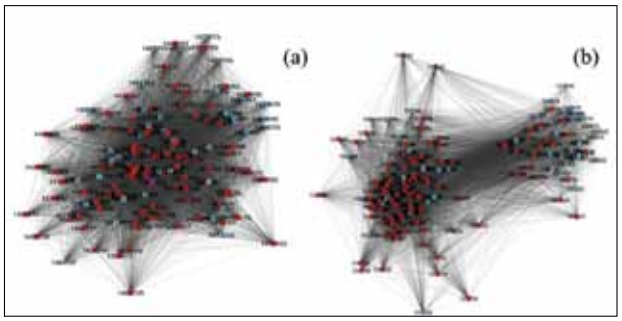


Fig. 3.20: Network constructed for HD2967 figure (a) and BT-Schomburgk figure (b).

security. In order to identify the genes and their interactions under heat stress, network analysis could provide a way forward. In this study, two contrasting varieties related to heat tolerance (HD2967) and heat susceptible (BT-Schomburgk) of wheat have been considered for generating gene expression data (Fig. 3.20).

WGCNA has been used and genes along with their relationships have been identified. Various modules in the network were delineated, which in turn facilitated identification of hub genes. These results may provide postulates for experimenters involved in the development of new heat stress resistant cultivars to mitigate the ill effects of global warming.

Network project on computational biology and agricultural bioinformatics under two subprojects - Sub-project-2: Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids

A series of experiments involving whole genome re-sequencing, transcriptome and methylome were conducted in a sub-tropical genotype HKI1105 under drought stress condition to understand the regulation of drought tolerant genes at different functional level. The HKI1105 was re-sequenced at whole genome level and assembled by keeping B73 genome as reference genome. The drought stress genes and transcription factors were mapped on the HKI1105 genome. The RNASeq assay of the control and drought stressed root and shoot samples revealed differentially expressed genes operating in various stress pathways. In addition, work has been carried out on dirigent proteins in maize. The dirigent proteins are members of a class of proteins which dictate the stereochemistry of a compound synthesized by other enzymes. The first dirigent protein was discovered in Forsythia intermedia and recently, a second, enantiocomplementary dirigent protein was identified in Arabidopsis thaliana, which directs enantioselective synthesis of (-)-pinoresinol. In order to find out the orthologues, this protein (PF03018) was searched in Gramene and NCBI databases against the maize genome. A total of 67 hits were found on different chromosomes of maize and the same were ordered on the chromosomes.

RiceMetaSys: Understanding rice gene network for abiotic and biotic stress through system biology approach

A comprehensive database called “RiceMetaSysB” of rice blast and bacterial leaf blight (BB) disease responsive genes in rice has been developed which is available at http://14.139.229.201/ricemetasysb/blast/ssr.html (Fig. 3.21). This database provides facility to the users such as retrieval of candidate genes using different search options like genotypes, tissue, and developmental stage of the host, strain, hours/days post-inoculation, physical position and SSR marker information. Search options like ‘common genes among varieties’ and ‘strains’ have been enabled to identify robust candidate genes. RiceMetaSysB can play an important role in providing robust candidate genes for rice blast and BB. This database has been developed using state-of-the-art information and communication technology based open source software. This database will help to accelerate the molecular breeding program for developing variety resistant to rice blast and BB diseases to meet the future needs of the country.

Fig. 3.21: Homepage of RiceMetaSysB (Biotic Stress)

Also, construction of GRN of cytokinin responsive genes and identification of hub genes in subnetworks have been done. Rice is an important staple food grain consumed by most of the population around the world. With climate and environmental changes, rice has undergone tremendous stress state which leads to impact the crop production and productivity. Plant growth hormones are essential component that controls the overall outcome of

growth and development of the plant. Cytokinin hormone plays an important role in plant immunity and defense system which is mediated by multi-step two components phosphorelay system that have different roles in various developmental stages. In this study, weighted gene co-expression network analysis (WGCNA) method has been used to identify the functional modules and hub genes involved in cytokinin pathway based on gene expression data related to cytokinin experiment. Nine functional modules comprised with different hub genes of each module that contributes to the cytokinin signaling route have been identified. Gene regulatory network of selected genes responsive to cytokinin has been constructed (Fig. 3.22).

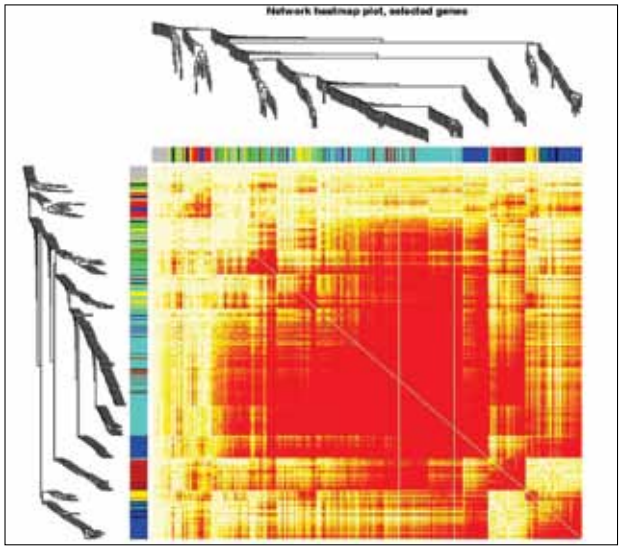


Fig. 3.22: Network heatmap plot of selected genes responsive to cytokinin

Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in wheat

Development of model web-server for crop variety identification using throughput SNP genotyping data has been done. The world's first of its kind model web server for crop variety identification using >350 Indian wheat varieties and Axiom 35 K SNP chip data has been developed. Standard filtering and linkage disequilibrium approach were used to develop varietal signature in Linux using HTML, Java, PHP and MySQL with provision of QR code generator to facilitate bar-coding. Phylogenetic tree constructed by selected SNPs confirmed six major trait based clusters of varieties and their pedigree. Our user friendly server based tool, VIS*Ta* (Variety Identification System of *Triticum aestivum*) (http://webtom.cabgrid.res.in/vista) (Fig. 3.23) can be used in DUS testing having dispute resolution of sovereignty and access benefit sharing (ABS) issues. This model approach can be used in other crops with pan-global level management of crop germplasm in endeavour of crop productivity.

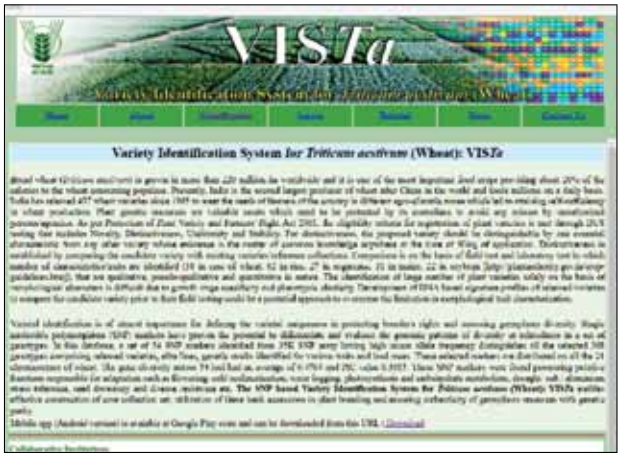


Fig 3.23: Homepage of VISTa (Variety Identification System for Triticum aestivum)

For most convenient remote location use, a mobile App has also been developed (Fig. 3.24). It is available at:https://play.google.com/store/apps/details?id=incabin.res.cabgrid.vistaapp1

Fig. 3.24: Mobile application screenshot of VISTa (Variety Identification System for Triticum aestivum)

Uncovering genomic regions associated with 36 agro-morphological traits in Indian spring wheat using GWAS was also done. GWAS studies were carried out using Breeders' 35K Axiom Array and diverse panel of 404 genotypes of study meet spring wheat. Phenotypic records of 36 agro-morphological traits were used to discover candidate genes associated with it. A total of 147 SNPs (-log10 P ≥ 4; (Fig. 3.25) were found associated with 23 traits explaining 3.7-47.0% phenotypic variations. To reveal this a subset of 260 genotypes was characterized phenotypically for six quantitative traits under five environments. Gene annotations mined ~44 putative candidate genes which were firmed up using tissue and stage specific gene expression data from RNA Sequence. Strong co-localized locus for four traits (glume pubescence, spike length, plant height and awn color) were observed on chromosome 1B (24.64 cM) annotated six putative candidate genes. This approach can be very promising for wheat cultivar improvement as favorable alleles identified could be introgressed into elite germplasm for better productivity.

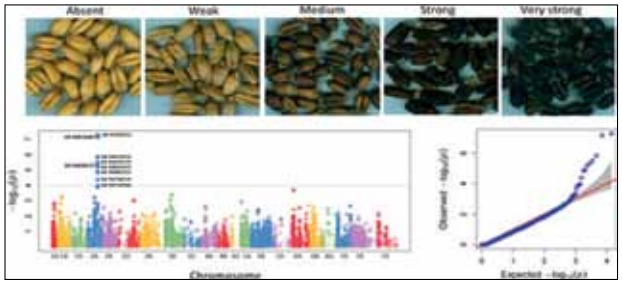


Fig. 3.25: Figure. Categories of phenol coloration viz. absent, weak, medium, strong, and very strong are shown. These variations in coloration are based on the phenol oxidase activity present in the seed coat. Manhattan plot and Q–Q plot for the trait of grain coloration with phenol (Grn_Ph) as observed in the study.

Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices

In order to delineate the terpanoid pathways synthesiszing 1, 8 cineol in small cardamom, three similar 1, 8 cineol synthase genes obtained from leaf transcriptome data were used. RNA isolated from capsules of small cardamom and large cardamom were sequenced to obtain all major terpene synthase genes in both the plants.

In order to delineate genes for alpha phellandrine in black pepper, all the key genes encoding in terpenoid backbone pathway (MEP and MVA pathways), were identified from black pepper transcriptome.Twelve terpene synthase genes were identified having similarity to Alpha-phellandrene synthase, Beta-pinene synthase, Alpha-pinene synthase, Myrcene synthase etc.

In order to delineate rotundone synthesis pathway controlling the key aroma in black pepper, similarity search was used to obtain two key candidate genes viz., alpha-guaiene synthesis and guaiene 2-oxidase which are involved in the oxidation of alpha-guaiene to form rotundone. Quantification of piperamides alkaloids, *Piper longuminine* and piperine in four Piper species were done. *Piper longumine* was detected only in *P. longum* and *P. sarmentosum* which are closely related species. Data mining for the prediction of genes for piperamide biosynthesis in *P. nigrum* was completed. Ten enzymes of this pathway were identified. Six genes involved in tropane, piperidine and pyridine alkaloid biosynthesis were identified. Eighteen Phenylpropanoid biosynthesis related genes were also identified from black pepper.

Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea

Identification miRNA from small RNA libraries of isogenic male fertile and sterile lines has been done. To identify miRNA, RNA was extracted from unopened flower buds of isogenic lines UPAS 120 A and UPAS 120B. Small RNA libraries were prepared using *illumina TruSeq Small RNA Prep kit* from 1 µg of total RNA (Table 3.4; Fig. 3.26; Table 3.5). The libraries were sequenced using 1x50bp chemistry to generate 1 GB data per sample. Data was generated in three replications with Illumina platform using 1x50bp chemistry. This work was done in collaboration with ICAR-IIPR, Kanpur.

Table 3.4: Statistics of data filtered at each filtration step

Sample	Raw reads	Cutadap filter (17-25)	Rfam filter	mRNA filter	Map to genome
UPAS120A_R1	41490235	9494592	4060683	3520314	2156913
UPAS120A_R2	10457091	3083749	2470012	2377587	518639
UPAS120A_R3	56754208	13198219	5571871	4635989	2696176
UPAS120B_R1	13729661	2668999	1454682	1327207	610126
UPAS120B_R2	25222818	7897385	5067197	4666647	2186455
UPAS120B_R3	90761697	21150824	11641230	10135907	6141555

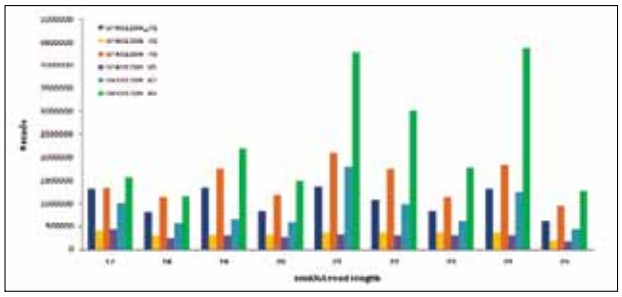


Fig. 3.26: Distribution of sequence length

Table 3.5: Differentially expressed miRNA

	Known miRNA	Novel miRNA
Significant difference in expression	25	94
Number of Upregulated	16	44
Number of Downregulated	9	50

Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families

Liver specific microRNAs were identified in farmed carp (*Labeo bata*) fed with starch diet. Filtered reads were aligned and mapped against the reference genome of Common carp, *Cyprinus carpio* and the standard protocol of miRNA identification was applied. Mature miRNAs sequences were identified by comparing the deposited database of miRBase using the miRCat tool. A total of 145 novel and 32 conserved microRNAs associated with carbohydrate metabolic pathway were identified. The differential analysis and functional level enrichment studies were also done which revealed the crucial role of microRNAs during modulation of metabolic genes and pathways (Fig. 3.27 & 3.28).

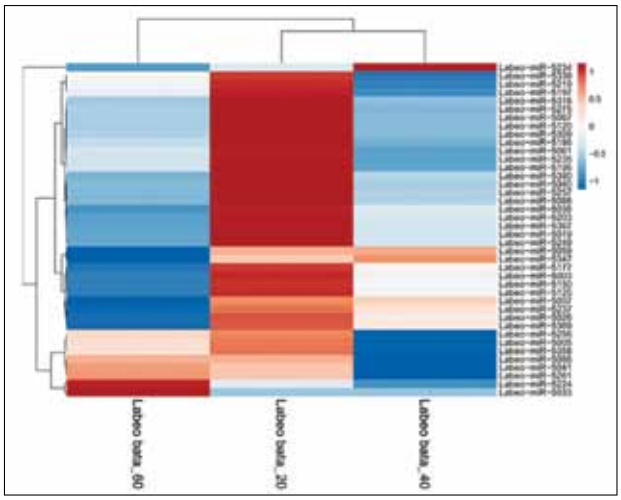


Fig. 3.27: Heat map depicting the differentially expressed miRNAs expression patterns.

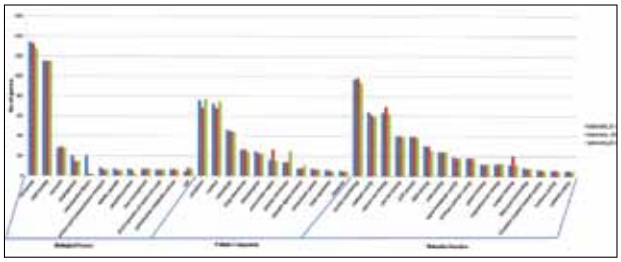


Fig. 3.28: Functional enrichment of differentially expressed novel miRNA target genes.

Investigations on pathogenic microorganisms of shrimp aquaculture using metagenomic and other bioinformatic approaches

Various biotic, abiotic and management factors cause stunted growth in shrimp aquaculture; metagenomics is useful in understanding the microbial profile environment. Shotgun metagenomic samples of diseased and normal conditions were analyzed and it was observed that diversity of the

microbiota is more in normal samples. Presence of microbes related to decomposition, biological cleanup and hydrocarbon degradation, algal bloom indicate poor pond management in disease sample. Some probiotic bacteria are abundant in normal samples. Further, study needs to be continued with more samples of gut microbiome has been initiated.

Identification of defense genes/QTLs associated with stripe rust resistance in wheat

The raw files generated from Illumina Hiseq 2500/4000 platform technology for 46S119 pathotype of *wheat* plant resistance to *Stripe Rust* at the seedling *stage* for a time course of 12 hrs and 48 hrs (dpi) (total of 8 samples with 2 replicates each) were checked for quality reads using FastQC. FastQC is a tool specialized for checking of quality of reads, adapter contamination, amount of repetitive sequences etc. Removal of Illumina adapters (AGATCGGAAGAGC) if present, trimming the reads at 3' end is essential to get only the quality trimmed reads. This purpose was served by trim galore (version 0.4.5), using default parameters for paired end reads to automate quality and adapter trimming as well as quality control. The quality trimmed reads for the 8 samples (2 replicates) for PBW343 were used for assembling the transcriptome using de-novo strategy of Trinity (version 2.4.0). Similarly, it was done for FLW29 having 8 samples in 2 replicates. Trinity uses 3 modules: chrysalis, Inchworm and butterfly to assemble the transcriptome. The transcriptome may contain redundant sequences, so a clustering was done with 90% similarity as cut-off using **CD-HIT** to get non redundant sequences. Thus the final de novo assembled transcriptomes have been obtained.

Computational biology approach for deciphering transcriptome and proteomic changes in rice-microbial interaction system

As a part of continued work of metagenomic and metatranscriptomic data analysis on 25 datasets of wheat rhizosphere metatranscriptome from John Innes Centre (analysis work only), a number of dominant bacterial communities, majorly characterized Proteobacteria and Actinobacteria were characterized at the domain, class, phylum, order and genera level. Annotation at the level of species richness (both abundance and count) has led to show the abundance of various communities including those of proteobacteria (max.) and probacteria (min.) alongwith archea, actinobacteria,

Fig. 3.29: Taxonomic distribution summary of the community richness and abundance along with the characterized functions in wheat rhizosphere metagenome

cyanobacteria, acidobacteria etc. Overall, 178 taxonomic classes have been identified. While annotating community functions, major functions linked with the cellular processes, signaling, information storage and processing, metabolism and stress responses etc. have been reported (Fig. 3.29). Apart from this, the common cellular functions were also identified and characterized in the metagenomes of the wheat rhizosphere. Our comparative results showed that nitrogen metabolism, pathways for the stress responses and metabolism of aromatic compounds were among the most dominant and prevalent functions identified.

Structural and functional genomics of potato and its pest/ pathogen using bioinformatics approaches

Water is an important input in potato cultivation and water stress has been found to be an important abiotic stress limiting its productivity and adaptability. In order to have broader picture of the effect of differential water application, two potato cultivars differing in their drought tolerance and water use efficiency were used at three different water levels viz: 100% Field Capacity (FC) (ii) 50 % FC and (iii) 25 % FC. Leaf and root samples from these plants were taken at different developmental stages and pooled separately for each treatment and cultivar. The harvested samples were used for comparative transcriptome analysis. Besides, two cultivars, namely, Kufri Jyoti (susceptible) and JEX-A/267 (tolerant) were considered for understanding the resistance mechanism of *Globodera rostochiensis* (Potato Cyst Nematode - PCN). Root tissues were processed for total RNA isolation. The sequenced raw data was processed to obtain high quality,

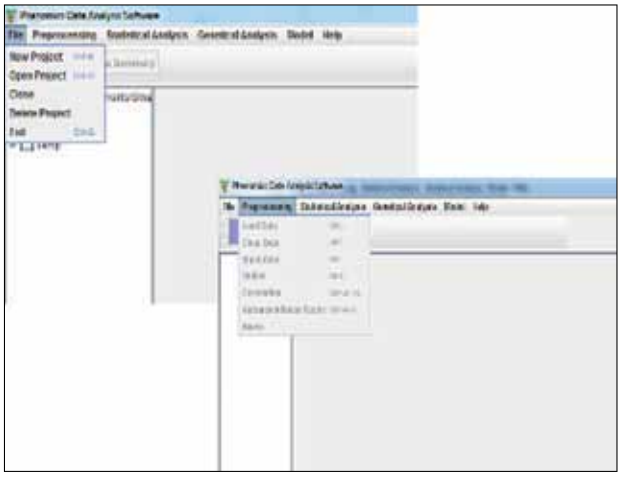
clean reads using Trimmomatic v0.35. Further, the libraries were assembled, and the differential gene expression was calculated in terms of RPKM - Reads per Kilo base of transcript per Million mapped reads. RNA Seq analysis of samples with 10 days of PCN inoculation revealed up-regulation of 299 genes in JEXA/267, which includes genes responsible for secondary metabolites production, auxin transport, PR1 protein, R3a protein, members of the NBS-LRR class of plant disease resistance (R) genes, cytochrome P450 hydroxylase, UDPxylose phenolic glycosyltransferase, flavanone 3 beta-hydroxylase and disease resistance protein Gpa2, suggesting a functional role and potential involvement in defense response. In addition, genome sequence data of somatic hybrid (P8), wild parent (S. pinnatisectum) and hybrid progenies (MSH/14-112) were generated to analyze genomic variations and chromosomal rearrangements in somatic hybrid and its parents & progenies.

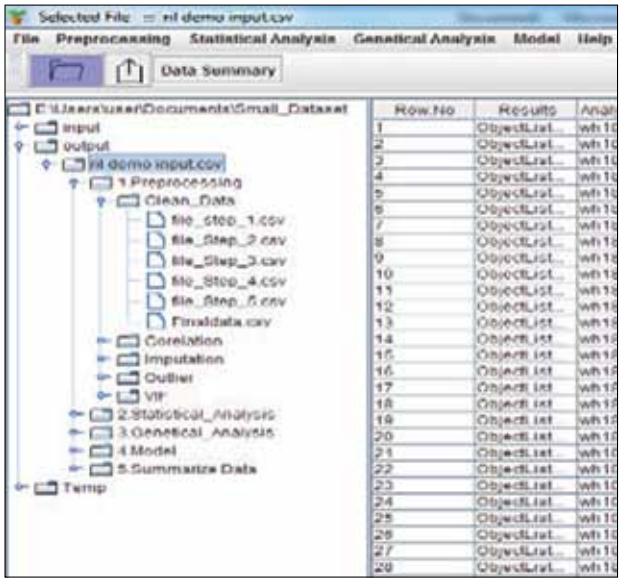
Computational and analytical solutions for high-throughput biological data

This project is funded under ICAR Consortium Research Platform on Genomics with ICAR-NBFGR as lead centre and ICAR-IASRI as one of the partner centres. The SNP genotyping data of 1762 swamp buffaloes for three traits: fat, protein and milk yield from NBAGR, Karnal has been received. The genome-wide association study (GWAS) was performed on GBS data using SUPER (Settlement of MLM Under Progressively Exclusive Relationship), MLMM (multi-locus mixed model), FarmCPU (Fixed and random model Circulating Probability Unification) and Bayesian models along with the MLM available in GAPIT. The SNPs identified using above five models were further filtered at p-value threshold of <10-5 and a total of 143, 47 and 43 SNPs were found to be associated with protein, fat and milk yield traits respectively from all the five models. The functional annotation of the identified SNPs is also being studied. Besides, Genomic selection was performed on the GBS dataset with phenotypic traits: protein, fat and milkyield. Prediction accuracies of four genomic selection models (rrBLUP, gBLUP, cBLUP and sBLUP) were assessed for the above mentioned traits. While comparing the prediction accuracies among the models, cBLUP and gBLUP performed equally well on protein trait whereas sBLUP outperformed on milkyield and fat traits. Other genomic selection models like BayesA, BayesB and BayesC etc. are being tried. The short and long read sequences of Indian goat have also been received from NBAGR, Karnal. The de-novo sequence assembly was carried out by ABySS and SOAPdenovo2 at different k-mer lengths (25–51 with step size of 4). The optimal assembly using ABySS was attained at K-mer of 49 which resulted in 12,578,737 scaffolds with N50 of 1779 bp whereas using SOAPdenovo2; we attained optimal assembly at K-mer of 41 with N50 of 1884 and 3,042,571 scaffolds. The assembly of PacBio long reads was performed using Canu assembler.

Phenomics of Moisture Deficit Stress Tolerance and Nitrogen Use Efficiency in Rice and Wheat – Phase II

High throughput Phenomics-Data Analysis Platform (HtP-DAP) has been designed and developed (Fig. 3.30) to support the analysis of large-scale image data sets of crop plants captured by different camera systems. It aims to bridge the gaps by integrating different approaches to data analysis and data mining. Software has been designed in modular fashion and following module has been incorporated for post-processing/analysis of image data: a) Project Management module: Creation and management of projects and management of large scale project specific data;b) Pre-processing module: Altogether six steps has been included in this module for cleaning and filtering of data. Following data operations has been integrated- Addition, Deletion, removal of null/blank values, Normalization, outliers detection and finally imputation of missing values; c) Statistical Analysis module: variable selection using variance inflation factors and other feature selection methods, SVM, Clustering, ANOVA, Self-organizing map, Principal component analysis etc.; d) Genetic analysis module: Heritability analysis, linkage map construction, QTL mapping etc.;e) Visualization: Heatmap plot, Growth Modeling (linear, exponential, monomolecular, logistic, Gompertz) curves and f) Report generation Module.





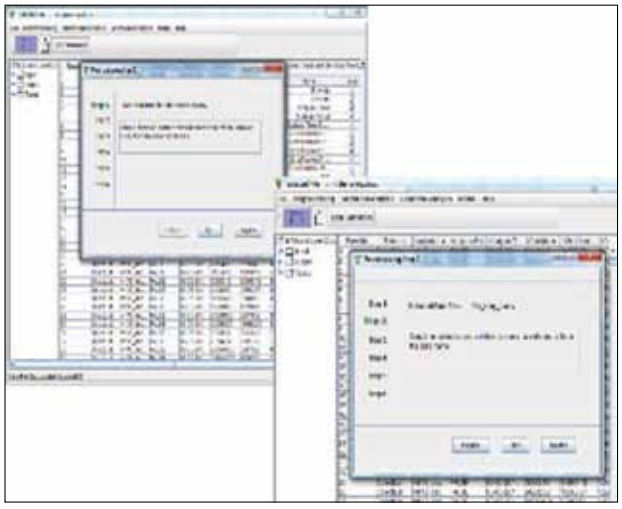


Fig. 3.30: Few Screen shots of the interface of the software HtP-DAP

In addition, phenotyping of 150+33 important Wheat cultivars under drought stress has been done. Images of total 150+33 wheat mini core cultivars with three replication under drought stress and control were received from Phenomics facility of ICAR-IARI, New Delhi. Three types of Camera (image angles) *viz.,* Visual (4 angles), NIR (2 angles) were & IR (2 angles) used for collecting data at 11 phases covering growth period of wheat during January to March 2017. Re-analysis were carried out again with inclusion of 33 more wheat cultivars to classify the wheat varieties into different groups with respect to drought stress: data cleaning and pre-processing, variable selection, SVM classification, K-mean clustering, hierarchical clustering, PCA and Estimation of heritability, repeatability and genetic correlation (Table 3.5; Fig. 3.31).

Table 3.5: Classification accuracy between drought vs control treatment based on selected image traits by using SVM

Time Points	Dimentions	Accuracy (%)
1	-	-
2	1021 x 116	90.44
3	1097 x 109	78.53
4	1098 x 110	96.81
5	953 x 112	97.37
6	1097 x 114	92.46
7	1098 x 113	98.86
8	1044 x 115	95.20
9	1098 x 114	95.44
10	1034 x 125	98.78
11	614 x 125	88.97
12	297 x 89	80.50
Overall		92.12

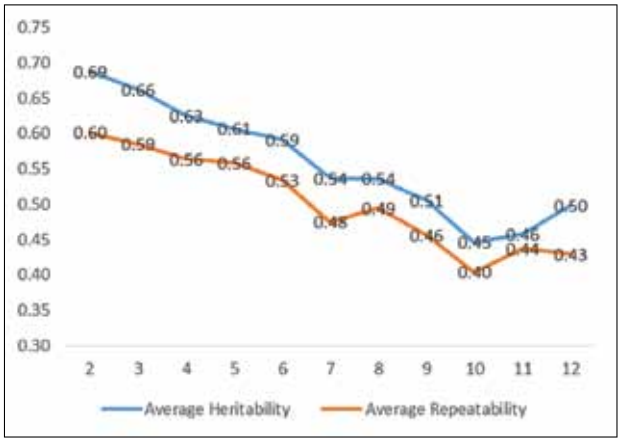


Fig. 3.31: Estimates of average Heritability and repeatability of the selected image traits of 183 wheat mini core.

Creating a fully characterized genetic resource pipeline for mustard improvement programme in India

This project is funded by National Agricultural Science Fund, ICAR, New Delhi with the PAU-Ludhiana being the lead centre and ICAR-IARI, New Delhi, Directorate of rapeseed-mustard research, Bharatpur, GBPUAT, Pantnagar and ICAR-IASRI being the collaborating centres. The Square Lattice design was recommended in all the five locations (PAU, Ludhiana; GBPUAT, Pantnagar; DRMR, Bharatpur; IARI, Delhi and Kota, Rajasthan) with two replications and 289 (treatments) mustard germplasm lines. The randomized layout plan for the lattice design was prepared for each centre and

sent for conduct of experiments. The analysis of variance for each trait (without missing observations) under every location was obtained to test the null hypothesis of equality of treatment means. In case of missing observations, appropriate imputation technique has been implemented. In addition, whole genome assembly of *Brassica fruticulosa* was carried out using SOAP de novo. The frequency and distribution of simple sequence repeats (SSRs) have been identified from the assembled genome. In total 962090 SSRs have been identified. A total of 322830 contigs were subjected to annotation and functional classification: Biological process (BP), Cellular component (CC) and Molecular Function (MF). The GO analysis identified 724574 terms (BP: 288706; CC: 211054; MF: 224814). Also, 133 KEGG pathways were found to be involved. Maximum number of genes were found to participate in the Purine and Thiamine metabolism, Purine metabolism, Aminobenzoate degradation, drug metabolism, Purine and pyrimidine metabolism.

Elucidating the mechanism of Pashmina fibre development: An OMICS approach

This project is funded by National Agricultural Science Fund, ICAR, New Delhi with SKUAST-Kashmir being the lead centre and ICAR-NDRI, Karnal and ICAR-IASRI being the collaborating centres. The binary alignment map (bam) files of the Pashmina goat transcriptome were analyzed by SAMtools and GATK for detection of SNPs between goats having white, black and brown hair follicles. The chromosome wise distribution of SNPs was obtained for the above three goat samples using in-house scripts. Besides, the SNPs between pair-wise samples, i.e., white *vs* black, white *vs* brown and black *vs* brown as well as between all the three samples have been identified and annotated. Further, the identified SNPs were classified as synonymous and non-synonymous SNPs. Besides, the in-dels were identified by setting parametric values in the tools. The data was processed in a suitable format for visualization in Circos. The long non-coding RNAs were identified by using suitable pipeline. Also, the transposable elements and SNPs present in the putative lncRNAs were identified using in-house *perl* scripts. An information system containing the above information was developed for the scientists involved in the goat improvement programme.

ICAR network project on functional genomics and genetic modification

Mango genome assembly has been completed by whole genome sequencing and chromosome wise assembly of Indian mango Amrapali. The assembly statistics is given in Table 3.6; Fig. 3.32. Genome finishing work has been completed using marker based anchoring of super scaffold to get pseudomolecule (Table 3.7). In order to evaluate completeness of mango genome assembly BUSCO (benchmarking universal Single Copy Orthologous) approach was used and its result revealed 91.4% completeness of assembly (Fig. 3.33). Completeness of Amrapali genome assembly was further evaluated by mapping of 19 different sets of transcriptome reads from India and global data (Table 3.8). These reads were mapped successfully on > 96% of genome assembly confirming the high coverage of the assembly in genic region at transcript level.

Table 3.6: Mango (Amrapali) Genome Assembly Statistics

Parameters	Value
No. and size of contigs	9,703 (400.9 Mb)
Longest contig	995.9 Kb
No. and size of scaffolds	4,312 (403.2 Mb)
N50 of scaffolds	282.5 Kb
Longest scaffold	2.0 Mb
Scaffolds > 10 Kbp	3,161 (73.3%)
Unknown bases (Ns)	2.1 Mb (0.5%)
GC Content	32 %

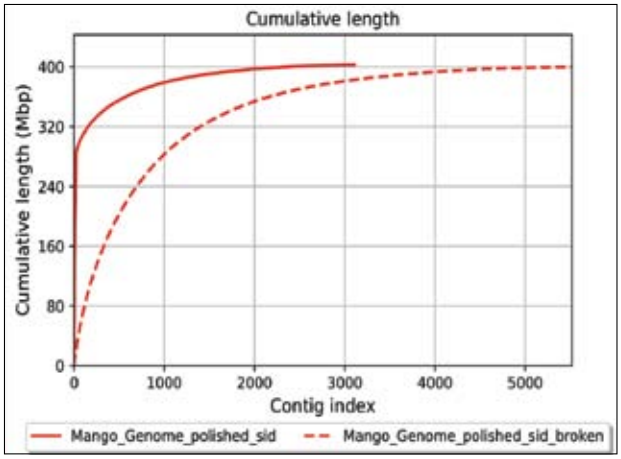


Fig. 3.32: Cumulative length of contigs

Table 3.7: Anchoring of scaffold in Pseudomolecules

• No. of markers (CASTA) mapped in contigs:	6,311/6,594 (95.7%)
• No. of markers included in pseudomolecules:	5,492/6,311 (87.0%)
• No. and size of anchored scaffolds:	1,222 (283.77 Mbp, 70.4 %)
• Longest pseudomolecule:	23.3 Mb
• Shortest pseudomolecule:	9.5 Mb
• No. and size of floating scaffolds:	3,089 (119.53 Mbp, 29.6 %)

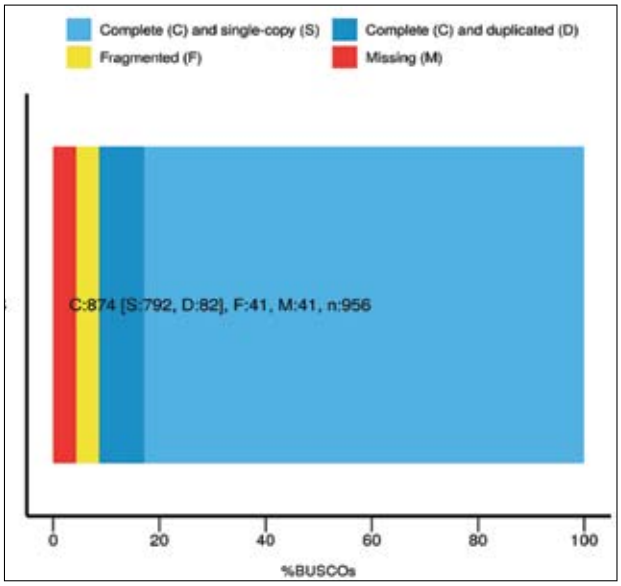


Fig. 3.33: BUSCO assessment results

Table 3.8: Completeness of the Amrapali genome assembly by mapping 19 different NCBI-SRA transcriptome reads

S.No.	Type of RNA-Seq Data (SRA-NCBI)	Sequencing Technology	Submitter	Mapping %
1	mango F1 population	Illumina HiSeq 2500	SSCRI, China	89.71825678
2	RNA seq Chausa	NextSeq 500	ICAR-CISH, India	97.90796949
3	RNA seq Amrapali	NextSeq 500	ICAR-CISH, India	97.86090310
	Mangifera indica 'TOMMY ATKINS' transcript reads from mixed organs	Illumina HiSeq 2000	Indiana University	98.42958719
4	Mangifera indica 'TOMMY ATKINS' transcript reads from seed	Illumina HiSeq 2000	Indiana University	98.05686491
5	Mangifera indica 'TOMMY ATKINS' transcript reads from mesocarp	Illumina HiSeq 2000	Indiana University	98.63497871
6	Mangifera indica 'TOMMY ATKINS' transcript reads from leaf	Illumina HiSeq 2000	Indiana University	98.19120256
7	Mangifera indica 'TOMMY ATKINS' transcript reads from flower	Illumina HiSeq 2000	Indiana University	98.04236459
8	Mangifera indica 'TOMMY ATKINS' transcript reads from exocarp	Illumina HiSeq 2000	Indiana University	98.03759958
9	Mangifera indica 'TURPENTINE' transcript reads	Illumina HiSeq 2000	Indiana University	98.28825616
10	Mangifera indica 'THAI EVERBEARING' transcript reads	Illumina HiSeq 2000	Indiana University	98.32381005
11	Mangifera indica 'NEELUM' transcript reads	Illumina HiSeq 2000	Indiana University	98.61319780
12	Mangifera indica 'M. CASTURI "PURPLE"' transcript reads	Illumina HiSeq 2000	Indiana University	98.39724743

S.No.	Type of RNA-Seq Data (SRA-NCBI)	Sequencing Technology	Submitter	Mapping %
13	Mangifera indica 'BURMA' transcript reads	Illumina HiSeq 2000	Indiana University	96.02066555
14	Mangifera indica 'TOMMY ATKINS' transcript reads from seed coat	Illumina HiSeq 2000	Indiana University	97.75470678
15	Mangifera indica 'AMIN ABRAHIMPUR' transcript reads	Illumina HiSeq 2000	Indiana University	98.53282503
16	Amrapali leaf transcritome sequence	Illumina MiSeq	ICAR-NRCPB, India	97.91252088
17	Plant sample from Mangifera indica	Illumina HiSeq 2000	Universidad Nat Auto de Mexico	97.84069045
18	Complete mango transcriptome	Illumina HiSeq 2000	University of Karachi, Pakistan	98.74955947
19	MANGO TRANSCRIPTOME	Illumina HiSeq 2000	SSCRI, , China	97.99064843

Analysis has also been done on Mango transcriptome data. Since biotic stress mango malformation is one of the major impediment in mango productivity thus RNA seqeuence approach was used to decipher the candidate genes involved in manifestion of this disease in mango. Transcriptome data were generated for four different stages namely, 1. Malformed Swollen Stage, 2. Malformed bud stage, 3. Healthy Bud stage, 4. Healthy Panicle (Table 3.9a). Transcriptome assembly was made using Trinity (2.5.1) and redundancy was removed used CAP3 tool. Total number of transcripts generated are 149889 with N50 > 817 bp and GC percentage 39.60. Further, results of CAP3 assembler considered for downstream analysis. Bowtie tool was used for mapping of reads and RSEM tool for calculation of expression values. Finally edgeR package was used for differential expression analysis with parameters FDR: 0.01 and LogFC: 2. The number of differentially expressed transcripts were shown in Table 3.9b.

Table 3.9b: Differentially expressed transcripts

Sample set	Upregulated	Downregulated	Total
1 vs. 3	1162	464	1626
2 vs. 3	1074	535	1609
1 vs. 4	2502	2385	4887
2 vs. 4	3136	2640	5776

Homology search was performed by using Blastx against NCBI NR database. Gene ontology, KEGG pathways analysis was performed using Blast2GO tool. PlantTFDB v 4.0 (http://planttfdb.cbi.pku.edu.cn/) database was used for identification of transcriptional factors. MISA tool was used for mining of microsatellite repeats.

Table 3.9a: Samplewise data statistics (before and after trimming)

Sample	Input read pairs	Both surviving	Forward surviving	Reverse surviving	Dropped
Sample 1	20311684	18047157 (88.85%)	1086434 (5.35%)	860858 (4.24%)	317235 (1.56%)
Sample 2	20773211	19937272 (95.98%)	386158 (1.86%)	424592 (2.04%)	25189 (0.12%)
Sample 3	27924723	27838982 (99.69%)	46388 (0.17%)	39188 (0.14%)	165 (0.00%)
Sample 4	18598750	16877484 (90.75%)	926227 (4.98%)	556930 (2.99%)	238109 (1.28%)

Genomics assisted crop improvement and management

This is a Centre for Advanced Agricultural Science and Technology (CAAST) project funded by National Agricultural Higher Education Project (NAHEP) with ICAR-IARI as the lead centre and ICAR-NBPGR, ICAR-IASRI and ICAR-NIPB as collaborating centres. The investigators of the project are the Teaching cum Student Research Guidance Faculty of ICAR-IARI. Training proposals were invited from the students at ICAR-IASRI interested to take up work relevant to genomic assisted crop improvement. One response was received from a fourth year Bioinformatics student. A presentation was made by the student at ICAR-IARI on 06.09.2018 and based on that, it was decided to send the student to Washington State University, USA for three months (05.03.2019 to 05.06.2019) to work on genome segmentation analysis. Preparation of materials for e-course on high dimensional genome data analysis has been initiated. In addition, necessary indents were prepared for procurement of equipment for the discovery centre that is to be established at ICAR-IARI.

Potential gene mining from salt tolerant grasses for improvement of salt tolerance in crops

Transfer of novel gene(s) from salt tolerant halophytes into crop plants would be a better option with high degree of acclimatization to environmental factors and less yield penalty on account of their hardiness, co-existence and relatedness. Towards this end, the transcriptomes of two halophytes *Dicanthium* and *Urochondra* were analyzed under conditions of high, moderate and low salt stress and differentially expressed genes were identified.

Improving the usability of buffalo spermatozoa by sperm surface remodeling and immune acceptance in female reproductive tract

For targeted SNP discovery of defensing gene in buffalo population, mining of buffalo specific defensin gene family from public domain was completed followed by mapping these over baffalo genome. A total of 48 defensin genes/ gene family of buffalo were mapped over latest buffalo de novo genome assembly. Abundance of defensin gene family was found on chromosome 1, 2, 3, 14 and 27 of buffalo genome (Table 3.10).

Table 3.10: Chromosomewise distribution of Defensin gene family/ protein in buffalo

Defensin gene family/ protein	Chromosome	Start Position	End Position
ABN72271	1	38593293	38593056
ABN72272	1	38832456	38832693
ABN72273	1	38594971	38594781
AIU56268	1	38593293	38593056
AIU56269	1	38832456	38832693
AIU 56270	1	38594971	38594781
ABV01367	1	38593293	38593133
ABE66309	1	38593293	38593136
AAP57565	1	38593293	38593101
ARO77466/ARO 77467	14	22582143	22592495
AAQ93463	27	7138963	7140882
ACU24717	1	38593293	38593198
AIU56269	1	38832456	38832693
XP_006060738	14	22519769	22530394
XP_006078162	1	38816953	38818369
AAP57565	1	38593293	38593101
ABE66309	1	38593293	38593136

Defensin gene family/ protein	Chromosome	Start Position	End Position
ABI36600	1	38455607	38455346
ABN72274	1	38403971	38403737
ACU24714	1	38593293	38593178
AUL75689	14	22500953	22503954
AUL75690	14	22519769	22530394
XP_006050778	2	30033427	30066332
XP_006060739	14	22582143	22592495
XP_006060762	14	22563786	22565078
XP_006078163	1	38816953	38818369
XP_006078164	1	38790943	38797374
XP_006078184	1	38746945	38752592
XP_025120495	14	22582143	22592495
XP_025136527	1	38758273	38761277
XP_025136548	1	38768903	38773000
XP_025137121	3	70230391	70237321
XP_006049643	14	22776470	22778768
DEFB113	2	30075407	30093561
DEFB114	2	30094935	30097443
DEFB115	14	22690393	22700723
DEFB116	14	22649281	2265449
DEFB121	14	22563786	22565078
DEFB123	14	22519769	22530394
DEFB124	14	22500953	22503954
DEFB125	14	22714437	22725577
DEFB129	14	22797496	22799903
DEFB133	2	30107586	30108754
DEFB134	3	70251706	70255062
DEFB136	3	70282706	70285062
LOC102414555	1	38816953	38818369
LOC102410677	14	22776470	22778768
LOC102395067	2	30033427	30066332

Genome and transcriptome sequencing of coriander (*Coriandrum sativum*) to reveal insight of its genomic architecture and breeding targets

De novo transcriptome assembly and evaluation statistics have been done. A total of 39.8 GB single end reads of two extreme genotypes of coriander, i.e., resistant and susceptible raw transcriptome data were generated using Illumina HiSeq 2000. After removal of poor quality reads from the 16 single end datasets of groundnut (both resistant and susceptible conditions), cleaned and good quality reads with phred score ≤ Q20 were retained for *de novo* assembly. After trimming, the reads were processed by FastQC tool to check the quality of the data. A total of 222723 contigs were generated using trinity assembler with N50 value of 662 base pair.

Table 3.11: RNA- seq assembly

Assembly	Total length of sequences	No. of contigs	Assembly size	N50 value	GC content
Trinity	116128668 bp	222723	176 Mb	662	42.16
CD- HIT	73597784 bp	133480	109 Mb	708	42.13
CAP3	74784594 bp	126612	92.6 Mb	844	41.78

In order to filter redundancies and to reduce noise in the generated contigs, clustering was performed by the CD-HIT and CAP3 assembler program. Trinity assembly 222723 contigs was considered with 42.16 % GC content for further analysis. In the RNA sequence assembly, the median contig length 335 base pair and average contig is 521.40 base pair. Total assembled bases is 116128668 in this assembly (Table 3.11).

In addition, estimation analysis and identification of differential expressed genes have also been done. Counts were estimated by re-mapping raw short reads to the assembled contigs using Bowtie. The RNA-Seq by Expectation-Maximization (RSEM) package was used to resolve ambiguous mappings and to perform final quantifications. EdgeR and DESeq2 Bioconductor package was done by calculating FPKM values (Fragments Per Kilo base of exon model per Million mapped reads) for each contig. False discovery rate and fold change values P=0.05 and C=2 parameters were used for the differentially expressed genes present in both conditions (resistant and susceptible), using EdgeR package getting total 12328 and 8103 DEGs from DESeq2 including upregulated and down regulated conditions. 7796 DEGs have been considered as common genes present in both methods DESeq2 and EdgeR results for further analysis.

Molecular Markers for Improving Reproduction of Cattle and Buffaloes

The defensin genes from the public domain were mined specifically from cattle. Finally, 116 such defensin genes of cattle were mapped over *Bos taurus* genome assembly. Abundance of defensin gene family was found on chromosome 8, 13, 23 and 27 of cattle genome.

Characterization, Evaluation, Genetic Enhancement and Generation of Genomic Resources for Accelerated Utilization and Improvement of Minor Pulses

Development of core set for mung bean, black gram, moth bean and cowpea using morphological data from three different locations (Total ~1200 accession for four crops) has been initiated. Data collection for morphological traits has been initiated by partner Institutions. Profiling of core set accessions of selected minor pulses for nutritional (proximate components, mineral profile, amino acid profile, sugars and oligosaccharides) and anti-nutritional components (total phenols, phytate and oxalates). The develop core set of four minor pulses will be shared to collaborating centers/institutes of the consortium for genotyping. Development of Near Infra-Red (NIR) prediction models for estimation of selected nutritional and anti-nutritional components for five minor pulses has also been initiated.

Non-linear modelling for genomic predictions based on multiple traits

Development of non-linear model for multi-trait genomic selection has been done. Genomic Selection (GS) is an advanced method of breeding where information on genome-wide dense markers is used to predict genetic merit of an individual in a breeding population. In this study, a multivariate non-linear model has been developed for GS. This model has been developed using multi-variate least absolute shrinkage and selection (MLASSO) technique along with kernel technique. The proposed method has been termed as “kernelized multivariate LASSO”. This developed methodology has been evaluated by using real data set and found to be outperforming in comparison to the other existing methods.

In addition, development of a software for single-trait and multi-trait genomic selection has also been done. For this, software for single-trait and multi-trait genomic selection named Genomic Selection Tool (GST) has been developed for web platform and programming has been done with the Java Server Pages (JSP), Cascading Style Sheets (CSS) and Java programming language (Fig. 3.34). This software is user friendly and provides genomic estimated breeding value (GEBV) information of each individual. It uses genotypic as well as phenotypic data for such prediction. GEBVs predicted by this tool may provide useful postulate for breeders for selection of important variety or breed.

Fig. 3.34: Home Page of Genomic Selection Tool (GST)

Development of web server for phenotype and genotype analysis for cattle breeding management

The collected sample data on cattle was standardized to develop a database (Fig. 3.35). For designing the database, registration, disposal, pedigree, health, semen collection, service, calving, milk production, feeding table have been created and integrated using MYSQL. Web based data entry tools have been developed using PHP for server side scripting, database connectivity and database management operations. Java and HTML were used for client side data entry forms and forms validation. All types of online data entry forms have been completed viz. Registration, Growth, Service, Confirmation, Calving, Milking, Feeding, Health, semen collection, Disposal. Inbox provisions has been made for data transaction among users such as data entry, data approval, rejection and modification. User management module has been developed. Draft user manual has been prepared.

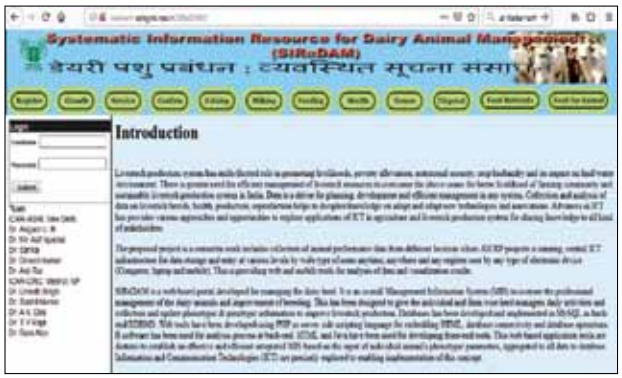


Fig. 3.35: Home Page of cattle breeding management website

Platform on integrated genomics warehouse

The system architecture for genomic data warehouse has been developed using open source software tools (Fig.3.36). Pentaho framework has been used for development of extraction, transformation and loading (ETL) of variants data into warehousing schema. Pentaho software suite,

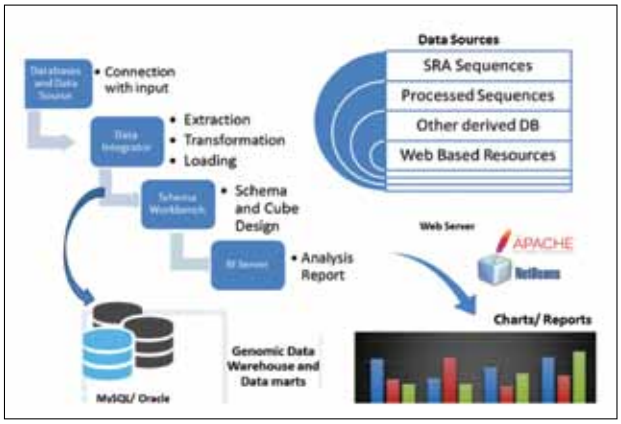


Fig. 3.36: Genomic Warehouse Architecture

open source intelligence software tools were used for data analysis and dashboard reporting. The OLAP is a gateway to provide the user interface for developed multidimensional models by enabling various OLAP operations such as drill down, roll-up, slice, dice and many more functions by transforming the existing data. The existing repository related to genetic variants were identified for input data retrieval. Pentaho data integration (PDI) was used for development of ETL process and workflow by utilizing core data integration (ETL) engine and easy to use GUI for development of workflows (Fig.3.37). Various types of transformation processes, SQL query design and data models were developed for data extraction and transformation to carry out further analysis. The PDI supports import/export of data from/to Excel files, text files, csv files, XML files and many other related databases. Development of OLAP cubes was accomplished using Pentaho Schema Workbench (PSW) and this tool is helpful in designing of OLAP schema, creation of hierarchies, populating the dimensions and integrating useful measures as facts in the data marts.

The metadata of developed OLAP cubes are stored in XML format and can be exported to the Pentaho Business Intelligence (BI) Server for further analysis and customization of reports/ dashboards (Fig.3.38).

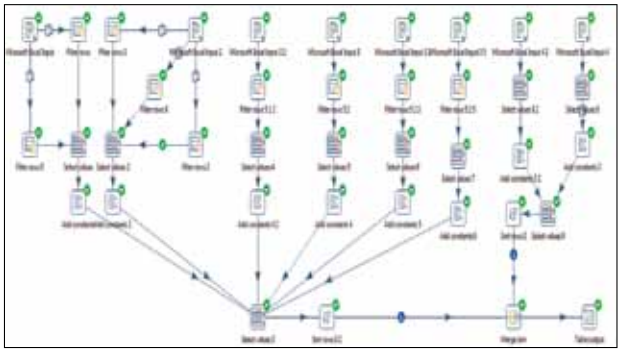


Fig. 3.37: ETL Workflow development

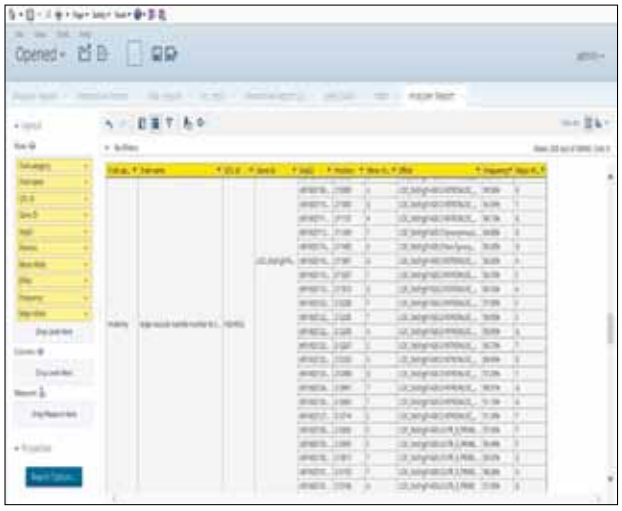


Fig. 3.38: Dynamic and Interactive reports through OLAP

OLAP cubes are updated through updation of related XML by creating automated job profiles. Finally, the developed XML Schema and data is published in the Pentaho BI Server with the suitable database connection. The access to the end users will be provided through the creation of username and password for authorized access of the information.

Development of an improved hybrid De-novo whole genome assembler

Web based interface in JSP has been developed which includes user module, file management module and database creation for profile. Parallelized programming for error correction of long reads using short reads has been done. Development of interface for integration of tool for error correction in the long reads using alignment with short reads has been completed. Installation of an alignment program FMLRC and other dependent programs such as *ropebwt* and *msbwt* were installed on cluster for parallelizing the error correction of long reads using short reads. Programming for scaffolding process has been done which can be executed using the web interface.

Discovery of novel genes and promoters responsible for salinity tolerance in *Haloarcula* spp.

Paired-end was prepared from two samples, each having three replicates (8% and 26% NaCl) using TruSeq stranded mRNA preparation kit. Fragment size were taken from 321 to 403 base pairs and sequenced on Next Generation Sequencing platform called Illumina NextSeq 500 using 2x75 base pair chemistry (Table 3.12).

Table 3.12: No. of Reads against sample names

Sample name	Number of Reads
8% replicate 1	13,859,212
8% replicate 2	8,459,748
8% replicate 3	13,646,634
26% replicate 1	8,216,418
26% replicate 2	15,159,087
26% replicate 3	4,214,792

a) **Quality Assessment:** All the six sample read (were quality assessed through FastQC tool. All the samples were passed with more than 85-90% reads with Q30.

b) **Adapter trimming:** Library sequencing Adaptors were removed by Trimmomatic version 0.33 joined to the ends of the reads.

c) **De-novo Assembly of Transcriptome:** The quality trimmed reads were pooled and assembled using Trinity software using k-mer value of 25 which is constant for the trinity algorithm. Trinity works on the de-brujin graph algorithm of assembly and is found to be better than the other transcriptome assembly programs in constructing full length transcriptome assembly without a reference genome. It is comprised of three programs:

   i. Inchworm- which merges reads into unique transcripts and also removes probable erroneous k-mers.

   ii. Chrysalis- takes contigs which are overlapping as a result of closely related paralogs and constructs de-brujin graph using them.

   iii. Butterfly- basically makes longer sequences from de-brujin graphs made by Chrysalis using the paired end reads.

A total of 1,03,346 transcripts were obtained in fasta format. These transcripts were further considered as a reference transcriptome onto which the reads mapped. Therefore, all the reads of the six libraries (3 replicate for 8% and 3 replicates for 26%) were mapped individually to the reference transcriptome using Bowtie2. Bowtie2 uses hybrid of two strategies viz. Burrows wheeler algorithm and dynamic programming to perform gapped alignment of the reads to the reference in fast and efficient method.

Transcriptome analysis to decipher mechanism related to distinctive morphological phenotypes in indigenous poultry

Literature available on identification of differentially expressed genes (DEGs) from transcriptome data

of poultry birds was studied. Few DEGs related to skin development, meat development, disease resistance etc. were also studied from the literature. Besides, the morphological attributes (body length, body weight, rumpless, naked neck, Shank length) associated with genes were studied. Also, the procedure for identifying SNPs association with traits using GATK pipeline has been explored.

Metagenomic profiling for assessing microbial biodiversity in river Ganga for ecosystem health monitoring

The sediment samples collected from Kanpur and Farakka sites of river Ganga were subjected to metagenome analysis to identify the probiotic bacteria and bacteriophages. In addition, three additional sediment samples from the Yamuna river have also been collected. A total of 243 probiotic / bio-remediating bacteria and 24 bioremediating fungal species were identified from the metagenome analysis of sediment samples. The metagenomics analysis was carried out using CLCGenomics Workbench and Kaiju software / tools.

Deciphering health biomarkers and thermo-tolerant traits by computational genomics approach in goats (Component 1: Host transcriptome analysis for identification of biomarkers and epitope mapping assisted diagnostics development for enterotoxaemia in goats; Component 2: Identification of heat stress/tolerance genes through transcriptomics approach in goats)

The Clostridium perfringens type D culture was inoculated in twenty goats (6-9 month age) divided into 4 groups: Group-I (culture supernatant), group-II (whole cultures), group-III (washed cells) and group-IV (uninfected control). The results from RNASeq showed higher expression of IL-1β and IL2. The toxin treated groups showed highest upregulation of the gene responsible for chemotaxis and the Cath-L showed higher upregulation in natural outbreaks. A new diagnostics sandwich ELISA was developed for detection of epsilon toxin in intestinal contents of Entero toxaemia (ET) suspected goats for which field validation is underway at partner centre ICAR-CIRG. Indirect dotELISA was developed to detect the seroconversion (protective antibodies titre) in animals' post-vaccination with ET.

Programme 5: Development of Informatics in Agricultural Research

Implementation of ICAR-ERP, Unified Communication and Web Hosting Solution

- Customization/Development of New Functionality and Reports have been done as per details given below:
- The payroll for scientific category has been customized according to 7CPC and salary reimbursed
- Modification done in project detail restriction on distribution level from line level to avoid mistake in booking of expenditure
- Generation of alert done enabled to supervisor for their staff whose Email IDs are not updated in FMS and employees where supervisor tagged with their records are End-Dated in FMS.
- Generation of mail attachment to Director for pending invoice transactions, transaction Count and bill tracking report for their respective Institutes.
- Functionality developed to restrict/personalise the email address field on Employee basic detail form for restricting duplicacy, special characters and validating the domains.
- Statement of Expenditure Report with Invoice Distribution Details created.
- Automation of user Creation with Self Service Responsibility and User Deletion once Employee retired from ICAR.
- Period Closure completed for all modules in FMS till Feb2018.
- A report "ICAR Invoices in Never Validated Status" customized and incorporated to xxx Payable Audit & Accounts Responsibility to get the details of all those invoices which are in never validated status.
- Annual Increment applied through FMS for all employees after 7Pay Commission.
- Functionality created for Director Level Responsibility to view the status of application on their own.

- Deployed leave alerts functionality as on date to Supervisor and Director of Institute.
- Created new employee ids of total 135 newly recruited scientists (including their basic and service details) and 72 FMS new users have been created.
- GPF Functionality complete solution uploaded on Production for IASRI.
- Payroll Schedules developed.
- Functionality for Central Budget Responsibility prepared.
- ICAR GAR Paybill Report designed and developed.
- The following forms personalized:
  - Addition of GSTIN Number in Purchase Order Form
  - Addition of GST on Vendor PAN Definition form
  - Adhaar Number Fields
  - Fixed asset bills which are posted and null across ICAR
  - Import Journal personalization
  - Leave Issue Validation | Study Leave
- The following reports modified by adding the GST number:
  - ICAR Purchase Order Print Report
  - ICAR Bill Report
  - ICAR Invoice Register Report
- Transfer Alert notification developed and system will send an alert to current and designated institute to take necessary action well in advance
- LTA functionality developed
- Restriction to update the Cost Element to avoid issue in payroll Run.
- Project End Date - Extension Approval process implemented.
- The following functionalities have been created
  - Online Forget Password Functionality
  - TDS on GST Functionality
  - GST Tax Creation across ICAR
  - Leave Carry Forward EL/HPL/CCL.
  - Employee to Supplier Conversion Program
  - Vendor Master Template (Bilk Vendor Upload)
  - GL Opening Balance (API)
  - Alert – ICAR Open Leave Notifications
- Fund type creation on SCSP (Scheduled Class Sub Plan).
- Modification in Import journal Form with GL Date of that batch.
- Bank detail Update restriction on user specific responsibility to avoid future error.
- HRA allowances with Arrear to Scientists across ICAR through FMS as per 7th CPC
- Changes done in CGHS, TA and DA as per Govt. Rules
- Pending Notifications with Approvers from 2014 till 2017 closed from system for smooth functioning of FMS MIS
- Financial Setup completed for all the modules implemented at ICAR for 2019-2020

The following instructions material for 44 FAQs have been prepared and uploaded in MIS/FMS website:

- Rollback process of Single employee
- How to Base Salary of an Employee
- 7th CPC Scientific Category
- How to correct ICAR joining date
- How to retire an Employee in system
- The document for **"**Steps to be followed by DDO Section for payroll process"
- CBT for Training for Payroll
- Document for "Steps to be followed to assign Institute Specific Vendor Creation Rights"
- Document for Receipt Reversal
- How to Identify Never Validated Invoices from System
- How to cancel Bill
- How to Create & Modify Work plan Activities and Monitorable Targets
- How to Create Inter Institutional Project
- How to Create Project Receipt
- How to Create RPPI for Externally Funded Projects
- How to Enter Budget for Externally Funded Projects
- How to release Insufficient Fund Hold in Project Invoice

- How to Create Inter Institutional Projects
- How to add more Items in previous created Receipt
- How to add a new requisition in an Existing PO
- How to Cancel a line from Indent having Rejected Status
- How to create a Miscellaneous Receipt & Miscellaneous Issue in (On hand Quantity) of Inventory
- How to Create Blanket Purchase Agreement (Complete Cycle)
- How to create Blanket Purchase Agreement (Rate Contract)
- How to create Blanket release against an Indent
- How to create PO matched Invoice for UP -VAT Commissioner
- How to create Tax Category
- How to Deduct TAX amount (any other amount) from the PO Matched Invoice
- How to Match PO with Tax Line
- How to Round-OFF the value of PO
- How to Split quantity of Indent Lines
- How to use Sourcing Rule Document
- How to cancel a bill
- How to add GST number for any Vendor
- How to reverse receipt document
- Creation of Asset related bill by DDO Section and procedure for Audit Section document
- Reverse receipt and Fixed Asset Invoice document
- QRN-How to add GSTIN Number of Institute
- Batch Element Entry document
- Instructions to generate Transaction count report from ERP system
- ICAR GPF Ledger entries document
- Rollback Payroll Process document
- Reset password
- Deduction of TDS on GST Tax prepared

The following twelve modules manual has been updated and made available on the MIS-FMS

- Accounts payable user manual V 30.0
- Fixed Asset version 30.0
- General Ledger user manual V 30
- Grants and budget version 30
- Receivables Version 30
- Core HR User Manual v30.0
- Payroll User Manual v30.0
- SSHR User Manual v30.0
- New Fund Type- Scheduled Cast Sub Plan (SCSP)-204
- Budgetary Control in Invoices
- Deduction of TDS on GST Tax
- March Salary Paid in April

The following key review meetings were held under the project:

- A meeting under the Chairmanship of Secretary (DARE) & DG (ICAR) was held on 28 June, 2018 to review the progress of implementation of ICAR-ERP and future strategy for ICAR-ERP solution.
- A meeting of the committee was organized under the chairmanship of Special Secretary (DARE) & Secretary (ICAR) on 13 August, 2018 in order to finalize the way forward for continuation, modification or creation of new ERP solution.
- Technical committee meeting has been organized to find out the way forward for migrating the ERP on higher version and prepared the RFP for providing the technical support for next three years.

The following End User Training & Support have been provided:

- Training organized for ICAR-ATARI, Umiam personnel during 09-10 May, 2018 on Finance and Assets modules.
- Training on ICAR-ERP was organized for Newly Established ATARIs personnel (Patna and Guwahati) during 14-17 May, 2018 for all modules.
- One day training provided at KAB-II for Finance module on 18 May, 2018.
- Training was organized on Finance module to personnel of ICAR-IIAB Ranchi during 21-22, 2018.

- Training provided to ICAR-HQ Education Division on 13-Jun-2018 for Finance module and budget section personnel for budget upload on 26-Jun-2018.
- Training organized at NIBSM, Raipur for HRMS and payroll module during July 11-13, 2018
- Support provided to personnel from IARI on creation of Project, budget entry and issue of PI Name in Project was resolved on 17-Nov-2018.
- Remote sessions were organized for following institutes:
  - ICAR-NIBSM, IARI, IISS, IIWM, HRM Division, ICAR (HQ), IGFRI, IIHR, SBI, NRCE, NIANP, IIFSR, NRRI, CICR, Sirsa, CISH,CCRI, CSSRI, IANP, NRC Grapes, NRCL, IIRR.

Monitoring & Coordination for Effective Implementation are being done as follows:

- Monitoring the day to day transactions in ICAR-ERP system and issues
- MSR Meeting with IBM personnel for reviewing the progress and issues
- Follow-up on the following issue with the all ICAR institutes (i) Payroll Run, (ii) Import of Payroll Entries which will impact the actual Expenditure of ICAR floated, (iii) Bills raised in system but not accounted / Validated / Paid in FMS – MIS, (iv) Transaction Count, (v) Leave, (vi) Supervisor Change, (vii) Pending notification information pending authority for required action.

Out of 113 ICAR institutes, status of modules being up created by them based on the transactions upto March 31, 2019 are given as follows:

- SCM -58
- FM-107
- HRMS-109
- PAYROLL-106

The information regarding work under ICAR-Data Center (DC) and Unified Communication Solution is given below:

- Total number of 19417 ICAR Domain (Directory) users, 18857 Mailbox users and 11599 Lync users are created till March 2019.
- All institutes have been taken onboard with ICAR mailing solution. Besides that, 653 email ids have been given to KVK institutes.
- 108 number of websites have been hosted and running through ICAR-DC till March 2019. List of Major Websites running through ICAR-DC are:
  - icar.org.in/icar.gov.in
  - kvk.icar.gov.in
  - krishi.icar.gov.in
  - eoffice.icar.gov.in
  - pgs.icar.gov.in
- SelfAD (Credential Administrator) tool has been launched for end users to Change/Reset password, Account unlock, Modification of User Information e.g. Contact details, address and institute information.
- ICT infrastructure enhanced by including hardware and software
- E-Office external l LDAP authentication successfully configured on array load balancer.
- Implementation of Call logging tool for ICAR users, https://helpdesk.icar.gov.in.
- Micro focus- OBR, OMI and NNMi tool implemented. Now, ICAR-DC Infra Monitoring and capacity Planning/Forecasting will be possible through system generate report and will help to better optimise the Data Center Infra.
- Considering Current security trend, all Security patches of Hardware/Application/OS running through Data Center was upgraded without interruption to DC services.
- New Attributes for Mobile Number and ERP ID has been added to Domain (ICAR.GOV.IN). Authentication of other DC Applications can now be integrated through ICAR-DC Domain. This will simplify the authentication process and reduce the burden of maintaining multiple user Database for different applications.
- Migration of E-office (https://eoffice.icar.gov.in) application from NIC to ICAR Data Center, Six Application/DB servers were installed in cluster mode for this application to be configured in High-Availability (HA) mode. Load Balancer Services were integrated to balance e-office application traffic and High-Availability.
- Cpanel & Plesk Server were installed in the ICAR Data Center for easy Configuration & maintenance of the websites. Users will also be able to access and maintain the databases related to their website(s).

- Latest Cumulative Update (CU20) of Email Solution (Exchange Server 2013) has been implemented for better security and advance feature of Email Solution.
- Preparation of Below mentioned Process/Policy/ Procedures and Technical documents for ISO 20k & 27k1 certification of ICAR-Data Center.
  - Email Solution (Exchange & Lync)- 54
  - Storage & Backup- 29
  - Linux – 28
  - Windows & Hyper-V – 32
  - Network & Security – 71
  - Database (My-Sql, MS-Sql, & PostGreSql) – 99
  - ITIL- (Information Technologies infrastructure Library)
  - Process Templates – 61
  - Guidelines- 7
  - Process Documents - 72
  - Risk Assessment - 4

Development and assessment of educational mobile apps for improving livestock health and production

During the period under report, the following activities were accomplished:

- IVRI-Pashu Prajanan App has been made available in English, Punjabi, Telugu and Marathi languages.
- IVRI-Shukar Palan /Pig Farming App has been developed in Punjabi and English languages.
- IVRI-Artificial Insemination App has been developed jointly with ICAR-IVRI (Fig. 3.39). The app is targeted to impart knowledge and skills to Graduating Veterinarians, Field Veterinary Officers and Paravets about Artificial Insemination (AI) in cattle and buffaloes. The App covers information on various aspects related to AI viz., symptoms of heat, stages of estrus cycle, heat detection, AI kit, proper time of AI, common sanitary measures, thawing, loading of AI gun, semen deposition post AI advice and follow-up. Additionally, the App provides guidelines for semen handling and pregnancy diagnosis in cattle and buffaloes. New link for heat detection and AI videos have been added to enrich AI App.

Fig. 3.39: ICAR-IVRI AI App

- Landlly Pig App has been developed jointly with ICAR-IVRI (Fig. 3.40). This App is targeted to provide information on newly developed Pig variety-Landlly to the UG and PG students of Veterinary Sciences, Veterinary professionals and Entrepreneurs. This App contains information on Landlly pig variety related to its development and release, economic features, appearance and characteristics, performance, scientific management, prospective stakeholders, germplasm availability etc.

Fig. 3.40: ICAR-IVRI Pig Variety App

- IVRI-Dairy Manager App has been developed jointly with ICAR-IVRI and ICAR-NDRI (Fig. 3.41). The App is targeted to impart knowledge and skills to Graduating Veterinarians, Field Veterinary Officers, Developmental Organizations and Entrepreneurs for promoting dairy farming. This is an educational app providing information on breeds and housing, feeding, calf and general management, clean milk production and identification and vices of dairy animals. Educational videos on clean milk production and neonatal calf management have been included in the App for enhancing the knowledge and skills of the persons involved in dairy farming.

Fig. 3.41: ICAR-IVRI Dairy Manager App

- IVRI-Pig Ration App has been developed jointly with ICAR-IVRI for pig diet formulation. The App contains (Fig. 3.42):
  - User Interface (UI) for entry of data by farmer
  - Pdf generation option after feed submission
  - UI and Value addition for Ingredients of pig ration
  - UI and Value (Table and chart) addition for ready-made ration
  - Compressed the images
  - List of PDFs generated in Pig Ration App

Fig. 3.41: ICAR-IVRI Pig Ration App

- Vaccination Guide App (Fig. 3.43): jointly developed with ICAR-IVRI to impart knowledge and skills to Graduating Veterinarians, Field Veterinary Officers, Paravets and Livestock Owners about vaccination in livestock. The App provides basic information about vaccination in livestock and covers specific information about vaccination related to all the major bacterial and viral diseases. For each of the disease in various species, the information on the causative agents, types of vaccines available, serotype / strain used for the vaccines, vaccination schedule and commercially available vaccines are provided in the App. The App also provides detailed information about the government and private institutions involved in vaccine production in the country.

Fig. 3.43: ICAR-IVRI Vaccination Guide App

- All newly developed and modified Apps have been uploaded to Google play store.
- Pashu Prajanan was updated in English and Punjabi Language versions.
- Pig farming app was updated in Hindi version
- Waste Management guide App has been developed is being fine-tuned.

Management and Impact Assessment of Farmer FIRST Project

- Farmer FIRST Programme (FFP) Portal (https://ffp.icar.gov.in/) has been developed (Fig. 3.44) which provides basic and detailed information of all projects under this programme. This portal acts as an interface between Farmers and Scientists for knowledge dissemination.
- ICAR-ATARIs can monitor their respective FFP activities. It is single window platform for collection of images, videos, trainings, activities and interventions under FFP projects.
- Search functionality has been developed in the portal Search Module via. It facilitates to search any record by entering keyword and display the results under different categories where the keyword matches. An advance search functionality has also been developed. The user can select different filtration criteria viz. Project, Intervention and Training for search and then can choose state and district where FFP programme is being conducted as further selection criteria.

The user can also select the category and put keyword for having more precise results.

- Dashboard functionality has been developed for monitoring purpose. In dashboard, count is displayed for number of Projects, Interventions, Organized events, images, videos, publications and registered farmers with on click detailed information.
- To capture the annual progress report from different centers, Annual Progress module has been developed so that user can upload their annual report through portal. The module is divided into five parts viz. background information, technical progress, project outputs, other achievements and list of publications.
- Farmer innovation and practices database has been developed in consultation with ICAR-DKMA. This feature is added to keep record of the new innovations practiced by the farmers for better farming techniques. This information can be shared among other farmers.
- Functionality has been created to add PI, CPI and CO-PI details in the project. The lead organizations are facilitated to add members of their respective projects.
- Functionality to upload budget at collaborative institute level has been developed. The user can add and update budget yearwise and monthwise. Reporting for the same has also been added in the portal.
- Modification has been done in the existing web pages to view activities of the organization at ATARI level and Project details at collaborative institute level. The system now allows institutes and ATARIs to view the budget entered by institutes associated with the project, events, interventions, images, videos, objectives and farmer innovations.
- Registration facility has been given to farmers and other stakeholders. Only registered farmer can submit a query on the portal through their login.
- A blog window has been developed for scientist-farmer interaction. Registered farmers are facilitated to send query to scientist for getting answers Blog Module by scientist(s). The query will go to many experts (based on intervention) and any one can reply. It is like chatting between a farmer and multiple scientists associated with the intervention selected by the farmer for query.
- Query Search option has been provided in the portal through which the farmer/others can see all the queries asked by the farmers. Farmer can use the selection criteria viz. institutes or/and interventions.
- A draft version of android mobile App has been developed to capture FFP related information in the portal. Web APIs have been developed to establish communication between database and android application to capture and store data in the database.
- 363 interventions, 196 events, 886 images, 30 videos and 86 publications related to FFP have been uploaded in the portal by 22 PIs of the lead organizations.
- 14264 numbers of visitors have visited the FFP portal since February 2018; in the month of March 2019, 1299 visitors have visited to get information from the portal.
- Support is being provided to PIs for uploading the information on the portal and technical issues have been resolved over email.

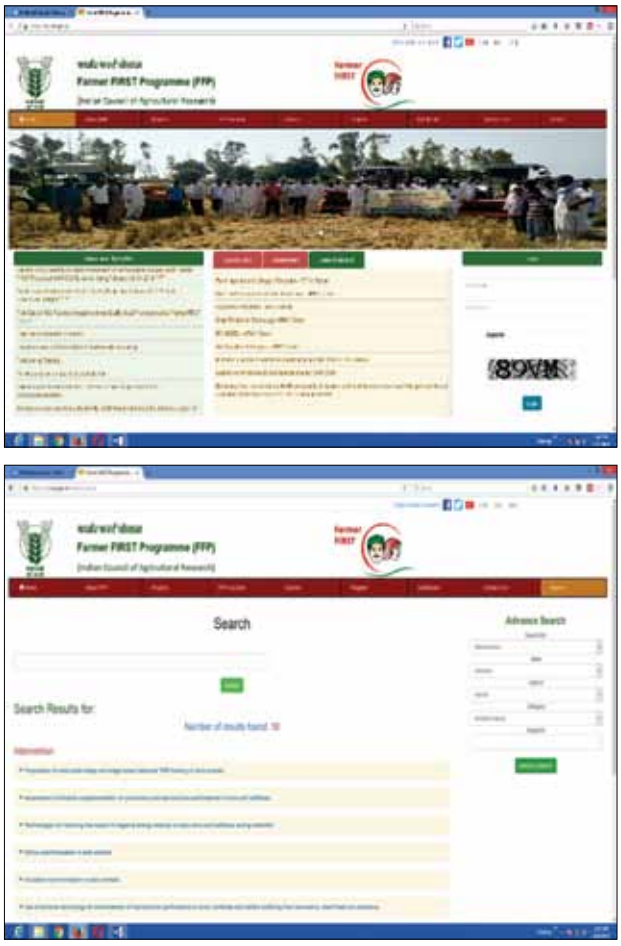


Fig. 3.44: Farmer FIRST Programme

National information system on agricultural education network in India (NISAGENET-IV)

Education Portal-ICAR (https://education.icar.gov.in) has been developed (Fig. 3.45 & 3.46) as a single window platform for providing vital education information/announcements/event schedules/e-learning resources from Agricultural Universities across the country to the rural youth in an easy and fast way at their doorstep. The portal also helps in management, monitoring and promoting activities/ schemes of Education Division, ICAR.

During the period under report, the following activities were done:

- Forms were developed to fill demand under different schemes according to PFMS Proforma
  - Development Grant
  - Library Strengthening
  - Niche Area of Excellence (NAE)
  - Tribal Sub Plan (TSP)
  - Experimental Learning Program (ELP)
- Reports was developed and customized to showcase demand filled at different user levels.
- Functionality has been developed to generate report and sanction letter through this system.
- Forms has been developed to fill UC and AUC (GFR-12A,GFR-12C)
- Forms for Student READY, NTS, JRF, SRF, MCM and Post metric scholarship schemes were customized and USID has been made mandatory for filling the demand information.
- MIS report has been customized to view allocations (under different schemes) for university in a single screen.
- Modification in JRF and SRF modules have been done to incorporate contingency amount.
- Functionality has been developed to auto calculate demand amount under different schemes (NTS, Student READY, JRF, SRF, MCM, Veterinary internship) for universities from a given date.
- Functionality has been developed for release of funds in instalments.
- Module has been developed for filling the unspent budget at Education Division, accordingly grant is released for the university. Sanction letter is auto-generated from the system based on unspent and demand amount. Information on file number and diary number is captured in the generated letter.
- Report “Authority memo” has been developed. This report covers release given to university at different timings along with demand and unspent balance at different stages.
- Installments I, II, III, IV and V of grant has been released and letters issued to universities from the Education portal.
- Various meetings were held with ADG (EP&HS) for requirement study and demo of functionality developed.
- Scholarship/fellowship for student READY, NTS, JRF, SRF and MCM has been released through agricultural education portal.
- Details of around 288980 students have been filled in the portal under schemes viz., Student READY, NTS, JRF, SRF, MCM and Vet Internship for the financial year 2018-19.
- USID has been generated for Approx. 116855 students covering 72 universities.
- Sanction letter for NTS and student ready has been generated through the system for Instalment Four and Five, backlogs and arrears (2018-19)
- Customization for NTS, JRF, SRF schemes have been done for scholarship and accordingly all reports and fill demand functionality was modified.

Fig. 3.45: Agricultural Education Portal

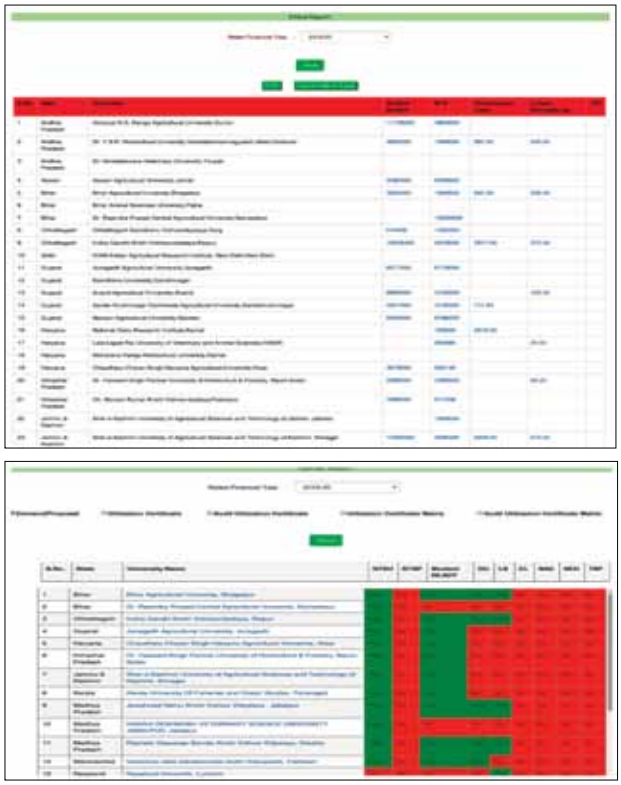


Fig. 3.46: Agricultural Education Portal page for particular financial year

- Grant of Development Grant and Library strengthening has been released through the portal.
- Support has been provided to university nodal officer to fill demand, update university basic details and USID Information.

Knowledge Management System for Agriculture Extension Services in Indian NARES

'Krishi Vigyan Kendra Knowledge Network' or KVK Portal (https://kvk.icar.gov.in/) and KVK Mobile App have been developed to disseminate knowledge and information from KVKs to farmers with the funding support from Extension Division,ICAR. Effective monitoring and management of Krishi Kalyan Abhiyan (KKA) along with other events were done through the system. Module for Direct Benefit Transfer (DBT) under Agriculture Extension Scheme was developed and implemented (Table 3.13; Fig. 3.47, 3.48, 3.49 & 3.50).

During the period under report, the following activities were done:

- Total 681 KVKs have been registered into this portal. Information on 101887 KVK event (past and future) details have been uploaded into the portal.
- 594 KVKs have uploaded their facility details in the portal.
- 515 KVKs have uploaded Package of Practices into the portal.
- 13803 Farmers are registered into KVK Portal.
- Portal was visited 3,66,0179 times till now.
- System was effectively used for e-governance of different phases of KKA. KKA Phase I was launched from 1st June 2018 to 31st August 2018 in 112 aspirational districts across the country with focus on giving a boost to agriculture and allied activities. Activities carried out under KKA involved Distribution of Soil Health Card, 100% coverage of bovine vaccination for Foot and Mouth Disease (FMD), 100% coverage of Sheep and Goat for eradication of Peste des Petits ruminants (PPR), Distribution of Mini Kits of pulses and oilseeds to farmers, Distribution of Horticulture/Agro Forestry/Bamboo plant @ 5 per family (location appropriate) to 100 families per village, Making 20 NADEP Pits in each village, Conduct of Training Programmes in the areas of Bee Keeping, Mushroom cultivation, Kitchen garden (preferably of women) and Other relevant income generating activities. Various meetings were held with Joint Secretary (Policy & FW), Ministry of Agriculture & Farmers Welfare and Additional Secretary, Animal Husbandry for KKA activities management on KVK Portal.
- Provisions have been made in the KVK portal for managing the reporting of KKA activities in an organized way. Data entry forms were designed to enter the information villagewise at district level. Master data entry was done for Villages, Districts, KKA activities along with their village wise targets. Input forms also had the provision to capture media files and images. Dashboard with MIS reports, Image gallery, Video Gallery and Media Gallery were developed for monitoring and showcasing the activities. MIS reports developed include Consolidated report for State, District, Beneficiaries and Activities; Districtwise report, Report for Animal Husbandry Activities, Ranking of the Districts based on the scores were given for activities and report for Non Performing Villages.
- KKA Phase II was launched from 2nd Oct to 25th December 2018 with 12 activities in 25 villages from each of the 117 aspirational districts. Provision was made in the data structure and

accordingly input forms were modified to avoid duplications in village name for same district. Two Dashboards were developed for monitoring the performance of KKA II activities at consolidated level and district level to incorporate reports like MIS reports (Village list with no Achievement, Animal Husbandry Activities), ranking the districts based on performance of different activities etc. KVK Portal homepage was modified to include Dashboard and other details of KKA-II. KVK mobile App was modified for management/data entry of activities by different users (KVKs, SO) and their approval by KVKs.

- KKA Phase III was launched from 15th Jan to 15th April for Genetic Up gradation in Bovines. Functionalities were developed to upload data under KKA III at KVK level as well as SO (State Official) level. New villages were added from LGD database. Summarized reports were developed to showcase information at State/District level. KVK Portal homepage was modified to include Dashboard and other details of KKA-III.
- 42504 Images and 1225 Media Clippings have been uploaded in the KVK portal under KKA initiatives.
- A brief book chapter "Krishi Kalyan Abhiyan Digital Implementation through KVK Portal" was submitted to Ministry of Agriculture & farmers Welfare for showcasing KKA activities.
- KVK portal was appreciated by managers for effective planning and reporting part (Dashboard) of KKA activities. Appreciation letter was received from Joint Secretary (Policy), Ministry of Agriculture & Farmers Welfare for developing Dashboard in KVK Portal for real time progress monitoring of KKA activities.
- Forms and summary reports were designed and developed for DBT Schemes (Training, FLD and OFLD) at KVK level. Module was developed in the KVK portal for DBT in respect to Agriculture Extension Scheme of DARE. Data entry forms were developed at KVK level and mechanism was developed to approve these summary reports in workflow manner at ATARI and Extension Division, ICAR. User Manual was created and uploaded in the portal for DBT functionality at ATARI level, KVK level and Extension level. System has been integrated with DBT DARE portal and data transfer were carried out.
- Functionality was developed for uploading data for Swachhta Hi Sewa 2018 event. Table was created on database level to incorporate various activities under this event. Consolidated reports were developed on Swachhta Hi Sewa 2018 activities.
- Event category 'PM KISAN 2019› was added in the database to upload data of this event in the KVK portal. MIS reports were developed to showcase information at State/District level. Image Gallery for this event was created. Home page was modified to reflect menu of PM KISAN event.
- Functionality on farmer outreach page was modified to upload data of current year.
- Brochures of different sizes (A5 and A4) were prepared on KVK Portal in Hindi and English language.
- News from KVKs and ATARIs was uploaded in the portal under News Section.
- In e-governance review meetings, project progress was submitted regularly and whenever desired KVK portal progress was presented to Secretary, ICAR.
- In the KVK Mobile App, account of Subject Matter Specialists, ATARIs and Extension Division were created. Queries of the farmers now could be forwarded to Subject Matter Specialist by KVK HEAD. Functionality of broadcast message was added at the level of KVK HEAD, ATARI and Extension Division of ICAR. Functionality of Dashboard and video gallery was developed.
- Provision was provided for KVK Heads to log into the KVK mobile App and perform the following activities for his/her own KVK: viewing of farmers' query and replying back the solutions, viewing and uploading of package of practices, viewing the KVK events and updating the KVK location (latitude and longitude).
- KVK website URL and email id along with link of KVK activities was added in the KVK map view.
- Workshops/ Meetings were organized at different KVKs/ATARIs where discussions were made on KVK Portal and KVK App.
- Workshops organized:

Table 3.13: Workshop Conducted for KVK Portal

Organizing Institute/ Place	Date	No. of participants (No. of KVKs)
KVK, Hazaribagh	3 Dec 2018	47 (22)
ATARI, Kanpur	17 Dec 2018	25 (25)
ATARI, Zodhpur at Banasthali	23 Jan 2019	41 (39)
KVK, Howrah	23-24 Jan 2019	09 (05)
ICAR-ATARI, Zone – VII, Umiam, Meghalaya	1-2 Mar 2019	43 (43)

- Issues related to portal have been continuously monitored and resolved. Support was provided to ATARIs and KVKs over email and Whatsapp.

Fig. 3.47: Workshop at ATARI, Kanpur

Fig. 3.48: KVK Portal & KVK Mobile App

Fig. 3.49: KVK Portal- KKA Dashboard and MIS Report

Fig. 3.50: KVK Portal- KKA Image and Media Gallery

Development of direct benefit transfer portal for DARE schemes

- Forms have been designed and developed to upload (individual as well as bulk data upload) master beneficiary details under different DBT Schemes of DARE into the DBT DARE portal (https://dbtdare.icar.gov.in/). Mechanism has also been implemented to avoid uploading of duplicate beneficiary records into the portal.
- Report module has been developed to show the uploaded beneficiary details under different DBT Schemes of DARE.
- Forms have been designed and developed to upload (individual as well as bulk data upload) transaction details under different DBT Schemes of DARE into the portal.
- Forms have been designed and developed to generate summary reports for all the DBT schemes of DARE in the portal. Mechanism has been developed to approve these summary reports.
- KVK Portal (https://kvk.icar.gov.in/) has been integrated with DBT DARE Portal for accessing of DBT related data on training, Front Line Demonstrations (FLD) and On Farm Trial (OFT) under Agriculture Extension scheme (scheme code AWU5S).
- Web APIs have been developed using ASP.NET framework 4.5 MVC model for data exchange between DBT DARE Portal and DBT Bharat Portal (https://dbtbharat.gov.in/) of DBT Mission, Govt. of India.
- Public and Private IPs have been created for DBT DARE Portal for accessing the Web APIs.
- MIS Integration testing has been done successfully with DBT Bharat Portal for all the 20 schemes of DARE with sample data in test as well as production environment.

- DBT on boarded schemes budget for FY 2018-19 has been uploaded in the DBT Bharat Portal for 20 DARE schemes.
- Production data of six Schemes for 6 months (April, 2018 to October, 2018) have been pulled manually by DBT Bharat using web service from DBT DARE Portal and the data have been uploaded in DBT Bharat Portal.
- Production data of the eight Schemes for the month of November, 2018 have been pulled manually by DBT Bharat using web service from DBT DARE Portal and the data have been uploaded in DBT Bharat Portal.
- The scheduler job responsible for data pulling from DBT DARE database has been made operational as per SOP (Standard Operating Process) shared with DBT Mission. It has been scheduled on 10th of every month at 11 PM.
- Production data of the eight Schemes for the month of December, 2018 have been pulled through Scheduler job by DBT Bharat using web service and the data have been uploaded in DBT Bharat Portal.
- The logic for cumulative number of beneficiaries for all the schemes has been implemented in the portal.
- In case there is no data for a scheme, provision for sending zero values against transaction for that scheme has been implemented in the portal.
- For the months of January and February, 2019, data for all the 20 schemes has been pulled through Scheduler job by DBT Support team using web service and the data have been uploaded in DBT Bharat Portal.
- A dedicated mail box viz. dbtdare@icar.gov.in has been created to provide the technical support to the nodal officers who are responsible for data uploading in the portal.
- Technical support has been provided to the nodal officers for issues in data uploading in the portal.

Training management information system for ICAR (TMIS)

A systematic approach to develop and continuously improve individual competencies and capabilities is necessary for achieving the organizational objectives and goals effectively. Organizations including ICAR are attaching tremendous importance to the management and development of their employees. HRM unit in ICAR strengthens and facilitates the training and capacity building of all categories of ICAR employees. A step has further been taken by our institute to ease out the overall process of training, starting from the training needs assessment, training application and approval process till the training feedback and evaluation process. For this, an online Training Management Information System (TMIS) has been designed, developed and implemented at IASRI data centre. The system is available online at https://hrm.icar.gov.in. The system has been launched by the honourable Minister of Agriculture and Farmer's Welfare, Sh. Radha Mohan Singh in the VCs' and Directors' Conference on 31st of January'2019. TMIS, caters to all employee categories in ICAR and facilitates the complete training process online without any manual intervention. All ICAR users can login into the system using their authorised ICAR email id and password which they use for logging into the ICAR-ERP system. The main features of TMIS are online training data management, reporting and decision support for RMP's. It is responsible for the management of information related to trainings sponsored by the HRM Unit of ICAR (Fig. 3.51 & 3.52).

Fig. 3.51: TMIS Home Page

Fig. 3.52: User Screen of TMIS

Management system for post graduate education-II

Post Graduate (PG) School Education, Academic Management System (AMS) has been developed and has been implemented at the following five locations:

- ICAR-IARI, New Delhi
- ICAR-NDRI, Karnal
- ICAR-CIFE, Mumbai
- ICAR-IVRI, Bareilly
- CAU Imphal

In addition, the deployment and implementation has been started at RP CAU, Bihar. The system helps in achieving the institutes' objectives by giving online access to various resources. The AMS is available to students, faculty members, scientists and administrative staff of the respective institutes. Broadly all features of the system are categorized under the following sub modules:

- Courses Management
- Student Management
- Faculty Management
- Administration Management
- e-Learning

The AMS automates various academic processes of the university and enhances the efficiency of the overall system by saving time and efforts reducing manual processes. It continues to be customized as per the respective needs of the various institutes. The data collated by the system is used for generating the reports that are being used by the respective users of the system directly, viz. Students, Professors, Faculty, Controller of Examination, Heads of Departments, Deans etc. Regular SKYPE/ LYNC meetings have been conducted with the institutes from time to time to provide support and for gathering requirements for further customization.

The most recent development encompasses the following functionalities:

- **ICAR-IARI, New Delhi**
  - Modified Repeat course functionality and worked on new version.
  - Course Registration has been done for Trimester-III, 2017-18 and Trimesters-I, II of the Academic Year 2018-19.

Fig. 3.53: Home page of Academic Management System of ICAR-CIFE, Mumbai

  - Feature has been added to enable the students to upload their photos in the system
  - The feature to submit PhD Entrance Online Application and collect the fees, has been implemented
- **ICAR-NDRI, Karnal**
  - Examination Result Reports & Grade Cards are being generated for User Type: Student and Admin
  - Functionality has been incorporated for the generation of separate PDFs of Grade Card for individual student for uploading the grade cards directly to National Academic Database (NAD)
  - Examination Module has been customized for various type of exams viz., Regular/ Supplementary/Improvement/Retotalling
  - New feature developed and provided in the Grade Card module for bulk PDF download of all the students' Degree-wise & Roll Number-wise; PDF splitter utility is also provided
  - Modified Student Registered Course Report w.r.t. CGPA/ SGPA
- **ICAR-CIFE, Mumbai (Fig. 3.53)**
  - Customization w.r.t. Report Module is an ongoing activity
  - The system has been completed for making the system compatible with Internal and External examination modes.
  - Functionality developed for automatic allocation for Guide in the first Semester
  - Added new type of courses such as Non-credit courses and research courses.

- **ICAR-IVRI, Bareilly**
  - Tech Environment has been upgraded to the latest framework of ASP.Net
  - Customizations have been primarily made in:
    - Examination Module - Assignment of marks functionality
    - Features relating Non-credit course approval cycle
    - Guide Allocation report - year wise w.r.t. student enrolment
    - Functionality pertaining to uploading of marks using csv-file for Non-Credit course and Credit course at COE level.
- **CAU, Imphal**
  - ICAR-IASRI conducted AMS Implementation and Usage training to CAU Team
  - Customized the system for Under-Graduate Courses
  - Modified the following functionalities:
    - Advisory Committee Functionality
    - Qualification Functionality
    - User Registration Functionality
    - Semester Registration Functionality and Fee payment functionality
    - PPW and ORW functionality at all user levels
    - Customization of E-mail notifications & their triggers

Artificial intelligence based mobile App for identification and advisory of maize diseases and insect pests

This project has been initiated from the funding support by NASF with the objective to develop artificial intelligence based mobile app for providing the advisory to the farming for major diseases and pests of maize using deep learning algorithm. IIT Delhi and IIMR Ludhiana are partner organizations in the project. The prototype for collection of images was prepared jointly with IIT, Delhi. IIMR Ludhiana has captured and collected the disease and Insects images of maize during February- March 2019. Development of one deep learning model with Convolutional Neural Network (CNN) has been initiated based on image data of total 240 size (190 for train 50 for test) image search for classification of Southern Leaf Blight (SLB) and Northern Leaf Blight (NLB) downloaded from internet.

Investments in ICAR for leadership in agricultural higher education

- Procurement Plan for the entire project duration was prepared and uploaded in World Bank's software Systematic Tracking of Exchanges in Procurements (STEP).
- After the approval from the World Bank, the process of procurement has been initiated.
- RFPs for procurement of various items have been prepared and submitted to PIU for approval.
- Letters were sent to Participating Agricultural Universities for initiating the development of the eLearning courses and video lectures.
- A National Workshop on "Academic Excellence through Building Partnerships and Resource Generation" was organised during 30 April 2019 and 1 May 2019 at NAARM, Hyderabad under the project.
- The Project Team attended the World Bank Mission meeting during 28-29 March 2019 for the discussion on the project.

4

Technology Assessed and Transferred

- EncDNA: An R-package “EncDNA” for encoding of splice site sequences in particular and DNA sequences in general with respect to prediction of different functional elements on the genomic DNA, using fixed length sequences fungal species identification using DNA barcode has been developed. This package is available in CRAN repository https://cran.r-project.org/web/packages/EncDNA/index.html.
- WaveletANN: R-package named “WaveletANN” has been developed. This package relates to combination of Wavelet and ANN for forecasting the time series based on hybrid Wavelet-ANN model. This package is available in CRAN repository https://CRAN.R-project.org/package=Wavelet ANN
- corrDNA: An R-package “corrDNA” has been developed for finding associations between different positions of position-wise aligned sequence dataset. The package has been submitted to CRAN repository and is available at https://cran.r-project.org/web/packages/corrDNA/index.html.
- Field training for estimation of post-harvest losses in livestock products in Zambia under the project “Study on field testing of the developed guidelines on estimating post-harvest losses of horticultural crops, livestock products and fish and fish products” has been imparted. This work was funded by Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.
- Field training for demonstration of Crop Cutting Experiments (CCE) technique for horticultural crops and field training for estimation of post-harvest losses in horticultural crops in India under the project “Study on field testing of the developed guidelines on estimating post-harvest losses of horticultural crops, livestock products and fish and fish products” has been imparted. This work was funded by Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.
- CBP Vortal: CBP Vortal (Fig. 4.1) has been designed and developed to facilitate the online management of all training programs [Centre for Advanced Faculty Training (CAFT – 21 days duration), Summer-Winter Schools (SWS – 21 days duration) and Short Courses (10 days duration) under Capacity Building Program

Fig. 4.1: Image gallery of CBP Vortal

(CBP) sponsored by Agricultural Education Division, ICAR. System is hosted at ICAR-IASRI server and can be accessed from the URL https://cbp.icar.gov.in/.

- **HYPM Portal:** A web based system (Fig. 4.2) for Half-Yearly Progress Monitoring (HYPM) of the agricultural scientists working in ICAR institutes has been developed and maintained at ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi (http://www.hypm.iasri.res.in). The system is operational since April, 2012. Individual scientists fill their research targets and the achievements (under different heads of teaching, training, extension and other prioritized activities) against the proposed targets twice in a year. Those targets and achievements are evaluated by reporting officer and then by reviewing officer.

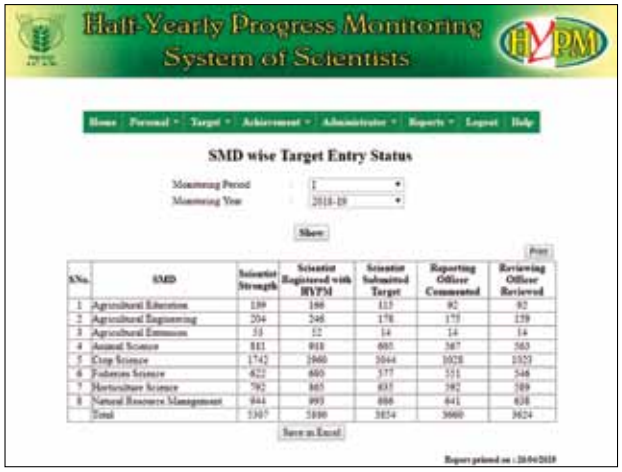


Fig. 4.2: SMD wise Target entry Status of Period-I, 2018-19

In year 2018-19 and for period I (April to September), 73% scientists submitted their targets, out of which 95% were evaluated by reporting officers and 94% were reviewed by their reviewing officers across all ICAR institutes. Approximately 65% scientists submitted their achievements for year 2017-18 and period II (Oct to Mar). Out of them 96% were evaluated by reporting officers and 93% were reviewed by reviewing officers. In year 2018-19 and for period II (Oct to Mar), 73% scientists submitted their target out of which 91% were evaluated by reporting officers and 86% were reviewed by reviewing officers across all ICAR institutes. Approximately 64% scientists submitted their achievements for year 2018-19 and for period I (April to September). Out of them, 93% were evaluated by reporting officers and 89.3% were reviewed by reviewing officers. HYPM website has been visited approximately 63,120 times during April, 01 2018 to March, 31 2019.

- **TMIS:** The Training Management Information System for ICAR has been designed, developed and implemented at ICAR-IASRI data centre. The system is available online at https://hrm.icar.gov.in to cater the needs of all employee categories in ICAR and facilitates the complete training process without any manual intervention. Some of the main features of TMIS are online training data management, reporting and decision support for RMPs. It is responsible for the management of information related to trainings sponsored by the HRM Unit of ICAR It is operational in all the ICAR institutes (Fig. 4.3).

Fig. 4.3: Homepage of Training Management Information System for ICAR

IASRI Website: The website of the institute has been redesigned, revamped and redeveloped on a new open source platform. It follows the Guidelines for Indian Government Websites. The open source technologies such as Wordpress, PHP and MySQL have been used for the development new website. Many new features and information have been added into the site to make it more comprehensive and informative. The overall look and feel of the website

has been enhanced and more images and pictures have been used rather than text for depicting the content. The site is available in both English and Hindi languages. The site has been hosted on a new and more secure domain: https://iasri.icar.gov.in/. It can also be accessed by clicking on the old website domain. The website was launched by DDG (Fisheries Science) Dr. J.K. Jena in the Annual Day function of the institute held on 4th July 2018 (Fig. 4.4).

Fig. 4.4: ICAR-IASRI new website launched by DDG (Fisheries Science) Dr. J.K. Jena in the Annual Day function of the institute held on 4th July 2018

The new features added in the site are: Separate Divisional Interface for each division including the About Us, Mandate, Thrust Areas, Projects, Publications, Trainings and Staff Information. Further, the divisional staff information constitutes of individual photographs and complete profile pages of Scientists (Fig. 4.5). The profile page of scientific staff constitutes of his/her projects, publications and awards. There is a statistical hub, information hub and e-governance corner on the website, under which links to all the statistical systems, information systems and the systems developed by ICAR-IASRI for e-governance in ICAR have been enlisted. A separate corner has been kept for institute employees having all daily resources such as the Antivirus, Calender, WebMail and Telephone Directory. A separate News and Events corner for providing the information about important events held and the events going to be organized by the institute are listed and linked with their image gallery. In addition to these features, the Social Media, Screen font size management and Screen access reader options are also provided.

Fig. 4.5: Homepage of ICAR-IASRI New website

VIS*Ta* (Variety Identification System of *Triticum aestivum*): Developed world's first of its kind model web server for crop variety identification using >350 Indian wheat varieties and Axiom 35K SNP chip data. VIS*Ta* (Variety Identifcation System of *Triticum aestivum*) (http://webtom.cabgrid. res.in/vista) tool searches in all the 368 varieties across all the 54 SNPs to find the related varieties with similarity frequencies of each. User can also compare these varieties with 36 DUS features as well as 54 SNPs by checking the box. These tools can be of greater relevance for wheat breeders for *in silico* and rapid identification of varieties based on DUS features and SNPs. The full information of the related varieties can be viewed by putting the cursor on the graphical view. Data/ query can be uploaded and submitted in .txt or .xls format or as QR code image in .jpeg format using PC, tablet or mobile device. This tool can be used in DUS testing having dispute resolution of sovereignty and access benefit sharing (ABS) issues. This model approach can be used in other crops with pan-global level management of crop germplasm in endeavour of crop productivity (Fig. 4.6).

Fig. 4.6: Homepage of **VIS*Ta* (Variety Identification System of *Triticum aestivum* web server**

- **VIS*Ta* Mobile App:** In the era of digital communication, using handheld communication devices, the developed VIS*Ta* mobile App can further popularize the above approach of VIS*Ta*

Fig. 4.7: Homepage of VIS*Ta* Mobile App

web server having huge data of SNP array and varietal signature for remote accessibility and rapid use (Fig. 4.7). It is available at google play store: https://play.google.com/store/apps/details?id=incabin.res.cabgrid.vistaapp1

- **TamiRPred (Species specific putative miRNA and its target prediction tool in wheat (*Triticum aestivum* L.)):** MicroRNA are 20–24 nt, non-coding, single stranded molecule regulating traits and stress response. Tissue and time specific expression limits its detection, thus is major challenge in their discovery. Wheat has limited 119 miRNAs in MiRBase due to limitation of conservation based methodology where old and new miRNA genes gets excluded. This is due to origin of hexaploid wheat by three successive hybridization, older AA, BB and younger DD subgenome. Species specific miRNA prediction (SMIRP concept) based on 152 thermodynamic features of training dataset using support vector machine learning approach has improved prediction accuracy to 97.7%. This has been implemented in TamiRPred (http://webtom.cabgrid.res.in/tamirpred). This tool can accelerate miRNA polymorphism discovery to be used in wheat trait improvement. Since it predicts chromosome-wise miRNA genes with their respective physical location thus can be transferred using linked SSR markers. This prediction approach can be used as model even in other polyploid crops.

Fig. 4.8: TamiRPred tool

- **PolyMorphPredict:** A universal web-tool for rapid polymorphic microsatellite marker discovery from whole genome and transcriptome data *PolyMorphPredict* has been developed using Perl, R, Java and launched at Apache, which is available at http://webtom.cabgrid.res.in/polypred/. It mines microsatellite loci and computes primers from genome/transcriptome data of any species. It can perform e-PCR using published primers for polymorphism discovery and across species transferability of microsatellite loci. Present tool has been evaluated using five species of different genome size having 21 genotypes. Though server is equipped with genomic data of three species for test run with gel simulation, but can be used for any species. Further, polymorphism predictability has been validated using *in silico* and *in vitro* PCR of four rice genotypes. This tool can accelerate the *in*

Fig. 4.9: Homepage of PolyMorphPredict

silico microsatellite polymorphism discovery in re-sequencing projects of any species of plant and animal for their diversity estimation along with variety/breed identification, population structure, MAS, QTL and gene discovery, traceability, parentage testing, fungal diagnostics and genome finishing (Fig. 4.9).

- ***SCMVTDb*:** Small Cardamom Mosaic Virus Transcriptome Database has been developed which is based on "three-tier architecture" consisting of client tier, middle tier and database tier and available freely for non-commercial use at http://webtom.cabgrid.res.in/scmvtdb. In client tier, web pages have been developed using HTML and Javascript for user queries and browsing. In middle tier, scripting has been done using PHP for database connectivity, performing query and fetching data. Database tier has been developed using MySQL for storing information of DEGs, putative molecular markers (SSRs, SNPs and InDels) along with primers, blast results, transcription factors and KEGG pathways. It catalogues 123338 transcripts from control and mosaic virus infected samples assembly, 5317 differential expressed genes with blast results, >20 thousand genic region putative markers from control and mosaic virus infected samples, respectively. Also 2267 transcriptional factors, 1219 domains and 807 families were found in DEGs along with pathways. This resource can be used further in germplasm improvement especially against mosaic disease in the endeavour of productivity of this spice (Fig. 4.10).

Fig. 4.10: Homepage of SCMVTDb

- ***BPDRTDb*:** Black Pepper Drought Transcriptome Database (*BPDRTDb)* is based on *three-tier architecture* and available at http://webtom.cabgrid.res.in/bpdrtdb/. The top most level *i.e.*, client tier is user interface for which web pages were developed using HTML (Hypertext markup language) and Javascript for defining the queries and browsing. In middle tier or logical tier, PHP (Hypertext Pre-processor) language has been used for writing codes for server side for process, fetching data, defining queries and create and maintain database connectivity. The last tier, *i.e.,* database tier was developed using MySQL where the information was stored and retrieved from the database for storing various data in the form of tables such as contigs id, sequence, length, assembly, blast result file, DEGs, expression values, markers like SSRs, SNPs, INDELs, transcription factors, pathways. It also provides provision for users to blast transcript ids against NCBI non- redundant database. *BPDRTDb* catalogues 114598 transcripts, 4914 differential expressed genes, a total of 20124 putative markers, 14742 primers and 259236 variants which contains 246458 and 12778 SNPs and Indels, respectively identified from *de novo* assembly. A total of 2110 transcriptional factors, 786 domains and 1137 families are also catalogued in this resource. The developed genomic resource of analysed drought transcriptome of black pepper can be used for gene and QTL mapping studies, diversity studies and variety management in endeavour of black pepper germplasm improvement (Fig. 4.11).

Fig. 4.11: Homepage of BPDRTDb

- **funbarRF**: DNA barcode based identification of fungal species (http://cabgrid.res.in:8080/funbarrf/) has been developed. Identification of unknown fungal species aids to the conservation of fungal diversity. As many fungal species cannot be cultured, morphological identification of those

species is almost impossible. But, DNA barcoding technique can be employed for identification of such species. For fungal taxonomy prediction, the ITS (internal transcribed spacer) region of rDNA (ribosomal DNA) is used as barcode. Though the computational prediction of fungal species has become feasible with the availability of huge volume of barcode sequences in public domain, prediction of fungal species is challenging due to high degree of variability among ITS regions within species. In funbarRF, A Random Forest (RF)-based predictor was built for identification of unknown fungal species (Fig. 4.12).

Fig. 4.12: Homepage of funbarRF

- **CbLncRNAdb:** Cluster Bean LncRNA database is an online portal useful to retrieve long non-coding RNA sequences (lncRNAs) of cluster bean based on their physical properties like length, expression value, coding potential index, Open Reading Frames (ORFs) and number of exons. [http://cabgrid.res.in/cblncrnadb]. Long non coding RNAs (lncRNAs) are a class of non protein coding RNAs that play a crucial role in most of the biological activities like nodule metabolism, flowering time and male sterility. Quite often, the function of lncRNAs is species-specific in nature. Thus, an attempt has been made in cluster bean (*Cyamopsis tetragonoloba*) for the first time to computationally identify lncRNAs based on a proposed index and study their interactions with miRNAs. Further, the targeted genes of lncRNAs were identified and characterized for their role in various biological processes. Besides, lncRNAs and miRNAs bearing Simple Sequence Repeat (SSR) were identified that contribute towards biogenesis of small non-coding RNAs. Moreover, five novel endogenous Target Mimic (eTM) lncRNAs were identified from the interaction between putative lncRNAs and miRNAs. The predicted lncRNAs are found to involve in regulating various stress mechanisms, DNA damage repair and cell wall synthesis (Fig. 4.13).

Fig. 4.13: Homepage of Cluster Bean LncRNA database

- **MODII:** MOlecular Database on Indian Insects (MODII) is an online database linking several databases like Insect Pest Info, Insect Barcode Information System (IBIn), Insect Whole Genome sequence, Other Genomic Resources. This database was developed with a holistic approach for collecting information about phenomic and genomic information of agriculturally important insects. It is available at http://cib.res.in/.
- **FisOmics:** FisOmics, a portal of fish genomic resource, acts as a platform for sharing fish genomic sequences and related information in addition to facilitating the access of high-performance computational resources for genome and proteome data analyses. It provides the ability for quarrying, analyzing and visualizing genomic sequences and related information. It is available at URL: http://mail.nbfgr.res.in/FisOmics/.
- **RiceMetaSysB:** RiceMetaSysB is a database of blast and bacterial blight responsive genes in rice and its utilization in identifying key blast-resistant WRKY genes. It is available at URL: http://14.139.229.201/ricemetasysb/ .
- **TAGPT:** A web server for prediction of Trait Associated Genes using Gene Expression Data TAGPT has been developed. It is an user friendly web server which provides the list of predicted genes related to a specific trait with their expression value along with their evaluation measures (sensitivity, specificity, classification accuracy, etc.)

- **GSAQ:** Based on statistical approach called Gene Set Analysis with QTLs (GSAQ), an R package, i.e., GSAQ has been developed. The GSAQ approach provides a valuable platform for integrating the gene expression data with genetically rich QTL data. It is available at URL: https://cran.r-project.org/web/ packages/GSAQ
- **BootMRMR:** An R Package named Bootstrap-MRMR Technique for Informative Gene Selection BootMRMR has been developed. This package selects informative features like genes, transcripts, RNA seq, etc. using Bootstrap Maximum Relevance and Minimum Redundancy technique from a given high dimensional genomic dataset. Informative gene selection involves identification of relevant genes and removal of redundant genes as much as possible from a large gene space. Main applications are in high-dimensional expression data analysis (e.g. microarray data, NGS expression data and other genomics and proteomics applications). It is available at https://cran.r-project.org/web/ packages/BootMRMR.
- **An Ensemble Based Clustering Approach for Metagenomics Data:** A new methodology has been developed for binning of metagenomics data using correspondence analysis for dimensionality reduction and ensemble based clustering approach. Various codes for this methodology have been developed using PHP programming language and R software package.
- A web resource (Fig. 4.14) on "Incomplete block designs for incomplete two-factor factorial experiments" has been made available on Design Resources Server at http://iasri.res.in/design/IFE/IFE.htm. The web resource gives catalogue of efficient incomplete block designs for two-factor incomplete factorial experiments. Treatment combinations are denoted as *ij, i* = 0,1,...,*p*; *j* = 0,1,...,*q*. Here, treatment combination 00 is eliminated from the treatment structure. A denotes first factor-alone treatment combinations and B denotes second factor-alone treatment combinations and D denotes treatment combinations where both first and second factors are at non-zero level. Two lower bounds of the designs are also given. Lower bound 1 is obtained following Gerami, A. and Lewis, S. (1992). [Gerami and Lewis (1992)]. Comparing dual with single treatments in block designs. *Biometrika*, pages 603–610.] Here, E_1 denote efficiency of the concerned design computed using lower bound 1 and E_2 denote efficiency of the concerned design computed using lower bound 2. The notations *b* and *k* denote number of blocks and block size, respectively. In the layout of designs, block contents are arranged in rows.

Fig. 4.14: Web resource on incomplete block designs for incomplete two-factor factorial experiments

- A web resource on "Nearly balanced treatment incomplete block designs" has been made available on Design Resources Server at http://iasri.res.in/design/nbtib/NBTIB.htm. (Fig. 4.15).

Fig. 4.15: Web resource on nearly balanced treatment incomplete block designs

- A web resource on "Nearly balanced bipartite block designs" has been made available on Design Resources Server at http://iasri.res.in/design/nbbpb/NBBPB.htm. (Fig. 4.16).

Fig. 4.16: Web resource on nearly balanced bipartite block designs

- The software AICRP on Integrated Farming Systems - On-farm Farming Systems Research: Online data submission and analysis, developed jointly by ICAR-IASRI and ICAR-IIFSR and its user manual were released on 21st December 2018 by Honourable Chief Guest Dr. S. Rajendra Prasad, Vice Chancellor (UAS-Bengaluru) and other dignitaries in the V Biennial Workshop of AICRP on IFS organized at University of Agricultural Sciences, GKVK Campus, Bengaluru during 20-22 December, 2018.
- Unit level repository of AICRP-FIM, ICAR Technology repository and ICAR video gallery developed under KRISHI project team were released by Secretary, DARE and DG, ICAR Dr. T. Mohapatra, DDG (Ag. Engg.) Dr. K. Alagusundaram, DDG (Ag. Edn.) Dr. N. S. Rathore, ADG (NRM) Dr. S. K. Chaudhari in the presence of other dignitaries and participants during Third National Workshop of Officer Incharge, Data Management (ICAR Research Data Repository for Knowledge Management during December 04-05, 2018 at NASC and ICAR-IASRI, New Delhi.
- A web application has been developed for online generation of Orthogonal and nested orthogonal Latin hypercube Designs comprising of four different modules, (i) 1st order OLH design (ii) 2nd order OLH design (iii) Nested OLH design and (iv) OLH design with good space filling property. The application has been developed using JSP language and STS (Java) platform.

5

Education and Training

The Institute conducts post graduate teaching and in-service courses in Agricultural Statistics, Computer Application and Bioinformatics for human resource development. Institute is conducting M.Sc. and Ph.D. programmes in Agricultural Statistics since 1964, M.Sc. in Computer Application since 1985-86, Ph.D. in Computer Application since 2013-14, M.Sc. in Bioinformatics since 2011-12 and Ph.D. in Bioinformatics since 2014-15. A brief description of human resource development during the year is given subsequently.

DEGREE COURSES

The Institute continued to conduct the following degree courses in collaboration with the Post Graduate School of Indian Agricultural Research Institute (IARI), New Delhi which has the status of a Deemed University:

1. Ph.D. (Agricultural Statistics)
2. M.Sc. (Agricultural Statistics)
3. Ph.D. (Computer Application)
4. M.Sc. (Computer Application)
5. Ph.D. (Bioinformatics)
6. M.Sc. (Bioinformatics)

Both Ph.D. and M.Sc. students are required to study courses not only in Agricultural Statistics but also in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics, etc. The Courses in Mathematics, Agricultural Statistics, Computer Application and most of Bioinformatics, are offered at this Institute while the courses in Agricultural Sciences are offered at ICAR-IARI.

Number of students admitted / completed various courses during the period under report are:

S. No.	Course	No. of Students	
		Admitted	Passed Out
1	Ph.D. (Agricultural Statistics)	05	03
2	M.Sc. (Agricultural Statistics)	07	07
3	Ph.D. (Computer Application)	05	00
4	M.Sc. (Computer Application)	06	04
5	Ph.D. (Bioinformatics)	03	01
6	M.Sc. (Bioinformatics)	04	03

FACULTY MEMBERS OF P.G. SCHOOL, IARI IN AGRICULTURAL STATISTICS

S. No.	Name	Year of Induction
1.	Dr. Lal Mohan Bhar, Director (A) (since 22.01.18)	1998
2.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	1995
3.	Dr. Anil Rai, Principal Scientist	1995
4.	Dr. K.N. Singh, Principal Scientist	2011
5.	Dr. Tauqueer Ahmad, Principal Scientist	1998
6.	Dr. Rajender Parsad, Principal Scientist	1995

7.	Dr. Amrit Kumar Paul, Principal Scientist	1998
8.	Dr. A.R. Rao, Principal Scientist	1998
9.	Dr. Girish Kumar Jha, Principal Scientist (at IARI)	1999-2005; 2006
10.	Dr. Cini Varghese, Principal Scientist	2000
11.	Dr. Himadri Ghosh, Principal Scientist	2004
12.	Dr. Ajit, Principal Scientist	2015
13.	Dr. Anil Kumar, Principal Scientist	2010
14.	Dr. Prawin Arya, Principal Scientist	2003
15.	Dr. Hukum Chandra, National Fellow	2003
16.	Dr. Prachi Misra Sahoo, Principal Scientist	2002
17.	Dr. V. Ramasubramanian, Principal Scientist	1999-2013; 2017
18.	Dr. Amrender Kumar, Principal Scientist (at IARI)	2003
19.	Dr. Md. Wasi Alam, Senior Scientist	2003
20.	Dr. Ranjit Kumar Paul, Scientist	2011
21.	Dr. Mir Asif Iqubal, Senior Scientist	2011
22.	Dr. B.N. Mandal, Scientist	2011
23.	Dr. Susheel Kumar Sarkar, Scientist	2011
24.	Dr. Kaustav Aditya, Scientist	2012
25.	Dr. Sukanta Dash, Scientist	2013
26.	Dr. Arpan Bhowmik, Scientist	2014
27.	Dr. Ankur Biswas, Scientist	2015
28.	Dr. Anindita Datta, Scientist	2017
29.	Dr. Soumen Pal, Scientist	2017
30.	Dr. Sarika, Senior Scientist	2018
31.	Mr. Deepak Singh, Scientist	2018
32.	Dr. Achal Lama, Scientist	2018
33.	Dr. Pradip Basak, Scientist	2018
34.	Dr. Mrinmoy Ray, Scientist	2018

FACULTY MEMBERS OF P.G. SCHOOL, IARI IN COMPUTER APPLICATION

S. No.	Name	Year of Induction
1.	Dr. Sudeep Marwaha, Head & Professor (Computer Application)	2002
2.	Dr. Rajni Jain, Principal Scientist (at NIAP)	2007
3.	Dr. Alka Arora, Principal Scientist	2001
4.	Dr. Anu Sharma, Senior Scientist	2004
5.	Dr. Shashi Dahiya, Senior Scientist	2001
6.	Md. Samir Farooqi, Scientist	2001
7.	Dr. K.K.Chaturvedi, Senior Scientist	2002
8.	Dr. S.B. Lal, Senior Scientist	2004
9.	Dr. Anshu Bhardwaj, Principal Scientist	2004
10.	Dr. Sangeeta Ahuja, Scientist	2002
11.	Sh. Pal Singh, Scientist	2010
12.	Dr. Mukesh Kumar, Principal Scientist	2014
13.	Dr. A.K. Mishra, Principal Scientist (at IARI)	2014
14.	Ms. Shaloo, Scientist (at WTC, IARI)	2016
15.	Sh. S,N. Islam, Scientist	2018

FACULTY MEMBERS OF P.G. SCHOOL, IARI IN BIOINFORMATICS

S. No.	Name	Year of Induction
1.	Dr. A.R. Rao, Professor (Bioinformatics)	2010
2.	Dr. Anil Rai, Head (CABin)	2010
3.	Dr. Rajender Parsad, Principal Scientist	2010
4.	Dr. Seema Jaggi, Principal Scientist	2010
5.	Dr. S.S. Marla, Principal Scientist	2010

6.	Dr. Sudeep Marwaha, Principal Scientist	2010
7.	Dr. Kishore Gaikwad, Principal Scientist (at NRCPB)	2010
8.	Dr. P.K. Singh, Principal Scientist (at IARI)	2010
9.	Dr. A.K. Mishra, Principal Scientist (at IARI)	2010
10.	Dr. U.B. Angadi, Principal Scientist	2014
11.	Dr. S.B. Lal, Senior Scientist	2010
12.	Mohd. Samir Farooqi, Scientist	2010
13.	Dr. Anu Sharma, Senior Scientist	2010
14.	Dr. Sunil Archak, Senior Scientist	2010
15.	Dr. D.C. Mishra, Scientist	2010
16.	Dr. Sarika, Senior Scientist	2010
17.	Sh. Sanjeev Kumar, Scientist	2010
18.	Dr. Mir Asif Iquebal, Senior Scientist	2013
19.	Dr. Monendra Grover, Principal Scientist	2013
20.	Dr. K.K. Chaturvedi, Senior Scientist	2014
21.	Dr. M.G. Mallikarjuna, Scientist (at IARI)	2017
22.	Dr. Yasin Jeshma K., Scientist (at NBPGR)	2018

DISSERTATIONS APPROVED

Ph.D. (Agricultural Statistics)
Name: Raju Kumar
Guide: Dr. Lal Mohan Bhar
Roll No. 10093

Title of the Thesis: Outliers in Block Designs for Incomplete Multi-response Experiments

In any experiment, if data on a single response variable are measured from each experimental unit corresponding to the application of a treatment, is known as uni-response experiment and if data on several response variables are measured from an experimental unit corresponding to the application of a treatment, is known as multi-response experiment. In many multi-response experiments, due to constraints on resources and time, it may not be feasible to collect the observations on all the response variables from each experimental unit. As a consequence, the data on a subset of response variables is collected from one subset of units; the data on another subset of response variables is collected from another subset of units. Such experiments are called incomplete multi response experiments. If outlier(s) is/are present in the data set in case of designed experiment, the assumption like normality and homogeneity of error variances and additivity of the experimental effects gets violated. In the present study an attempt has been made to tackle the problem of outlier(s) in block designs for incomplete multi-response experiments. Cook-statistic and AP-statistics for identification of outlier(s) in block designs for incomplete multi-response experiments are developed. Observations from a particular experimental unit have been considered as outliers. Thus, we have taken vectors of outliers for developing the statistics. Developed statistics are illustrated with real experimental data. Tackling of multiple outliers is very difficult owing to the presence of masking. Following the techniques used in linear regression model two methods have been developed in the present study for detecting outliers in incomplete multi-response experiments in presence of masking. One method is based on the eigenvalues of a well defined influence matrix and the other is based conditional Cook-statistic. Both the methods are again illustrated with real experimental data. The problem of outliers in data set can also be tackled by adopting a design that is insensitive to the presence of outliers. In the present study, a robustness criterion has been proposed for block designs for incomplete multi-response experiments for one-way elimination heterogeneity and designs that are robust against the presence of a single outlier vector are identified.

Name: Saurav Guha
Guide: Dr. Hukum Chandra
Roll No. 10544

Title of the Thesis: Use of Calibration Approach in the Estimation of Domain Total in the Presence of Auxiliary Information

In many surveys, sample estimates are required not only for the population parameters but also for the various subgroups or subpopulations which are generally known as domains. For example in a household survey, main aim of the survey is to obtain separate estimates on the basis of income

level, gender or may be the literacy rate of the household etc. The number of units corresponding to a particular domain is random in nature and sometimes very small. One can think of the domain as a stratum when there is availability of perfect sampling frame like in stratified sampling and may proceed to estimate the parameter of interest. But when the number of domains are large and problem of imperfect frame arises as well as high cost is associated with them, then it is practically impossible to single out the domain as a stratum. It is a common practice to incorporate auxiliary information at the estimation stage to improve the precision of the sample estimates. The present study investigates the situations where calibration approach can be used in estimation of domain parameter using two auxiliary variables. It is assumed that complete information is available for one auxiliary variable while information is not available for other auxiliary variable which is highly correlated with the study variable, and the double sampling approach is proposed accordingly. Different conditions like known and unknown domain sizes, positive as well as negative correlation between study and auxiliary variable are considered. Different ratio and regression type estimators for domain as well as population total along with their variance and variance estimator have been developed. The expressions for all the proposed estimators and their variance estimations are derived under simple random sampling without replacement. It is shown, through empirical studies that the proposed estimators perform better than the existing estimators. Further, empirical studies reveal that higher the correlation between the study and the unknown auxiliary variable, greater the precision. It may be noteworthy that proposed estimators outperforms the existing estimators in both synthetic data as well as in the real datasets considered.

Name of Student: Shyamsundar Parui
Chairman: Dr. Rajender Parsad
Roll No. 10582

Title of Thesis: Efficient Designs for Incomplete Factorial Treatment Structure

In many factorial experiments, certain treatment combination(s) need to be excluded from complete factorial treatment structure due to practical considerations. The remaining factorial treatment structure is incomplete. The literature on designing experiments with incomplete factorial treatment structure is limited and concentrated on placebo (no drug or no application of factor) controlled clinical trials for two factors where treatment combination associated with double placebois excluded. In the present investigation, a general procedure has been developed for obtaining A-optimal completely randomized designs for three factors considering all possible sets of treatment contrasts of interest after excluding triple placebo or both double and triple placebo. Catalogues of A-optimal completely randomized design shave been prepared for three factors up to 4 levels and maximum 10 choices of experimental units starting from minimum number required for existence. A-efficient proper block designs have been obtained for two factors with arbitrary number of levels having incomplete factorial treatment structure using replications of treatment combinations of A-optimal completely randomized designs and modifying strongest treatment interchange algorithm. Several new and more efficient designs have been obtained as compared with the designs available in literature. Catalogue with layout of A-efficient designs up to 4 levels and blocks and block size 10 has also been prepared. Lower bound to A-efficiency of non-proper block designs has been derived. A general method of construction of A-efficient non-proper block designs for two factors with one factor at 2levelshas been developed. SAS codes for obtaining designs for all the three situations have been developed.

M.Sc. (Agricultural Statistics)

Name: Sandipan Sarkar
Guide : Dr. Ranjit Kumar Paul
Roll No. 20781

Title of Thesis: Study of Wavelite and Long Memory Time Series Models for Forecasting

Now a day's time-series analysis and forecasting is a burning issue in the area of statistical modelling. In the field of agriculture, spot price forecasting is an important argument for both farming community as well as policy makers. Mainly the agricultural commodity prices are symbolize with a high degree of risk in terms of volatility. Therefore, more rigorous forecast of price volatility is highly essential for budgetary planning and monitoring. In the practical field, mainly for financial time-series data of agricultural commodity has long memory property. Usually Autoregressive fractionally integrated moving average (ARFIMA) model is used to capture the characteristic feature of the long memory time-series. But time-series data consist of signal parts and irregular parts. Due to this irregular part, the forecasting performance of ARFIMA model is reduced significantly. Keeping it in view, in our

study wavelet transformation is used to extract the signal part for modelling the long memory process more precisely. The better performance of wavelet approach is demonstrated using the daily wholesale price data of wheat in Rewari market of Haryana, India. In many situation volatile series exhibits the long memory property in mean model. In this type of situation Generalized autoregressive conditional heteroscedastic (GARCH) model is not a good choice for specification of the time-series model. To capture the volatility and long memory, ARFIMA-GARCH model is fitted to the maximum and modal spot price of mustard in Bhopal market of Madhya Pradesh, India. The residuals of the fitted model have been investigated and no systemic pattern is found, confirming the adequacy of the model. The out-of-sample forecast formulae along with forecast error variance for fitted ARFIMA-GARCH model is derived theoreticallyby recursive use of conditional expectation.A comparative study between usual GARCH and ARFIMA-GARCH has been executed in this study. The predictive performance of the ARFIMA-GARCH model is examined in terms of MAPE and RMSE values.

Name of Student: Jitendra Kumar
Guide: Dr. Seema Jaggi
Roll No. 20782

Title of Thesis: Statistical Designs for Fitting Response Surfaces Incorporating Neighbour Effects

Response Surface Methodology (RSM) approximates the relationship between one or more response variables and a set of experimental variables or factors. In RSM, it is generally assumed that the observations are independent and there is no effect of neighbouring units. But under the situation when the units are placed linearly with no gaps there is high possibility of overlapping or neighbour effects from the adjacent units. So including these effects into the model is of great importance in deciding the precision of the experiment. Further, availability of resources and size of the experiment is important factor in conducting an experiment. As the size increases, cost involved in conducting the experiment increases, thereby decreasing the precision of the experiment. In this study, response surface designs incorporating neighbour effects have been considered. Method of constructing First order rotatable designs with differential neighbour effects (FORDDNE) and second order rotatable designs with differential neighbour effects (SORDDNE) have been developed in smaller number of runs. The methodology for response surface designs with neighbour effects at distance 2 has been developed and a method of constructing FORDDNE at distance 2 has been obtained. The designs developed ensure the constancy of the prediction variance. Relevant SAS macros/codes using PROC IML have been developed to generate the designs and the variance of the estimated response.

Name of student: Garima Singh
Guide: Dr.Baidya Nath Mandal
Roll No. 20783

Title of Thesis: On Block Desins for Comparing Test Treatments with Control(s)

There are many research investigations where the interest of the experimenter is in comparing a set of new treatments called test treatments with one or more established standard treatment(s) known as control treatment(s). Under the presence of one nuisance factor, two popular classes of block designs for comparing test treatments with control treatment(s) namely balanced treatment incomplete block (BTIB) designs and balanced bipartite block (BBPB) designs are used for such situations.

In this investigation, two new classes of block designs namely nearly balanced treatment incomplete block (nearly BTIB) designs and nearly balanced bipartite block (nearly BBPB) designs are introduced for comparing test treatments with a single control treatment and with more than one control treatments, respectively. Necessary parametric conditions for existence of these two classes of block designs are obtained. Two algorithms are proposed to construct nearly BTIB and nearly BBPB designs for given parameters. The algorithms are implemented using R programming language. Nearly BTIB designs are obtained in a restricted parametric range using the first algorithm. In the restricted parametric range, a total of 635 nearly designs are possible and 595 of them are constructed. It was found that 182 nearly BTIB designs have higher A-efficiency compared to BTIB designs of Mandal et al. (2013). Using the second algorithm, nearly BBPB designs are also obtained in a restricted parametric range. In this parametric range, 886 nearly BBPB designs may exist out of which 874 designs are obtained.

Name: Mahalingraya Prakash Changond
Guide: Dr. Tauqueer Ahmad
Roll No. 20784

Title of Thesis: Estimation of Harvest and Post-harvest Losses of Major Crops using Double Sampling Approach

Increasing agricultural production is one aspect of fulfilling food demand and the efficient use of food materials produced and saving them as much as possible is another aspect. Delivering food to the consumers by saving produced commodities from loss in fields, transport, storage, retailing, processing etc. without straining, our fields, water and environment seems much better option. In this study, the methodology for estimation of quantitative harvest and post-harvest losses for major crops agro-climatic zone level and at district level has been provided under stratified two-stage sampling. The double sampling approach under stratified two stage sampling design framework for estimation of harvest and post-harvest losses for major crops has been developed. In the proposed study, samples were selected using stratified two-stage sampling design in two phases i.e., for enquiry and for actual observations from each districts. Here, at the first stage, districts are selected which are considered as PSU's and at the second stage i.e., at the farm household (SSU's) stage, two-phase sampling design is employed where a preliminary sample is selected using SRSWOR to estimate the harvest and post-harvest losses of crops by enquiry and the second phase sample selected using SRSWOR from the already selected preliminary sample for actual observation. The estimates using developed double sampling approach and existing pooling technique approach were obtained through the simulation study. The real data obtained in the large scale National Survey conducted for estimation of quantitative harvest and post-harvest losses of major crops and commodities by ICAR-IASRI in collaboration with ICAR-CIPHET, Ludhiana in 2013-14 has been considered for simulation in this study. The efficiency of the estimator obtained using developed methodology was evaluated with help of simulation study. Estimate of the percentage loss at farm operations at district level and agro-climatic zone level has been obtained from the simulation study. The developed methodology provided estimates of percentage loss, variance and estimate of variance along with percentage bias of the estimates at district level and at agro-climatic zone level and these are compared with the same parameters estimated through existing methodology which are obtained an optimum pooling technique. The percent bias of estimates obtained using the proposed methodology were less than those obtained by existing pooling technique. The estimates obtained using the proposed methodology were found to be more reliable and almost at par with the estimates obtained through pooling technique.

Name: Kapil Choudhary
Guide: Dr. Girish Kumar Jha
Roll No. 20785

Title of Thesis: Study on Empirical Mode Decomposition based Neural Network for Agricultural Price Forecasting

Agricultural price forecasting is one of the challenging areas of time series analysis due to its strong dependence on biological processes. In this study, an ensemble empirical mode decomposition (EEMD) based neural network model is proposed for agricultural price forecasting. For this purpose, the original price series were first decomposed into several independent intrinsic mode functions (IMFs) and one residual component. Then a time-delay neural network (TDNN) with single hidden layer was constructed to forecast these IMFs and residual component individually. Finally, the prediction results of all IMFs including residual are aggregated to formulate an ensemble output for the original price series. Empirical results demonstrated that the proposed EEMD-TDNN model outperforms the TDNN model in terms of root mean square error and directional prediction statistics. Besides, efforts were made to propose an EEMD based hybrid model including TDNN and ARIMA for agricultural price prediction. For this, all IMFs were divided into high frequency, low frequency and trend components using the fine-to-coarse reconstruction method. Further, TDNN is suitable for forecasting the high frequency and trend components and ARIMA is appropriate for predicting the low-frequency components. The prediction results of all the components are aggregated to obtain the final forecasting values of the price series. Empirical results showed that EEMD-TDNN-ARIMA outperformed TDNN but under performed compared to EEMD-TDNN model, mainly due to nonlinear characteristics of low frequency component.

Name: Rohit Kundu
Guide: Dr. Rajender Parsad
Roll No. 20786

Title of Thesis: Response Surface Designs with Four and six Levels

Second order response surface is fitted to find the relationship between the response and the level combination(s) of experimental factors. Most of the designs available in literature for fitting second order response surfaces are for 3-level and 5-level factors. In agricultural sciences, several experiments are conducted with 4- or 6-equispaced level factorial experiments. In the literature, it has been shown that it may not be easy to construct second order rotatable response surface designs with 4- and 6-equispaced level factorial experiments. Therefore nearly rotatable second order response surface designs with 4-equispaced and 6-equispaced levels have been obtained. Methods of construction available in literature for obtaining second order rotatable designs in 4- and 6-level factorial experiments have been modified to get designs with equispaced levels. It has also been shown that it is possible to construct a 4-equispaced level second order rotatable response surface design in 16 factors. The methods given are general in nature and can be used for obtaining designs with any number of factors. In the present investigation, designs up to 6 factors are constructed. Rotatability measure of second order response surface designs with 4-equispaced and 6-equispaced level factorial experiments up to 6 factors have been computed. Catalogues of 4-equispaced and 6-equispaced level designs with minimum number of designs points and/or maximum value of rotatability measure up to 6 factors are also given. Value of rotatability measures of the designs catalogued is more than 0.968, therefore, these designs can be used in practical experimental situations.

Name: Ms. Sayantani Karmakar
Guide: Dr. Prachi Misra Sahoo
Roll No. 20787

Title of Thesis: Soil Health Assessment Using Spatial Statistics

Soil health is one of the key factors for efficient agricultural production system. In this study soil health assessment is done using spatial statistics. For this spatial variability of various soil parameters has been captured. Soil Health Index (SHI) has been developed and optimum sampling distance for sampling soils has been identified. The present study has been conducted using data of Bihar state. Soil samples at 12264 locations spread across 29 districts of Bihar with 11 soil parameters (i.e. pH, Electrical Conductivity, Organic Carbon, Phosphorus, Potassium, Sulphur, Copper, Iron, Manganese, Zinc, Boron) was used for the study. Initially, spatial variability of soil attributes was captured using Inverse Distance Weighing (IDW) and kriging techniques. Different variogram models applied for kriging were compared using Akaike Information Criterion score (AIC). The exponential model was found to be best. Based on Root Mean Square Error (RMSE), Ordinary Kriging was found to be better than IDW. Soil Health Index (SHI) was developed using Principal Component Analysis (PCA) approach for each of the 12264 sampled points. Classified SHI map has been generated based on three classes- low, medium and high indicating good soil health for high index values. The index values were also validated by comparing the yield of rice, wheat and maize, at district level, for which the data was obtained for the year 2016-17. SHI was found to be in accordance with the yield data. The contribution of each of the soil parameters to SHI has been obtained using variance based approach of sensitivity analysis. Potassium (K_2O) was found to be highly sensitive followed by pH, Boron, and Phosphorus (P_2O_5). An optimal sampling distance was identified using Global Moran's I statistic of spatial autocorrelation computed at different sampling interval of 2, 4, 6, 8 and 10 km, which resulted in identification of optimum distance of 6 km, beyond which next soil sample should be collected. Therefore, from this study it can be concluded that Kriging using exponential model performs best for capturing maximum spatial variability of various soil parameters. Soil health index could be efficiently used for assessing soil health and contribution of each parameter can be studied by sensitivity analysis. The optimum distance at which sampling should be done can be obtained by observing the pattern of spatial autocorrelation.

M.Sc. Computer Application

Name: Debdali Chowdhury
Chairperson: Dr. Anshu Bharadwaj
Roll No. 20802

Title: GIS Approach for Mappint the Mega-Environment for Maize in India.

Greater emphasis on future constraints to agricultural production are motivated by the

projections of environmental change. The speed of population, change in climate and environmental has pressurized the crop community to understand the importance of those stresses which may result in the significant declines in yield. Advances in data availability, advance information technology, and new and improved methods to target genotypes to environments have benefited the crop improvement practices. No methodology is found in literature which integrates factors like climate, soil, land cover etc., and can predict the most suitable environment (Area) for growing maize based on its genetic variability for India. Therefore, a methodology is needed which considers the integration of factors like climate, soil, land cover etc., to map the most suitable Mega- Environment for growing maize based on their genetic variability. Mega-environment can be defined as a part, which may not necessarily be contiguous, of growing region of any species of a particular crop, with homogeneous environment which encourages similar genotypes to perform best. The MEs (homogeneous environments of production delineated on the basis of an agro-climatic) are helpful to the crop breeders in managing the genotype-by-environment interactions and then extrapolate the same within similar agro climatic areas. MEs are known to be broad and may not necessarily be contiguous growing areas, which are international and frequently transcontinental, They have similar cropping system requirements, biotic and abiotic stresses, consumer preferences and production volume of the relevant crop, enough to justify attention," for example, "tropical lowland, late-maturing, white dent" corn with relevant disease resistances, which occupies 3.8 million hectares across 18 countries (CIMMYT1, 1989a). Sites suitable as testing sites for the selection of new varieties to be sown with specific and wide adaptability to different environmental conditions can be identified. Over the period of time, the concept of global maize mega-environments (MEs) has been developed a defined by the International Maize and Wheat Improvement Centre (CIMMYT) and its partners. The MEs (homogeneous production environments defined on the basis of agro-climate) help the crop breeders to manage genotype-by-environment interactions and to extrapolate them within similar agro climatic zones (Hartkamp et al., 2000). In this research study, an effort has been made to using GIS to map/ identify mega environment for breeding of maize crop for all over the India.

Nme of student: Vivek Kumar
Guide: Dr. Anu Sharma
Roll No. 20804

Title of Thesis: Development of Web based Tool for Visualization of Genetic Variants

India is an agricultural country. Agricultural plays a significant role in our Indian economy. Agriculture is the main source of livelihood of many people in India and world. Increasing human population requires more land for living as well as for growing food, but one major problem is that land is fixed. Hence, there is a requirement of more food from less land, which is the basic need. To fulfil this need, we have to apply modern methods on crop production. In modern agricultural practices, genetics and plant breeding plays a significant role in increasing the agricultural products. Genetic variations are used to describe the variations present in a DNA sequence of an individual's genome. Individuals belonging to specific species have similar characteristics but they are rarely identical, the difference between them is called variation. Single Nucleotide Polymorphisms (SNPs) pronounced as 'snips', is the most common type of genetic variation amongst individuals genome. Each SNP represents a difference in a single DNA base namely Adenine (A), Thymine (T), Cytosine (C) or Guanine (G) in a person's DNA. On average, they occur once in every 300 bases and are often found between genes in the DNA. Similarly there are many other genetic variants namely Simple Sequence Repeat (SSR), Copy Number Variations (CNV), InDels etc. The identified genetic variants are scattered at different locations in a genome and are also explored in isolation. There is a need to integrate these genetic variants to bring at common platform where they can be easily explored and compared to identify the causes of such variations.

Therefore, there is a need to make an attempt to integrate and provide these genetic variants and its associated information to the end users with easy accessibility in the form of a Web based Tool for Genetic Variants. This tool will help users to access and study genetic variants and its associated information through single window. Hence, a web based tool has been developed for visualization of genetic variants.

Name: Vaijnath Shivlingappa
Chairman: Dr. S.B. Lal
Roll No. 20805

Title of Thesis: Development of Software Prototype for In-Solico copy Number Variation Identification

The biggest challenge facing Indian agriculture is to develop high yielding varieties to feed the vast increasing population of the country. Seed is critical and basic input for attaining high crop yields and sustainable growth in agricultural production. The advances in genome sequencing technologies are helpful in identification of different types of markers which can help in development of high yielding varieties. Single reference genome is not able to provide the representation of genetic diversity in a given species. The diversity can be identified and discovered using the study of structural variation in the form of copy number variants (CNVs) by studying the sequences of different accessions. The CNV will account for complete value of genetic information that is present in individual species. Copy number variation (CNV) plays an important role in identifying the genetic and phenotypic variation in the breeding population. Web based software for identification of CNV has been developed to and will help to perform CNV identification. Development work has been carried out using some technologies like Java Server Pages (JSP), Hyper Text Markup Langauge (HTML), Java script, Cascading Style Sheets (CSS) for front end interface, SQL for backend database and R has been used for integration with JSP to display the results in developed web based interface for CNV identification. The developed interface shows information about Chromosome name, starting position, ending position, size, position of the CNV, depth of the normal sample , depth of the targeted sample and shows the relative Copy Number Ratios (CNRs) between the normal and targeted sample. This CNV information can further be used by researchers for retrieval of CNV information to identify disorder and helpful in developing diagnostic kits and treatments, varietal development and improvement by genome wide association of different cultivars.

Name: Lakshmi Sonkusale
Chairman: Dr. Sangeeta Ahuja
Roll No. 20807

Title of Thesis: Design and Development of Mobile App for Ergonomics Assessment of Drudgery Prone Activities in Agriculture

Agriculture is one of the significant contributors to the Indian economy. For enterprise based agriculture, it is important to utilize the available resources in best possible way. Most of agricultural activities performed by different workers/farmers are done in inappropriate way which can lead to the physical stress of worker's body and many potentially serious problems/harmful. Different researchers and other many scientists have conducted studies to reduce all these problems of workers related to agricultural activities. Manual evaluation involves more efforts, time and sometimes can affect the quality of decisions. Hence, android based mobile app named "Ergon" for Evaluating Agricultural Activities on Ergonomics Protocol is designed and developed to overcome the these limitations that can be faced by some of the evaluators. It helps to evaluate workers, store data, display various reports (based on search criteria of district wise, activity wise, mode of activity wise and gender wise), export data to excel for further analysis, provide authentication to different users that include administrator, internal user (under ICAR-Institutions) and external user.

The 'Ergon' app can be installed on user's mobile or shared on a network. It is developed, tested and validated to insure its functionality as well as reliability. Its interface that is used for the interaction with users was developed by using Java language. The mobile app named 'Ergon' has been developed on Android Studio 3.0.1 and the minimum requirement for the app is a device running on API 16: Android 4.1 (Jelly Bean). Java and XML programming languages are used. Tools used to develop the 'Ergon'app are Android Studio IDE, SQLite, Android Device Monitor, and Firebase Cloud Firestore Beta as a database. The 'Ergon' app has been tested for the various agricultural activities in field and provided the best result form of mean and standard deviation. The developed android app 'Ergon' would be of great use to the farmers/user for reducing drudgery during farm activity. In future, more information can be easily added in the 'Ergon' app like farm equipments, ergonomics protocol that are involved in agricultural activities etc.

Ph.D. (Bioinformatics)

Name: Tanmaya Kumar Sahu
Chairman: Dr. A.R. Rao
Roll No. 10433

Title of Thesis: Computational approaches to understand host pathogen interactions in foot-and-mouth disease (FMD) of cattle

Foot-and-mouth disease (FMD), being an extremely infectious viral disease in wild and domestic cloven-hoofed animals, endangers several livestock populations nurtured in India. FMD adversely affects the socioeconomic status of millions of farmers. Though considerable amount of genomic information related to FMD is available, it has remained as a major threat to the livestock industry world-wide. The high genetic variability in the FMDV genome limits the effectiveness of vaccination. Moreover, traditional vaccine and drug development methods are time consuming. Hence, an intervention of bioinformatics approaches is required to supplement the rapid therapeutics development for FMD infected animals. Among these animals, cattle are highly affected by FMD that contribute substantially to the survival of mankind since several years. Therefore, the present study has been designed to explore the *in silico* aspects of therapeutics development against FMD in cattle. Specifically, the study includes development of a flexible length B-Cell epitope prediction method to supplement FMD therapeutics, computational designing of an effective therapeutic antibody that can address the problem of genetic variability in FMDV, unraveling the role of RNA interference in host-pathogen interaction and development of an information system on FMD of cattle that can assist related research community in controlling FMD in cattle.

The performance of machine learning models like, Random Forest(RF) and Support Vector Machine (SVM) were assessed using the flexible length linear B-Cell epitope datasets encoded with nineteen different amino acid encoding schemes (feature vectors) including a proposed scheme. Out of these nineteen encoding schemes, Amino acid Composition(AC; 20 dimensional feature vector), Distribution component of Composition Transition Distribution(CTDD; 105 dimensional feature vector), Amino acid anchoring Pair Composition(APC; 1200 dimensional feature vector), Codon Degeneracy based Encoding(CDE; 16 dimensional feature vector), Di-Peptide Composition (DC; 400 dimensional feature vector) were combined based on their performance as well as length of the corresponding feature vectors. The combinations namely, AC+CTDD, CDE+CTDD and APC+AC+CTDD with RF model have exhibited high prediction accuracy while using specialized FMDV dataset. Whereas, the combination APC+DC with RF model showed high accuracy while using generalized homogeneous flexible length B-Cell epitope dataset. A similar trend was also observed while APC+DC with RF was compared with existing state-of-art methods for prediction of flexible length B-Cell epitopes while using an independent test set.

As far as, the computational antibody design is concerned, six variants of the monoclonal antibody (mAb) 4C4 were identified with better binding potential than the native one. Amongst the 4C4 variants, the model with mutations at 2096 (N®C), 2098(D®I), 2599(A®G) and 2602(S®Q) positions was found most favorable for interacting with the antigen. Another 4C4 variant having mutations at 2034(N®L), 2096(N®C) 2098(D®Y), 2532(T®K) and 2599(A®G) positions confirmed better binding potential with two genetically variable GH loops of FMDV-VP1 protein than the native ones.

In the context of RNAi mechanism in host pathogen interaction, nine mature host miRNAs were identified to have a total of 284 targets in 98 distinct FMDV genomic sequences. Futher, 14 miRBase miRNAs were found with better target accessibility in FMDV than that of *Bos taurus.* Besides, eight putative targetable regions having sense strand properties of siRNAs were identified on FMDV genes that are highly dissimilar from the host genome. In addition, 21 simulated nucleotide sequences having >90% identity with mature miRNAs were identified to have targets in FMDV accessions.

The **"**Foot and Mouth Disease Information System for Cattle (FMDISC)" has been developed based on the information generated on antibodies, ncRNAs and epitopes related to FMD with user-friendly retrieval system. FMDISC also incorporates a flexible length linear B-Cell epitope prediction server (FlexiBcF), which is especially trained with the experimentally validated B-Cell epitopes related to FMD. The FMDISC is freely accessible at http://bioinformatics.iasri.res.in/fmdisc.

M.Sc. (Bioinformatics)

Name of Student: Ankita Negi
Guide: Dr. Sarika
Roll No. 20797

Title of Thesis: Development of transcriptome based web-genomic resources for drought responsiveness in block pepper

Black pepper (*Piper nigrum* L.) (2n= 52) is a perennial, trailing woody flowering vine belonging to the family *Piperaceae*, also commonly known as white pepper, green pepper, peppercorn, Madagascar pepper. It is known as the "*King of spices*" due to its global trade and widespread dietary, medicinal, and preservative uses. It is cultivated for its fruit, which is dried and used as spice, seasoning food as well as traditional medicine. The pungency of black pepper is due to the chemical *piperine*, an alkaloid present in the fruits and roots of the plant. It is cultivated as a major cash crop in more than 30 tropical countries of the world. Black pepper germplasm is costly and economically important. The crop production in black pepper is affected by both biotic as well as abiotic factors. Drought or water deficit stress is one of the major environmental stresses affecting plants, resulting in reduced productivity and crop losses.

The present study is based on the paired-end reads of control and drought affected leaf transcriptome of black pepper, generated by Illumina Hiseq 2000 technology. The study aims at identification of candidate genes in leaf tissues of black pepper for drought tolerance by its transcriptional profiling, mining of putative molecular markers (SSRs, SNPs and InDel markers) with their primers, transcription factors, pathways etc and cataloguing of these information in the form of web genomic resource, which is otherwise lacking. *De novo* transcriptome assembly was performed using *trinity* assembler. A total of 114598 transcripts, 4914 differential expressed genes, 2110 transcriptional factors, 786 domains and 1137 families, 20124 putative SSR markers and 259236 variants (246458 SNPs and 12778 and Indels) were identified from *de novo* assembly. Leucine-rich repeats (LRR) and ubiquitin-like domain-containing At2g30105, serine threonine protein kinase, Mitogen-activated protein kinase (MAPKKK), NBS-LRR, Myeloblastosis related proteins (MYB), Basic helix-loop-helix (bHLHs) found in this study are reported to be associated with plant tolerance against drought condition. All the information have been catalogued in Black Pepper Drought Transcriptome Database (BPDRTDb) accessible freely for academic use at http://webtom.cabgrid.res.in/bpdrtdb/. All these information can be further be utilized in the implementation of genetic improvement, breeding programmes, mapping population and validation for development of new improved cultivars. The molecular markers can also be valuable genomic resource in endeavour of drought tolerant variety development for higher productivity of black pepper.

Name of Student: Mohan Babu H.S.
Guide: Dr. Sunil Archak
Roll No. 20800

Title of Thesis: Development of Non-B, DNA Database for Rice and Maize

Amongst nucleic acids it has been found that apart from normal canonical form of B-DNA there are many other forms which are biologically functional. Keeping this in mind a database of non-B DNA was created for Rice and Maize. The Chromosome sequences and the gene information was collected from NCBI Database for Rice (*Oryza sativa Japonica Group*) and Maize (*Zea mays*) crops. The seven major non-B forms of DNA i.e., A-DNA, Z-DNA, G-Quadruplex motifs, Inverted Repeats, Direct Repeats, Mirror Repeats and Short Tandem Repeats were predicted in Rice and Maize chromosomes using the non-B DNA motif search tool which is freely available over the internet. The results were used to create the database, using the WAMP framework for Windows operating system. The database Architecture includes three tiers with the clients at the top, web server at the middle and MySQL database at the bottom. Bioperl script with the SeqIO module was used to divide the chromosomal sequences into subsequences while predicting the motifs from the chromosomes of Maize since their size is more than the analysis limit of the motif search algorithm. Window analysis was done to obtain the motifs that might have been missed, at the flanking regions of the subsequences. The interface was created using the client side programming languages HTML (Hypertext markup Language), CSS (Cascading style sheets), and JavaScript. PHP (Hypertext Preprocessor) was used as server side scripting language. MySQL was used as the structured query language to create the General search option to retrieve the motif data and the advanced search option in which user can search by Gene ID, accession number and description of the protein product coded by the gene. With these search options the interface also includes the menu for crop wise and chromosome wise statistics of non-B DNA motifs. The glossary menu includes the definitions for

technical terms used in the project. Link is provided to NCBI Genome Data view to visualize the motif location on the genome. Links are also provided to the User manual, index files of Rice and Maize, tools and resources used in the research project. Since these motifs are involved in critical functions in the cell their study may be important for understanding economically important physiological phenomenons in other crops and animals of agricultural importance so the database can be further extended to meet this objective.

Name: Dipro Sinha
Guide: Md. Samir Farooqui
Roll No. 20887

Title of Thesis: An Ensemble Based Clustering Approach for Metagenomics Data

Metagenomics is the study of microorganisms and a major part of it to reconstructing the genome of different organisms because it is difficult to isolate and clone some organism in *in-vitro*. It is also known as environmental genomics, eco-genomics or community genomics. In order to reassemble the reads obtained from shotgun sequencing, genome assembly plays an important role in this process. The main problem appears in separating and assembling the genomes obtained from different organisms as they are very large in number and also all the genomics reads are jumbled up. The shotgun sequencing resulting genomic reads which contain fragments from different genomes of several microorganisms. So in order to reconstruct them, these reads are needed to be clustered in different bin according to the different microorganism separately. For this, classification of the jumbled genomes from various organism's different clustering techniques are evolved like binning, boosting, bagging, stacking. Among them, nowadays, binning is the most widely used algorithm. In other words genomes are grouped into operational taxonomic units (OTUs) for further taxonomic profiling and down-streaming functional analysis. This OTU clustering is considered as binning. For clustering binning uses several clustering techniques like k-means, k-medoids, Hidden Markov Model (HMM), hierarchical clustering *etc*. But each of these clustering techniques has their own drawbacks. In past, a very few efforts had been seen to apply ensemble based clustering on the metagenomic data for clustering. Here in this research an ensemble based clustering approachP has taken to cluster the metagenome. Different clustering technique like k-means, hierarchical, PAM and DBSCAN is applied on the metagenome. For this R-packages namely Consensus ClusterPlus (for k-means, hierarchical and PAM) and dbscan (for DBSCAN) is used. K-means clustering outperforms other clustering technique, having a rand index 0.7831 by cluster the metagenome in seven bins where hierarchical clustering can only able to generate two bins and DBSCAN and PAM unable to cluster the metagenome. In a population where diversity can be observed by means of abundance, k-means can give a satisfactory result.

AWARDS TO STUDENTS

- Sh. Dipankar Mitra (Agricultural Statistics)
  - Received Nehru Memorial Gold Medal 2018 of ICAR-IASRI for being Best M.Sc. (Agricultural Statistics) Student during the Annual Day of the Institute
- Sh. Asit Kumar Pradhan (Computer Application)
  - Received Nehru Memorial Gold Medal 2018 of ICAR-IASRI for being Best M.Sc. (Computer Application) Student during the Annual Day of the Institute
- Ms. Ritwika Das (Bioinformatics)
  - Received Nehru Memorial Gold Medal 2018 of ICAR-IASRI for being Best M.Sc. (Bioinformatics) Student during the Annual Day of the Institute
- Sh. Kapil Choudhary (Agricultural Statistics)
  - Received ICAR-IARI Medal for M.Sc. (Agricultural Statistics) student during 57th Convocation 2019.

ANNUAL DAY CELEBRATIONS

The Annual Day of the Institute was celebrated on July 4, 2018. Dr. P.S. Dashora, Former Vice Chancellor, University of Kota, Udaipur delivered the Nehru Memorial Lecture. Dr. Joy Krushna Jena, Deputy Director General (Fishery Science), ICAR presided over the function. Dr. G. Venkateshwarlu, Assistant Director General (EQA&R), ICAR was the Guest of Honour.

TEACHER'S DAY CELEBRATIONS

The Teacher's Day was celebrated on 5th September, 2018 in which Dr. S.D. Sharma, Ex-Director Presided over the function and Dr. Prajneshu, Ex-Professor, IASRI was honored on this occasion.

RESEARCH FELLOWSHIPS

During 2018-19, 47 Ph.D. and 35 M.Sc. students received research fellowships. 30 Ph.D. students received IASRI fellowship at the rate of Rs.25,000/- p.m. in addition to Rs 10,000 /- per annum as contingent grant. 05 Ph.D. students received Rajiv Gandhi Fellowship @ Rs.25,000/- P.M. 01 Ph.D. students received DST-Inspire scholarship @ Rs.25,000/-+30% H.R.A. P.M. in addition to Rs.20,000/- per annum as contingent grant. 02 Ph.D. students received ICMR Fellowship @ Rs.25,000- P.M. in addition to Rs.20,000/- P.A. as contingency grant. 04 Ph.D. students are getting UGC Fellowship @Rs.25,000/- and contingency @ Rs.10,000/- per annum. 04 Ph.D. students are getting MANF Fellowship @Rs.25,000/- and contingency @ Rs.10,000/-per annum. 01 PhD. student is getting DBT Fellowship @Rs. 25,000/- and contingency @ Rs.10,000/- per annum. 11 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 12,640/- p.m. in addition to Rs.6000 /- per annum as the contingent grant and 24 M.Sc. students received IASRI fellowship at the rate of Rs.7560/- p.m. in addition to Rs. 6000/- per annum as the contingent grant.

Courses Offered in the academic session 2017-18 (Agricultural Statistics)

Code	Course Title	Credits		Course Instructors
		L	P	
Trimester-III (2017-18)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Sarika, Ajit, Anil Kumar
AS 503	Basic Sampling and Non-parametric Methods	2	1	K.N. Singh, Kaustav Aditya, Ankur Biswas
AS 563	Statistical Inference	4	1	K.N. Singh, Arpan Bhowmik, Pradip Basak
AS 564	Design of Experiments	3	1	Seema Jaggi, B.N. Mandal, Anindita Datta
AS 566	Statistical Genetics	3	1	Lal Mohan Bhar, A.K. Paul, Himadri Shekhar Roy
AS 575	Spatial Statistics	1	1	Prachi Misra Sahoo, Anil Rai
AS 664	Inferential Aspects of Survey Sampling and Analysis of Survey Data	2	1	Tauqueer Ahmad, Hukum Chandra, Pradip Basak
AS 667	Forecasting Techniques	1	1	Amrender Kumar, Bishal Gurung
AS 668	Bayesian Inference in Survey Sampling	1	1	Hukum Chandra, Pradip Basak
AS 691	Seminar	1	0	Prawin Arya
Trimester – I (2018-19)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Susheel Kumar Sarkar, Md. Wasi Alam, Anindita Datta
AS 501	Basic Statistical Methods	2	1	Mir Asif Iquebal, Mrinmoy Ray, Achal Lama
AS 550	Mathematical Methods	4	0	Cini Varghese, Himadri Ghosh, Susheel Kr. Sarkar
AS 560	Probability Theory	2	0	K.N. Singh, V. Ramasubramanian
AS 561	Statistical Methods	2	1	Seema Jaggi, V. Ramasubramanian, Ranjit Kumar Paul
AS 567	Applied Multivariate Analysis	2	1	A.R. Rao, Prabina Kumar Meher
AS 568	Econometrics	2	1	G.K. Jha, Achal Lama
AS 569	Planning of Surveys/ Experiments	2	1	Tauqueer Ahmad, Prachi Misra Sahoo, Ajit
AS 572	Statistical Quality Control	2	0	Md. Wasi Alam, Prawin Arya
AS 600	Advanced Design of Experiments	1	1	Rajender Parsad, Cini Varghese

Code	Course Title	Credits		Course Instructors
		L	P	
AS 601	Advanced Sampling Techniques	1	1	Hukum Chandra, Prachi Misra Sahoo, Pradip Basak
AS 602	Advanced Statistical Genetics	1	1	A.K.Paul, Himadri Shekhar Roy
AS 603	Regression Analysis	1	1	L.M. Bhar, Ranjit Kumar Paul
AS 604	Linear Models	2	0	Rajender Parsad, B.N. Mandal
AS 606	Optimization Techniques	1	1	Amrender Kumar, Harish Kumar H.V.
AS 691	Seminar	1	0	Kaustav Aditya
Trimester – II (2018-19)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Arpan Bhowmik, Kaustav Aditya, Himadri Shekhar Roy
AS 502	Basic Design of Experiments	2	1	Susheel Kr. Sarkar, Sukanta Dash
AS 551	Mathematical Methods in Statistics	4	0	Cini Varghese, Himadri Ghosh Sukanta Dash
AS 562	Advanced Statistical Methods	2	1	Seema Jaggi, Ranjit Kumar Paul, Arpan Bhowmik
AS 565	Sampling Techniques	3	1	Anil Rai, Tauqueer Ahmad, Ankur Biswas
AS 570	Statistical Modeling	2	1	Ranjit Kumar Paul, Achal Lama, Mrinmoy Roy
AS 573	Demography	2	0	Prawin Arya, Wasi Alam
AS 574	Advanced Data Analysis Using Statistical Software	1	2	B.N. Mandal, Rajender Parsad, Hukum Chandra, Ankur Biswas
AS 605	Advanced Statistical Inference	1	1	K.N. Singh, L.M. Bhar
AS 661	Advanced Designs for Single Factor Experiments	2	1	Cini Varghese, B.N. Mandal, Seema Jaggi
AS 663	Advanced Theory of Sample Surveys	2	1	Tauqueer Ahmad, Hukum Chandra, Ankur Biswas
AS 665	Advanced Statistical Methods for Population Genetics	2	1	A.K. Paul, L.M. Bhar
AS 691	Seminar	1	0	V. Ramasubramanian

Course Allotment for the academic session 2017-18 (Computer Application)

Code	Course Title (L + P)	Credits		Instructors
		L	P	
Trimester – III (2017-18)				
CA 503	Statistical Computing in Agriculture	1	2	V. Ramasubramanian, Wasi Alam, Bishal Gurung,
CA 563	Operating System	2	1	A.K. Mishra, Soumen Pal
CA 567	Computer Networks	2	1	Mukesh Kumar, Soumen Pal
CA 571	Modeling and Simulation	2	1	Anshu Bharadwaj, Md. Wasi Alam, Ankur Biswas
CA 576	Theory of Computation	2	0	Soumen Pal

Code	Course Title (L + P)	Credits		Instructors
		L	P	
CA 613	Artificial Neural Networks	2	1	Anshu Bharadwaj, V. Ramasubramanian, Mrinmoy Ray
CA 614	Knowledgebase Systems for Semantic Web	2	1	Sudeep Marwaha
CA 615	Digital Image Processing	2	1	Alka Arora, Anshu Bhardwaj
CA 622	Advances in Data Warehousing	2	1	K.K. Chaturvedi, Samir Farooqi
CA 616	Big Data Analysis	2	1	Anshu Bharadwaj, Shashi Dahiya, S.B. Lal, K.K. Chaturvedi
CA 691	Seminar	1	0	Shashi Dahiya
Trimester I (2018-19)				
CA 502	Introduction to Computer Application	1	1	Ajit, Md. Samir Farooqi
CA 551	Mathematical Foundations in Computer Application	4	0	A.K. Choubey, Sukanta Dash, Sunil Kumar Yadav
CA 552	Computer Oriented Numerical Methods	2	1	Pal Singh, Deepak Singh
CA 560	Computer Organization and Architecture	3	0	Shashi Dahiya, Mukesh Kumar
CA 561/ BI 505	Principles of Computer Programming	2	1	Sudeep Marwaha, S.B. Lal
CA 565	Compiler Construction	2	1	Soumen Pal, A.K. Mishra
CA 569	Web Technologies and Applications (2+1)	2	1	Alka Arora, S.B. Lal
CA 570	Computer Graphics	2	1	Pal Singh, S.N. Islam
CA 575	Artificial Intelligence	2	1	Rajni Jain, Sudeep Marwaha
CA 579	Graph Theory and Application	2	0	Anu Sharma, K.K. Chaturvedi
CA 611	Design and Analysis of Algorithms	2	1	Mukesh Kumar, A.K. Choubey
CA 621	Advances in Data Mining	2	1	Anshu Bharadwaj, Rajni Jain
CA 691	Seminar	1	0	Shashi Dahiya
Trimester II (2018-19)				
CA 501	Computer Fundamentals and Programming	3	2	Ajit, Pal Singh
CA 562	Object Oriented Analysis and Design	2	1	Sudeep Marwaha, Sangeeta Ahuja
CA 564	Data Structures and Algorithms	2	1	A.R. Rao, Shashi Dahiya
CA 566/ BI 507	Data Base Management System	2	2	S.B. Lal, Soumen Pal
CA 568	Software Engineering	2	0	A.K. Choubey
CA 572	GIS and Remote Sensing Techniques	2	1	Anshu Bharadwaj, Prachi Misra Sahoo
CA 573	Data Warehousing	2	1	A.K. Choubey, K.K. Chaturvedi
CA 574	Multimedia and Applications	1	1	Sangeeta Ahuja
CA 577	Data Mining and Soft Computing	2	1	Anshu Bharadwaj, Shashi Dahiya
CA 578	Information Security	2	1	Mukesh Kumar, Samir Farooqi
CA 580	Mobile Application Development	1	1	S.B. Lal, Soumen Pal
CA 612	Fuzzy Sets and Rough Sets	2	1	Rajni Jain, Alka Arora
CA 617	Natural Language Processing	1	1	Anu Sharma
CA 691	Seminar	1	0	S.N. Islam

Course Allotment for the academic session 2017-18 (Bioinformatics)

Code	Course Title (L + P)	Credits		Instructors
		L	P	
Trimester – III (2017-18)				
BI 502	Protein Structure Analysis	2	1	Anil Rai, Sarika
BI 503	Computational Biology	2	1	DC Mishra, M.A. Iquebal, Sanjeev Kumar
BI 504	Evolutionary Biology	2	1	Sunil Archak
BI 612	Quantum Theory and Applications in Biology	2	1	Monendra Grover
BI 633	Biological Data Integration and Quality Control	2	1	AR Rao, KK Chaturvedi
BI 643	Graphics and Visualization of Biological Data	2	1	UB Angadi
BI 651	Recent Advances in Bioinformatics	1	0	Not offered
BI 691	Seminar	1	0	M.A. Iquebal
Trimester I (2018-19)				
BI 501/ MBB 509	Introduction to Bioinformatics	2	1	Mallikarjuna M.G., A.R. Rao,
BI 505/ CA 561	Principles of Computer Programming	2	1	KK Chaturvedi, S.B. Lal
BI509/ BIO601	Nucleic Acids	2	1	
BI 510/ MBB 501	Principles of Biotechnology	4	0	
BI 511 /BIO 501	Basic Biochemistry	4	1	
BI 512	Advanced Programming in Bioinformatics	2	2	Anu Sharma, UB Angadi
BI 513/ GP 500	Elements of Genetics	3	2	
BI 514	Statistical Techniques in Bioinformatics	3	1	Seema Jaggi, Rajender Parsad, D.C. Mishra
BI 601	Genome Assembly and Annotation	1	2	DC Mishra, Sanjeev Kumar
BI 602	Biomolecular Modelling and Simulation	2	1	Anil Rai, Monendra Grover, UB Angadi
BI 611	Metagenomics Data Analysis	2	1	MS Farooqi, Anu Sharma
BI 622	Molecular Dynamics	2	1	Monendra Grover, Anil Rai
BI 613	Parallel Programming and Algorithm Development	2	1	KK Chaturvedi, UB Angadi
BI 614	Biological Network Modelling and Analysis	2	1	Sanjeev Kumar, Prabina Kumar Meher
BI 651	Recent Advances in Bioinformatics	1	0	
BI 691	Seminar	1	0	S.B. Lal
Trimester II (2018-19)				
BI 506	Computational Genomics	3	1	Mir Asif Iquebal, DC Mishra, Sarika, Yasin
BI 507 / CA 566	Database Management System	2	2	S.B. Lal

Code	Course Title (L + P)	Credits		Instructors
		L	P	
BI 508	Computer Applications in Bioinformatics	2	1	KK Chaturvedi, S.B. Lal, Anu Sharma, A.K. Mishra
BI 603	Machine Learning Techniques in Bioinformatics	2	1	Sanjeev Kumar, DC Mishra, V. Ramasubramanian
BI 604	Computational Techniques of Transcriptomics and Metabolomics	1	1	Md. Samir Farooqi, Monendra Grover
BI 632	Peptide Design, Synthesis and Applications	2	1	UB Angadi, Monendra Grover
BI 623	Optimization Techniques in Bioinformatics	2	1	UB Angadi, Himadri Ghosh
BI 624	Genome Wide Association Study	2	1	Sunil Archak, Mallikarjuna M.G., Anil Rai
BI 651	Recent Advances in Bioinformatics	1	0	
BI 691	Seminar	1	0	Md. Samir Farooqi

Board of Studies for Academic Year 2018-19

Agricultural Statistics

1.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	Chairperson
2.	Dr. L.M. Bhar, Director (since 22.01.2018)	Member (Ex-officio)
3.	Dr. K.N. Singh, Head (F&ASM)	Member
4.	Dr. Kaustav Aditya, Scientist	Member
5.	Dr. Arpan Bhowmik, Scientist	Member Secretary
6.	Sh. Amit Saha, Student	Students' Representative

Computer Application

1.	Dr. Sudeep Marwaha, Professor (CA)	Chairman
2.	Dr. L.M. Bhar, Director (since 22.01.2018)	Member (Ex-officio)
3.	Dr. Anshu Bhardwaj, Principal Scientist	Member
4.	Dr. Mukesh Kumar, Principal Scientist	Member
5.	Dr. Shashi Dahiya, Senior Scientist	Member Secretary
6.	Md. Samir Farooqi, Scientist	Member
7.	Md. Ashraful Haque	Students' Representative

Bioinformatics

1.	Dr. A.R. Rao Professor (Bioinformatics)	Chairman
2.	Dr. L.M. Bhar, Director (since 22.01.2018)	Member (Ex-officio)
3.	Dr. Kishore Gaidkwad, Principal Scientist	Member
4.	Dr. K.K. Chaturvedi, Senior Scientist	Member
5.	Dr. (Mrs.) Anu Sharma, Scientist	Member Secretary
6.	Ms. Soumya Sharma	Students' Representative

Central Examination Committee for Academic Year 2018-19

Agricultural Statistics

1.	Dr. L.M. Bhar, Director (since 22.01.2018)
2.	Dr. Seema Jaggi, Professor (Agricultural Statistics)
3.	Dr. Anil Rai, Head, CABin
4.	Dr. K.N. Singh, Head, Statistical Genetics
5.	Dr. Rajender Parsad, Principal Scientist
6.	Dr. Hukum Chandra, National Fellow

Computer Application

1.	Dr. L.M. Bhar, Director (since 22.01.2018)
2.	Dr. Sudeep Marwaha, Professor (Computer Application)
3.	Dr. Alka Arora, Principal Scientist
4.	Dr. Mukesh Kumar, Principal Scientist
5.	Dr. Anshu Bhardwaj, Principal Scientist
6.	Sh. S.N. Islam, Scientist

Bioinformatics

1.	Dr. L.M. Bhar, Director (since 22.01.2018)
2.	Dr. A.R. Rao, Professor (Bioinformatics)
3.	Dr. Anil Rai, Head, CABin
4.	Dr. Sunil Archak, Principal Scientist, ICAR-NBPGR, New Delhi
5.	Sh. Sanjeev Kumar, Scientist

NATIONAL / INTERNATIONAL TRAINING PROGRAMMES

Programmes under Centre of Advanced Faculty Training (CAFT)

Sr. No	Title	Course Coordinators	Period	No. of Participants
1	Recent Trends in Data Analysis and Knowledge Management (CAFT)	Shashi Dahiya Anshu Bharadwaj Soumen Paul	06.09.18 to 26.09.18	15
2	Recent Advances in Agricultural Bioinformatics: Big Data Analysis Perspectives (CAFT)	K.K. Chaturvedi Md. Samir Farooqi	14.11.18 to 04.12.18	14
3	Advances in Designing and Analysis of Agricultural Experiments under the aegis of Centre of Advanced Faculty Training (CAFT)	B.N. Mandal Sukhanta Dash Anil Kumar	06.12.18 to 26.12.18	24
4	Modern Statistical Techniques in Genetics Under the aegis of Agricultural Education Division, ICAR (CAFT)	Himadri Shekhar Roy Ranjit Kumar Paul Amrit Kumar Paul	01.02.19 to 21.02.19	21
5	Recent Advances in Statistical Modeling and Forecasting for Agricultural Data Analysis (CAFT)	K.N. Singh Achal Lama R.S. Shekhawat	23.02.19 to 15.03.19	21

Other Training Programmes:

Sr. No	Title	Course Coordinators	Period	No. of Participants
1	Bioinformatics Tools and Techniques for Genomic Data analysis	Mir Asif Iquebal U.B. Angadi Sarika	11.09.18 to 15.09.18	24
2	Handling of Large Scale Data analysis using R	Hukum Chandra Pradip Basak	08.10.18 to 13.10.18	13
3	Advanced Sampling Techniques with practical examples from NSSO and Health Surveys	Hukum Chandra Deepak Singh	29.10.18 to 03.11.18	09
4	कृषि सर्वेक्षणों के लिए प्रतिदर्श तकनीके एवं प्रतिदर्श ऑकड़ों का सांख्यिकीय विश्लेषण	राजू कुमार दीपक सिंह अंकुर विशवास	22.02.19 to 27.02.19	09
5	Recent Advances in Agricultural Surveys Remote Sensing and GIS Application (International) (AARDO)	Prachi Misra Sahoo Tauqueer Ahmad Ankur Biswas	11.03.19 to 31.03.19	08

Winter School

S. No.	Title	Course Director/ Co-Director	Period	No. of Participants
1	Winter School Training Programme on Recent Advances in Statistical Techniques for Data Analysis and Agriculture Under the aegis of Agricultural Education Division, ICAR	Lal Mohan Bhar Ranjit Kumar Paul Amrit Kumar Paul	10.01.19 to 30.01.19	25

Training Programmes under HRM

Sr. No	Title	Course Coordinator	Period	No. of Participants
1	ICAR–ERP, HRM and HRM-SS Modules	Anshu Bhardwaj S.N.Islam Alka Arora	08.10.18 to 12.10.18	21
2	Experimental Designs and Statistical Data analysis for the Scientific Personnel of NARES under the aegis of HRM unit, ICAR	Seema Jaggi Arpan Bhowmik Anindita Datta	03.01.19 to 16.01.19	16
3	ICAR-ERP Finance Module	Mukesh Kumar Sudeep Marwaha Shashi Dahiya	11.03.19 to 16.03.19	14

Institute Seminar Association activities

The particulars of total seminars held during the year 2018-2019 at our institute are as given below:

New project Proposal	Project completion Seminar	Course Seminar	ORW Seminar	Guest Seminar	Thesis Seminar	Total
3	2	50	25	4	13	97

6

Awards and Recognitions

AWARDS

Rajender Parsad and B. N. Mandal

- Coauthored a paper presented by the student Mr. Shyamsundar Parui who received Dr. M.N. Das Memorial Young Scientist Award 2019 for the paper (cum presentation) in the National Conference on Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere especially in Agriculture held at Tirupati during January 29-31, 2019.

Seema Jaggi

- Panjabrao Deshmukh Outstanding Woman Scientist Award-2017 of ICAR during the Foundation Day of ICAR held at NASC New Delhi on July 16, 2018.
- Elected as Fellow, National Academy of Agricultural Sciences with effect from January 1, 2018. Received the award on June 5, 2018 during the Foundation Day and Annual General Body Meeting of NAAS at NASC Complex held during June 4-5, 2018.

A.R.Rao

- Best Teacher Award in Agricultural Higher Education 2018-19 from ICAR-IARI, New Delhi. Received the award from the Union Minister of Agriculture & Farmers Welfare, India on 8th February 2019. The award carried cash prize of Rs. 50,000/- and a certificate.

- Fellow of Indian Society of Agricultural Statistics – 2018 from the Secretary DARE & DG, ICAR at ICAR-CIAE, Bhopal on 14th December 2018.

Hukum Chandra

- Recognition Award for outstanding contributions in the field of Social Sciences for the Biennium 2017-2018 from the National Academy of Agricultural Sciences, New Delhi. The award

was conferred by Shri Radha Mohan Singh, Honorable Union Minister of Agriculture & Farmers' Welfare, and Shri Gajendra Singh Shekhawat, Honorable Union Minister of State for Agriculture & Farmers' Welfare Govt. of India, on February 20, 2019.

- Fellow of Indian Society of Agricultural Statistics; the award was conferred by Dr. T. Mohapatra, Secretary, DARE & DG, ICAR at ICAR-CIAE, Bhopal on December 13, 2018.
- Co-authored the paper by Dr. Sadikul Islam which fetched Dr. G.R. Seth Young Scientist Award 2018 to the latter by Indian Society of Agricultural Statistics.

Dr. Hukum Chandra receiving "Recognition Award" of NAAS from Shri Radha Mohan Singh, Union Minister of Agriculture & Farmers' Welfare, and Shri Gajendra Singh Shekhawat, Union Minister of State for Agriculture & Farmers' Welfare, New Delhi, February 20, 2019.

Dr. Hukum Chandra receiving Fellow of Indian Society of Agricultural Statistics from Dr. T. Mohapatra, Secretary, DARE & DG, ICAR, Bhopal, December 13, 2018.

S.N. Islam and Pal Singh

- Received Second prize in Hindi Prashan Manch Pratiyogita in Hindi Pakhawara during September, 2018

Sarika

- National Academy of Agricultural Sciences Associate with effect from January 1 2019.

Ranjit Kumar Paul

- Elected as Fellow, National Academy of Agricultural Sciences with effect from January 1, 2018. Received the award on June 5, 2018 during the Foundation Day and Annual General Body Meeting of NAAS at NASC Complex held during June 4-5, 2018.

Dr. Ranjit Kumar Paul conferred Fellow, National Academy of Agricultural Sciences on June 5, 2018 during the Foundation Day of NAAS at NASC Complex, New Delhi

Sukanta Dash

- Bharat Vikas Award on the occasion of National Seminar on Intellectuals Social Responsibility at Bhubaneswar, Odisha for loyalty, diligence and outstanding performance in the field of Artificial Neural Network and Multivariate Statistics on 1st December 2018.

Arpan Bhowmik

- Young Scientist Award-2018 of Coochbehar Association for Cultivation of Agricultural Science (COBACAS) for contribution in agricultural sciences during the COBACAS 4th National Conference organized jointly by COBACAS and UBKV at College of Agriculture, UBKV, Majhian, Dakshin Dinajpur, West Bengal during 17-18 January, 2019.

Anindita Datta

- Jawaharlal Nehru Award for P.G. Outstanding Doctoral Thesis Research in Agricultural and Allied Sciences 2017 on 16 July, 2018 on ICAR Foundation day at NAS Complex, New Delhi

Best Paper Award

A.K.Paul and Ranjit Kumar Paul

- Best Paper Award for Performance of parametric and Non Parametric Stability Measures, published in the Journal of the Indian Society of Agricultural Statistics, Volume 69, No. 3, December 2015 in the field of Statistical Genetics and Genomics at ICAR-CIAE, Bhopal during 13-15, December, 2018.

A. R. Rao

- Best poster award in XIV Agricultural Science Congress organized by NAAS and ICAR-IARI at NASC Complex, New Delhi during 20-23 February, 2019 for the research paper entitled "Development of bioinformatics tool for analysis of crop DNA fingerprints" jointly written by Kumari, S., Bhat, K.V., Rao, A.R., Mishra, D.C. and Paul, R.K.
- Poster paper on "SNP and SSR analyses of genetic diversity in cluster bean (Cyamopsis tetragonoloba) from RNAseq-data" jointly authored by Sahu, S., Ghosal, S., Gaikwad, K., Kaur, M. and Rao, A.R. was presented in International conference on NextGen Genomics, Biology, Bioinformatics and Technologies (NGBT) in Jaipur, 30th September – 2nd October, 2018. This paper received Gyan scholarship award and Sahu, S. presented the paper.
- Secured 1st position in Oral presentation for the paper "Identification of differentially expressed long non-coding RNAs and their functional role in cluster bean (Cyamopsis tetragonoloba)" jointly written by Sahu, S., Saxena, S., Ghosal, S., Gaikwad, K. and Rao, A.R. in the International Conference on Climate Change, Biodiversity and Sustainable Agriculture organized at AAU, Jorhat, Assam during 13th - 16th, December, 2018. The paper was presented by Sahu, S.

Himadri Ghosh

- Best Paper Award for *Stochastic Volatility Model Fitting using Particle Filter: An Application* in the Journal of the Indian Society of Agricultural Statistics, Volume 68, No.3, December, 2014 in the field of Applied Statistics at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Ramasubramanian V.

- Dr. Anamitra Saha Award for the paper Qureshi, N.W., Krishnan, M., Wani, S.A., Ramasubramanian, V., Sivaramane, N. and Sundaramoorthy, C. (2017) Negative Externalities in Kashmir Lake Fisheries: Transformation in Species Patronage, Use Priorities and Policy, Indian Journal of Agricultural Economics, 72(1), 89-101, awarded by Indian Journal of Agricultural Economics, Mumbai, adjudged as Best among the papers published in the Journal during the year 2017.

Cini Varghese, Seema Jaggi and Rajender Parsad

- Best Paper Award 2014-15 among the papers in the field of Design of Experiments published in Journal of the Indian Society of Agricultural Statistics during the 72nd Annual Conference of the Indian Society of Agricultural Statistics held at ICAR-Central Institute of Agricultural Engineering, Bhopal, MP from December 13-15, 2018.

Sudeep Marwaha and Alka Arora

- Best paper award for the paper "Online Progress Monitoring of Agricultural Scientists: e-initiative" by ISAS at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Ranjit Kumar Paul

- Best poster award in the 10th International Triennial Calcutta Symposium on Probability and statistics held at University of Calcutta, West Bengal during 27-30 December, 2018.

Arpan Bhowmik

- Best Paper Award 2017 among the published papers in Range Management and Agroforestry. The award has been conferred by the Executive council of the Range Management Society of India, Jhansi on 13 December, 2018 in the National Symposium on Forage and Livestock based Technological Innovation for Doubling Farmers' Income held at University of Agricultural Science, Dharwad, Karnataka.

Samarendra Das and A.K. Paul

- Best Paper Award for A Comparative Study of Various Classification Techniques in Multivariate Skew-Normal Data Published in the Journal of the Indian Society of Agricultural Statistics, Volume 69, No.3, December 2015 in the field of Statistical Theory and Methodology at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Deepak Singh

- Received best paper award in the session "Sample surveys and Applications" in 72nd Annual Conference of the ISAS, held at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Raju Kumar

- Received best paper award in the session "Sample surveys and Applications" in 72nd Annual Conference of the ISAS, held at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Vandita Kumari Choudhary

- Received best paper award in the session "Sample surveys and Applications" in 72nd Annual Conference of the ISAS, held at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Neeraj Budhlakoti

- Received Best Paper Award for Geocoris ochropterus Fieber: a potential predator. Best oral presentation award in First International conference on Biological Control: Approaches and Applications, organized at Bengaluru, India from 27-29 September, 2018.

Garima Singh and B N Mandal

- Best paper award in students' session at 72nd Annual Conference of Indian Society of Agricultural Statistics on Statistics, Informatics and Engineering Interventions held at ICAR-Central Institute of Agricultural Engineering, Bhopal, MP during December, 13-15, 2018.

Krishi Vigyan Gaurav (An Honorary Title)

एम. राय, आर.एस.तोमर, वी. रामा सुब्रमणियन एवं के. एन. सिंह (2018).

- एआरआईएमए एएनएन हाइब्रिड मॉडल के उपयोग द्वारा भारत की गन्ना की उपज का पूर्वानुमान। भारतीय कृषि अनुसंधान पत्रिका, 33(2),120–127.

अखिलेश झा, सिनी वर्गीस, सीमा जग्गी, मो. हारून एवं देवेन्द्र कुमार

- आदेशात्मक सहवासी प्रभावों हेतु समाधेय खण्ड अभिकल्पनाएं (2018)। भारतीय कृषि अनुसंधान पत्रिका, 33(2),113–115।

अखिलेश झा, सिनी वर्गीस, सीमा जग्गी, मो. हारून एवं देवेन्द्र कुमार (2018)।

- तीन प्रतिकृतियों वाली असमान खण्ड आकारो में समा धेय आंशिक संतुलित अपूर्ण खण्ड (2), अभिकल्पनाओं की एक नई श्रृखंला। भारतीय कृषि अनुसंधान पत्रिका. 33(3),161–164।

सुमित, सौरव, सिनी वर्गीस, मो. हारून, सीमा जग्गी एवं देवेन्द्र कुमार (2018)।

- संवेदी परीक्षणों मे दो नियत्रंण वाले परीक्षण उत्पादों की तुलना हेतु संतुलित अभिकल्पनाएं। भारतीय कृषि अनुसधान पत्रिका, 33(3),218–220,

बी. एन. मंडल, सुकान्त दाश, अनिल कुमार एवं देवेन्द्रं कुमार (2018)।

- अनुवंशिक अध्ययन के लिए परीक्षण अभिकल्पना का उपयोग, भारतीय कृषि अनुसंधान पत्रिका, 33(2),177–180।

सुकान्त दाश, अनिल कुमार, बी. एन. मंडल, कृष्ण लाल एवं देवेन्द्र कुमार (2018)।

- मिश्रणों का द्वारा परीक्षण। भारतीय कृषि अनुसंधान पत्रिका, 33(2), 181–184

अपर्ण भौमिक, सीमा जग्गी, एल्दो वर्गीस, सुनील कुमार यादव, मो. हारून, सिनी वर्गीस, अनिंदिता दत्ता एवं उदयवीर सिंह (2018)।

- विविधता के स्रोतों के अंतर्गत पशु परीक्षणों के लिए प्रवृति मुक्त अभिकल्पनाएं।
- भारतीय कृषि अनुसन्धान पत्रिका में अनु शर्मा, ज्योतिका भाटी, शशि भूषण लाल, कृष्ण कुमार चतुर्वेदी, मो. समीर फ़ारूक़ी, एवं अनिल राय द्वारा प्रेषित मौलिक शोध पत्र "संगणनात्मक विधियों द्वारा अरहर में माइक्रो–आर. एन. ए. की पहचान एवं उसका विवरण" को भारतीय कृषि अनुसंधान समिति तथा कृषि अनुसंधान संचार केंद्र (ARCC) के द्वारा राष्ट्र भाषा की सेवा करने के लिये कृषि विज्ञानं गौरव, 2018 की मानद उपाधि से अलंकृत किया गया।

- भा.कृ.अनु.प.–भारतीय कृषि सांख्यिकी अनुसंधान संस्थान, पूसा, नई दिल्ली में हिन्दी पखवाड़े के अन्तर्गत आयोजित ''डिजिटल हिन्दी शोध–पत्र प्रस्तुति'' प्रतियोगिता में शशि भूशण लाल, अनु शर्मा, सारिका एवं अनिल राय द्वारा लिखित जीवपूर्वानुमान, वंशावली विश्लेषण और प्राइमर डिज़ाइनिंग के लिये समानान्तरित कार्यप्रवाह नामक शोध–पत्र के लिए तृतीय स्थान प्राप्त किया।
- भा.कृ.अनु.प.–भारतीय कृशि सांख्यिकी अनुसंधान संस्थान, पूसा, नई दिल्ली में 11.09.2018 को हिन्दी पखवाड़े के अन्तर्गत आयोजित ''डिजिटल हिन्दी शोध–पत्र प्रस्तुति'' प्रतियोगिता में द्विजेश चन्द्र मिश्रा, नीरज बुढ़लाकोटी, संजीव कुमार, एस. बी. लाल एवं अनिल राय द्वारा लिखित टी.ए.जी.पी.टी. : जीन एक्सप्रेशन डाटा पर आध ाारित ट्रेट से संबंधित जीन की पहचान के लिए वेब सर्वर नामक शोध–पत्र के लिए प्रथम स्थान प्राप्त किया।

RECOGNITIONS

Lal Mohan Bhar

- Secretary of Indian Society of Agricultural Statistics and organized the 72nd Annual Conference of the society at ICAR-CIAE Bhopal during 13-15 December 2018.
- Convener of National Workshop on Artificial Intelligence in Agriculture: Status and Prospects at NASC complex, New Delhi during 30-31 July, 2018. The workshop was jointly organized by ICAR-IASRI, New Delhi, ICAR-NAARM, Hyderabad and ICAR-IIWM, Bhubaneshwar
- Chairman, Institute Research Committee (IRC) of the institute
- Chairman, Institute Management Committee (IMC) of the institute
- Member, Research Advisory Committee (RAC) of the institute for setting up Institute's specific annual work plan & targets for Agro-Economics research centres unit
- Member, Quinquennial Research Team (QRT) of the institute
- Working as Organizing Secretary of forthcoming 8th International Conference on Agricultural Statistics to be held in New Delhi during 18-21 November, 2019
- Served as Guest of Honour in the Conference on 'Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences during May 23-25, 2018 at Indian Council of Forestry Research and Education (ICFRE), Dehradun.
- Served as the Chief Guest in the Valedictory function of Smart India Hackathon held at Chennai during 3-4 March, 2019.
- Delivered the inaugural speech in one day Workshop on 'Building Evidence in Agriculture: Reviewing data system and way forward' organized in collaboration with International Growth Centre on 15th February 2019 at Hotel Maurya, Patna and also took part in a Panel discussion
- Served as Co-Chairman in the Technical Committee of Direction (TCD) meeting held at TSIRD, Hyderabad, Telangana during 13-14 November 2018, organized by Department of Animal Husbandry, Dairying & Fisheries (DADF), Ministry of Agriculture & Farmers Welfare, Govt. of India
- Attended various meetings and provided technical guidance to various organisations viz. Bureau of Indian Standard, DAC & FW, Ministry of Statistics and Programme Implementation, Institute of Applied Statistics & Development Studies, High Level Coordination Committee of various states etc.
- Chairman, Sansthan Rajbhasha Karyanvayan Samiti.
- Nodal Officer, Nagar Rajbhasha Karyanvayan Samiti
- Chairman, Institute Technological Management Unit (ITMU)
- Chairman, Technical Monitoring Committee (TMC) for improvement of Fishery Statistics, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India
- Chairman, Working Group on Agriculture and Rural Statistics
- Member, Standing Committee of the Conference of Central and State Statistical Organizations (COCSSO), Central Statistical Organization, Ministry of Statistics and Programme implementation, GOI
- Member, Technical Committee for implementing Forecasting of Agricultural Output using, SPACE, Agro-meteorology and land Based Observations (FASAL), National Crop Forecasting Centre, Department of Agriculture. & Cooperation, Ministry of Agriculture, GOI

- Member, High Level Coordination Committee for Improvement of Agricultural Statistics (Karnataka)
- Member, Working Group for Construction of Index Numbers of Area, Production and Yield of Crops, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, New Delhi
- Member, Empowered Committee of the Ministry of Statistics and Programme Implementation, Govt. of India for Awards and Fellowship for Outstanding and Meritorious Research Work in Statistics
- Member, Governing Body, Institute of Applied Statistics & Development Studies (IASDS), Lucknow
- Chairman of Restructuring of Master's and Ph.D. curriculum & Syllabi (BSMA)

Tauqueer Ahmad

- Invited by the National Institute of Statistics and Geography (INEGI), Aguascalientes, Mexico as an Expert for imparting training to the enumerators and officials concerned for field testing of guidelines on measurement of harvest and post-harvest losses of fruits and vegetables, filling up of questionnaires for primary data collection, pre-testing of questionnaires (class room training as well as field training including demonstration of crop cutting experiments for fruits and vegetables) during 9-16 September 2018.
- Invited by the Central Statistical Office (CSO), Lusaka, Zambia as an Expert for imparting training to the enumerators and officials concerned for field testing of guidelines on measurement of harvest and post-harvest losses of meat and milk, filling up of questionnaires for primary data collection, pre-testing of questionnaires (class room training as well as field training) during 23-29 September 2018.
- Expert in Statistics for all five Expert Committees constituted by the Horticulture Division, MoAFW, Govt. of India to review the methodology of area and yield estimation of major spices (black pepper, ginger, chillies, turmeric and garlic).
- Member, Technical Working Group-1 (TWG-1) constituted by the MoAFW, Govt. of India for technical discussion and future direction on implementation of PMFBY including improvement of methodology for crop insurance using new technology with World Bank support.
- Member, Technical Advisory Committee (TAC) constituted by the Credit Division, MoAFW, Govt. of India for participating in meetings for Crop Insurance to be held time to time at Krishi Bhawan, New Delhi.
- External Examiner by Kashmir University, Srinagar for conducting Survey project viva-voce of 210 M.Sc. final year students of Kashmir University, Srinagar, Jammu & Kashmir during 21-24 December 2018.
- Chairman and Convener of the session of Geo-statistics and Remote Sensing during 72nd ISAS Conference at ICAR-CIAE, Bhopal during 13-14 December 2018.
- One of Expert Members of Selection Committee by the Vice Chancellor, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar for conducting interviews for Associate Professor and Assistant Professor, Statistics on 25.03.2018.
- One Expert Members of CSO Award Committee for finalization of awards in a meeting held on 13.06.2018 at Patel Bhawan, New Delhi.
- Co-opted Member, Board of Studies (BOS), Department of Statistics and Operations Research, Aligarh Muslim University (AMU), Aligarh for four years with effect from 01.06.2016.
- Co-opted Member, Faculty of Science, Statute 20(3)(viii) of the Statutes of Aligarh Muslim University (AMU), Aligarh for a period of two years with effect from 03.01.2018.
- Chairperson, Session of Geo-statistics and Remote Sensing during 72nd Annual Conference of Indian Society of Agricultural Statistics at ICAR-CIAE, Bhopal, India, December 13-15, 2018.
- Course Coordinator, for Organizing a three weeks International Training Programme on "Applications of Remote Sensing and GIS in Agricultural Surveys" at ICAR-IASRI during March 11-31, 2019 for participants from African-Asian Rural Development Organization (AARDO) member countries.
- Member, Organizing Committee constituted by Secretary, DARE & Director General, ICAR for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 18-21 November 2019.

- Chairperson, Hall Management Committee of Local Committee constituted by Secretary, DARE & Director General, ICAR for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 18-21 November 2019.
- Chairman, Purchase Advisory Committee (PAC) of the Institute.
- Chairman, Screening Committee for conducting screening for the post of MTS, Office Assistant and Driver etc. on contract basis through third party for different Divisions, Sections and Units of the Institute.
- Chairman, Invitation Committee and member, Management Committee for organization of Annual Day of the Institute.
- Member, Institute Joint Staff Council (IJSC).
- Editor of Agricultural Research Data Book (ARDB) 2018.

Anil Rai

- Chaired a session on "Bioinformatics and data mining" in 72nd Annual Conference of Indian Society of Agricultural Statistics (ISAS) held during December 13-15, 2018.
- Associate Editor of Journal of Indian Society of Agricultural Statistics. New Delhi.
- Scheme Coordinator of "Network Project for Agricultural Bioinformatics and Computational Biology" under Centre for Agricultural Bioinformatics Scheme at IASRI, New Delhi.
- Officer In-charge of the institute Library.
- Chairman of review committee of SSS staff in the institute
- Member of committee related to conducting online UG and PG examination by Education Division of ICAR.
- Member of the tender committee related to conducting All India Examinations for admission in UG and PG in ICAR
- Member of Expert Advisory Committee (EAC) of "Proof of concept proposal for Digital Agricultural Mission in India" from ICPS Programme of DST.
- Member of three member committee for Ph.D. Confirmation of students, JNU New Delhi; attended the meeting on January 14, 2019 at School of Computer Science, JNU, New Delhi
- Membership of committees of other Institutes – IMC, IMTU, etc.
- Member of interview board for selection of scientist in Desert Medicine Research Centre (ICMR), Jodhpur.
- Member of Institute Management Committee of ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi
- Member of DPC of Scientists in ICAR Headquarters
- Member of the Institute Management Committee of ICAR-Indian Institute of Agricultural Biotechnology, Ranchi.
- Member in DPC at as member ICAR-NDRI, Karnal on December 20, 2018 for the promotion of scientists.
- Chairman of interview for selection of RA/SRF/ YP-II in various externally projects of ICAR-IASRI, New Delhi on November 3, 2018
- Nodal officer of institute RFD.

Rajender Parsad

- Member, QRT of ICAR-CRIDA, Hyderabad
- External Expert for Academic Audit for the session 2017-18 of the Department of Statistics, M.D. University, Rohtak.
- Co-Chaired a technical session on e-Governance in agricultural research and restructuring and development of new models of research in NARS during National Consultation on ICT in Agriculture organized at NASC Complex, New Delhi on March 06, 2019.
- Member, Committee constituted to Review the Draft Report on ICT Roadmap of ICAR
- Chief Data Officer, DARE/ICAR for Open Data Initiative of Government of India to function as per National Data Sharing and Accessibility Policy
- Officer Incharge, ITMU and Member Secretary, ITMC
- Chairman, Committee to oversee the quality of the services and food provided by the Vendor in International Training Hostel
- Judge in Debate Competition organized under the awareness programme स्वच्छता ही सेवा 2018 मिशन के तहत संस्थान में दिनांक सितम्बर 15 से अक्तूबर 02, 2018।

- Chairman, Consultancy Processing Cell since 05.08.2013
- Chairman, Works Committee
- Member, Committee constituted for examining the family details and fixing a criteria for service on the basis of compassionate grounds
- Chairman, Committee constituted to decide the services and equipment which can be spared on, including cost of service/unit basis and put the information on the portal.

Seema Jaggi

- Convenor for an invited paper session on Design of Experiments in the 72nd Annual Conference of the Indian Society of Agricultural Statistics organized at ICAR-Central Institute of Agricultural Engineering, Nabi Bagh, Bhopal, MP during December 13-15, 2018
- Co-Chair for a Technical Session on Publication Repository, Data Inventory and Inter-portal Harvester in the Third National Workshop of Officer Incharge, Data Management (ICAR Research Data Repository for Knowledge Management) KRISHI during December 4-5, 2018 organized by ICAR-IASR at NASC, New Delhi.
- Organized a session on Digital Hindi Research Paper Presentation competition held on 11 September, 2018 during Hindi Pakhwada celebration as Chairperson of the Sub-Committee

A.K. Paul

- Worked as acting Head during 13th June to 24th June, 2018.
- Convenor for an invited session "Statistical Geenetics & Genomics" in 72nd national conference of Indian Society of Agricultural Statistics during 13-15 December, 2018 at ICAR-CIAE, Bhopal.
- Chairman for a contributed Paper session "Statistical Genetics" in 72nd national conference of Indian Society of Agricultural Statistics during 13-15 December, 2018 at ICAR-CIAE, Bhopal.
- Chairman of the Committee for the preparation of tender of Civil Engineering work of IASRI and Krishi Niketan.
- Chairman of research work committee to review two years time period of JRF for the SERB funded project entitled "Stochastic differential equation model and their application to agriculture" on 1st June, 2018.
- Member of the Journal Rationalization Committee meeting of the library on 18th June, 2018.
- Chairman of DPC for Scientist Probationer Clearance and also for promotion of AAO and Assistant of the institute
- Chairman in Institutes purchase advisory committee
- Member for conducting the meeting of assessment committee on 11.05.2018 for cases of Technical Personnel holding posts in Category-II under function group "Library/ Information/Documentation Staff" by Director.
- MGMG nodal officer
- President, Seminar association
- Nodal officer for ARS Probationers' training
- Vigilance Officer

A. R. Rao

- Professor (Bioinformatics), Post Graduate School, ICAR-Indian Agricultural Research Institute, New Delhi
- Convener for technical Session on "Application of bioinformatics and statistical tools in genetics" organized under 1st National Genetics Congress held at ICAR-IARI, New Delhi during 14-16 December 2018.
- Convener for the session "Statistical Genetics and Genomics" in the 72nd Annual conference of Indian Society of Agricultural Statistics (ISAS) on "Statistics, Informatics, Engineering Interventions and Business opportunities: A Road-Map to Transform Indian Agriculture towards Prosperity" during December 13-15, 2018.
- Chairman, Presentations and Projection Systems Committee, XIVth Agricultural Science Congress, jointly organized by NAAS and ICAR-IARI at NASC Complex, New Delhi during 20-23 February, 2019
- Member, Broad Subject Matter Area (BSMA) for Biotechnology and Bioinformatics -2018, Education Division, ICAR
- Member, Editorial Board for the Indian Journal of Genetics and Plant Breeding

- Examiner for evaluating Ph.D. Thesis in Bioinformatics, Mangalore University
- Member, Expert Committee for Review & Ranking of R&D proposals submitted under Indo-German Joint Call on "BioHR: Bioinformatics in Health Research" for the year 2017-18, DBT, Government of India.
- Member, Academic Council of ICAR-IARI, New Delhi
- Member, Institute Management Committee (IMC) of ICAR-Central Institute for Cotton Research, Nagpur
- Member, Standing Committee on Faculty & Discipline, PG School, ICAR-IARI, New Delhi.
- Member Expert, Task Force for Theoretical and Computational Biology, Department of Biotechnology, Government of India till 2018.
- Chairman, Specification Committee constituted by ICAR-NBAGR, Karnal.
- DG, ICAR Nominee in Scientist Assessment Committee (DPC of scientists) in the discipline of Computer Application from RGP 7000/- to 8000/- at NIRJAFT, Kolkata on 30th June 2018
- Member, Evaluation Committee to evaluate the proposals received on "ICT Roadmap, ICAR".
- Member, Organizing Committee of 8th ICAS, organized by ICAR-IASRI, ISAS and NAAS, New Delhi.
- Member, Working Group for defining the data requirement for agronomy part for GE crops during confined field trials, Biosafety Support Unit, DBT since July 2016.
- Leading a team of 3-members, constituted by the Council to assist the ADG, National Agricultural Science Fund (NASF), ICAR in augmentation and analysis of resources generated under National Agricultural Science Fund project, ICAR
- Chairman, Purchase Advisory Committee (PAC) till 2018
- Chairman, Management & Operation of ASHOKA HPC at CABin, ICAR-IASRI.
- Chairman, Canteen Committee, ICAR-IASRI, New Delhi
- Chairman, Sub-Committee, Hindi Pakhwara, ICAR-IASRI, New Delhi (14.12.2018)
- Chairman, Technical Bids opening committee for Lekhan Samagri, ICAR-IASRI
- Chairman, Price Bids opening committee for Equipment Purchase other than Computers, ICAR-IASRI
- Member, Course Coordination Committee, CAFT on Modern Statistical Techniques in Genetics (01-21st February 2019)
- Member, Committee on "IASRI Highlights and its importance" (26-09-2018)
- Member, Coordination Committee, Institute Annual Day Function, ICAR-IASRI, New Delhi

Himadri Ghosh

- Member in interview board for selection of candidates for admission to Ph. D. course in the discipline of Agricultural Statistics, Computer Application in Agriculture and Bioinformatics.

Ramasubramanian V.

- Chairman, PAPC, ICAR-IASRI
- Co-Chairman, IASRI Newsletter Preparation Committee
- Chairman, Condemnation committee, ICAR-IASRI
- Member, Assessment Committee for Technical personnel holding posts in Category-II under Functional Group "Library/ Information/ Documentation Staff" on 11.05.2018
- Member Secretary, Committee for preparation of "Request for Proposal (RFP)/Replica/ Migration" with regard to "Server and Indian NARS Statistical Computing Portal"
- Chairman, Committee for GeM (Outsource manpower services) for opening Technical Bids
- Member Secretary, Working Group on Artificial Intelligence and Digital Agriculture (WGAIDA)
- Member in a Committee for reviewing the research work done in two years by one JRF under SERB (DST) funded project "Stochastic differential equation models and their applications to agriculture" at our institute in meetings held on 23.05.2018 and 02.06.2018
- Member in Committee to frame guidelines for providing TA/ DA from Indian Society of Agricultural Statistics fund to those Executive Council Members who cannot manage it from other sources for attending the Annual Conferences of the Society on 12.07.2018

- Acted as one of Members of Selection Board for recruiting one SRF under ICAR project "Studying dynamics of market integration and price transmission of agricultural commodities" at our institute on 10.04.2018.
- Acted as one of Members of Selection Board for recruiting three RAs under ICAR project "Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI component of CHAMAN program under MIDH" and also for recruiting one SRF in another project entitled "Statistical approaches for genome-wide association studies and genomic selection for multiple traits in structured plant and animal population" at our institute on 25.04.2018.
- Acted as External Member in Selection Committee for recruiting RAs/ SRFs for projects "NAHEP funded – National Knowledge Management Centre for Agricultural Education and Research" & "DST funded – ICRISAT Centre of Excellence on Climate Change Research for Plant Protection: Pest and Disease Management for Climate Change Adaption" at AKMU, IARI, New Delhi on 29.06.2018.
- Acted as Member in Selection Board for preparing 'Panels' for IT Professionals (I, II, III, IV, V) for various projects of the institute for which interview was held on 11.07.2018.
- Acted as Member (Outside Expert) in Selection Committee for recruiting one SRF in project entitled "Satellite based value added met product for early warning to farmers" being conducted at ICAR-NCIPM, New Delhi on 10.08.2018.
- Acted as Chairman of Selection Committee for recruitment of Young Professional-II at ICAR-DKMA, New Delhi on 30.11.2018
- As Member, Selection Board, conducted interview for recruitment of 01 RA/ 01 SRF in the externally funded project entitled "Artificial intelligence based mobile app for identification and advisory of maize diseases and insect pests" at our institute on 06.02.2019
- Rapporteur, Technical Sessions in National workshop on "Artificial Intelligence in Agriculture: Status and Prospects" (30-31 July, 2018) held at NASC Complex, New Delhi.
- As Member, Technical Committee, reviewed the papers/ abstracts (total six in number) submitted for presentation in Special Session on ICT Applications in Agriculture and Social Sciences in the AFITA/ WCCA Research Frontiers in Precision Agriculture Conference held at IIT, Mumbai during October 24-26, 2018.
- Convenor for the invited paper session on "Statistical modeling and forecasting" in 72nd Annual Conference of Indian Society of Agricultural Statistics (ISAS) to be held at ICAR-CIAE, Bhopal during December, 13-15, 2018.
- Chairman, Contributed paper session entitled "Artificial Intelligence and Robotics" in 72nd Annual Conference of ISAS to be held at ICAR-CIAE, Bhopal during 13-15 Dec., 2018.
- Member Secretary for Finance Committee & Member, ICAS Secretariat for Eighth International Conference on Agricultural Statistics (ICAS-VIII) to be held in New Delhi during November, 18-21, 2019.
- Faculty Coordinator (along with S.B. Lal) for Fourth year B.Sc.(Ag.) students of Agricultural College and Research Institute (TNAU), Eachangkottai, Thanjavur on 01.10.2018.
- Faculty Coordinator (along with Susheel Kr. Sarkar) for students' visit of College of Agriculture, Ahmednagar on 06.02.2019.
- Participated in "Hindi Dictation and Hindi/ English word meanings" competition under Non-Hindi speaking category on 06.09.2018 conducted as part of Hindi Fortnight and bagged certificate for 'Second place'
- Participated in Debate conducted as part of Swatchch Bharat Mission fortnight on (against) the topic "Swatchata mission is imperative for our country" on 29.09.2018 and bagged first prize within the 'against' group.

Hukum Chandra

- Elected Member, International Statistical Institute, The Netherlands.
- Fellow, National Academy of Agricultural Sciences, India.
- Member, Governing Body of the Institute of Applied Statistics and Development Studies, Lucknow, 2018-2021.
- Expert Member, Expert meeting on improvement of crop statistics under global strategy to improve Agricultural and Rural Statistics organized by FAO of United Nations in Myanmar, December 17-21, 2018.

- Expert Member, Core Group of Experts on Normalization, National Testing Agency, Ministry of Human Resource Development, Government of India, 2018-19.
- Expert Member, Tamil Nadu Household Panel Survey, Madras Institute of Development Studies, Chennai.
- Member, Technical Advisory Committee for the Coverage Evaluation Survey, Ministry of Health and Family Welfare, Govt. of India, New Delhi.
- Expert Member, Convergence Workshop on "Uttar Pradesh Development Report", Lucknow, Uttar Pradesh, July 19, 2018.
- Expert Member, Meeting on Energy Management in Agricultural scheduled, TNAU, Coimbatore, May 02-03, 2018.
- Member Group of Experts, Pooling data from DLHS-4 and AHS, Ministry of Health & Family Welfare, Government of India, 2018-19.
- Expert Member, Advisory Committee on "Assessment of Zero Budget Natural Farming in Andhra Pradesh", Centre for Economic and Social Studies, Hyderabad, 2018.
- Expert Member, Departmental Promotion Committee constituted by ASRB for the assessments of the Scientists in the discipline of Agricultural Statistics at ICAR-CIFRI, Barrackpore, West Bengal, November 15, 2018 and March 26, 2019.
- Reviewer, Engineering and Physical Sciences Research Council, United Kingdom, 2018-19.
- Guest of Honour, inaugural session, National workshop on "Big Data Analysis with R", Rabindranath Tagore University, Bhopal, March 15, 2019.
- Member, Scientific Advisory Committee, International Conference on Emerging Innovations in Statistics & Operations Research 2018. Rohtak, India, December 27-30, 2018.
- Member, Advisory Committee, National Workshop "Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences", Dehradun, India, May 23-25, 2018.
- Member, Organizing Committee constituted by Secretary, DARE & Director General, ICAR for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 18-21 November 2019.
- Member, Scientific Programme Committee constituted by Secretary, DARE & Director General, ICAR for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, India, 18-21 November 2019.
- Member, Scientific Secretariat constituted by Director, for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 18-21 November 2019.
- Member Secretary, Committee constituted by Secretary, DARE & Director General, ICAR for Young Statistician Seminar of the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 22-23 November 2019
- Member, Finance Committee constituted by Secretary, DARE & Director General, ICAR for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, India, 18-21 November 2019.
- Associate Editor, Journal of Statistical Theory and Practice (Springer).
- Associate Editor, Journal of Model Assisted Statistics and Applications, IOS Press.
- Associate Editor, Statistics and Applications.
- Member, Board of Editors, Advancements and Developments in Statistical Science - An International Journal.
- Member Editorial Board, Journal of Safe Agriculture.
- Guest Editor, Special issue on "Survey Methodology and Applications", in honour of Professor J.N.K. Rao on his 80th birthday, Statistics and Applications, 2018.
- Guest Editor, Special issue to felicitate and honour Prof Arun Nigam on his 75th birthday, Statistics and Applications, 2019.
- Convener, invited technical session on "Recent Advances in Analysis of Complex Survey Data", in the 72nd Annual Conference of Indian Society of Agricultural Statistics, Bhopal, India, December 13-15, 2018.
- Invited Speaker, Conference on "Challenges and Technological Solutions for Enrolment & Loss Assessment under Pradhan Mantri Fasal Bima Yojna", Mussoorie, May 18, 2018.
- Invited Speaker, National Workshop on Recent

Advances in Statistical Methods and Applications in Forestry and Environmental Sciences, Dehradun, 22-24 May 2018.

- Invited Speaker, for delivering guest lecture on "Spatial Non-Stationary Generalized Linear Mixed Model for Counts", Department of Mathematics, IIT, Delhi, September 26, 2018.
- Invited Speaker, International Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, December 27-30, 2018.
- Invited Speaker, International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019.
- Invited Speaker, National Conference on "Recent Developments in Statistics and their -Applications to the Society", Ahmednagar, January17-18, 2019.
- Invited Speaker, National Conference on "Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere especially in Agriculture", Tirupati, January 29-31, 2019.
- Invited Speaker, workshop on "Statistical Computing Using R Software in the National workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences, Dehradun, 22-24 May 2018.
- Invited Speaker, Institute of Valuer, New Delhi, May 15, 2018.
- Invited Speaker, Workshop on "Small Area Estimation Techniques and its Applications", Eastern Africa Statistical Training Centre, Dar Es. Salaam, Tanzania, December 03-07, 2018.
- Invited Speaker, Workshop on "Applications of Spatio-Temporal models", University of Hyderabad, Hyderabad, January 31 to February 01, 2019.
- Invited Speaker, workshop on "Statistical Computing Using R", at Department of Statistics, Punjab University, Chandigarh, February 28 to March 01, 2019.
- Invited Speaker, National Workshop on "Big Data Analysis with R", Rabindranath Tagore University, Bhopal, March 15, 2019.
- Course Director, Refresher training programme on "Handling Large Scale Data and Data Analysis using R" from October 08-13, 2018 funded by NSSTA, Ministry of Statistics and Programme Implementation, Govt. of India, ICAR-IASRI, New Delhi.
- Course Director, Refresher training programme on "Advanced Sampling Techniques with Practical Examples from NSSO & Health Surveys" from October 29 to November 03, 2018 funded by NSSTA, Ministry of Statistics and Programme Implementation, Govt. of India at ICAR-IASRI, New Delhi.
- Resource Person, Session "Statistical Computing Using R Software" during National workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences, Dehradun, 22-24 May 2018.
- Resource Person, delivered two lectures on "Introduction on Statistics", Institute of Valuer, New Delhi, May 15, 2018.
- Resource Person, training programme on "Survey Research Methodology for Researchers and Faculty", ICMR-NIMS, New Delhi during October 08-10, 2018.
- Resource Person, workshop on "Applications of Spatio-Temporal models", University of Hyderabad, Hyderabad, January 31 to February 01, 2019.
- Resource Person, workshop on "Statistical Computing Using R", Department of Statistics, Punjab University, Chandigarh, February 28 to March 01, 2019.
- Resource Person, National workshop on "Big Data Analysis with R", Rabindranath Tagore University, Bhopal, March 15, 2019.
- Resource Person, refresher training programme on "Handling Large Scale Data and Data Analysis using R", ICAR-IASRI, New Delhi during October 08-13, 2018.
- Resource Person, refresher training programme on "Advanced Sampling Techniques with Practical Examples from NSSO & Health Surveys", ICAR-IASRI, New Delhi during October 29 to November 03, 2018.
- Chaired Invited Paper Session, National Conference on "Recent Developments in Statistics and their -Applications to the Society", Ahmednagar, January 17-18, 2019.
- Chaired Contributed Paper Session, International

Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, December 27-30, 2018.

- Chaired Invited Paper Session on "Recent Advances in Analysis of Complex Survey Data", in the 72nd Annual Conference of Indian Society of Agricultural Statistics, Bhopal, India, December 13-15, 2018.

Anil Kumar

- Nominated as a Member Institute Joint Staff Council and attended a meeting on 29.10.2018 at ICAR-IASRI, New Delhi.
- Nominated as a Chairman , "Accommodation and Food Committee" for smooth conducting of training program "Advance techniques in Agricultural bioinformatics in the context of big data analytics" during 14.11.2018 to 04.12.2018. at ICAR-IASRI, New Delhi
- Appointed as an External Examiner by Honourable Vice-Chancellor CCS University for conducting M.Sc. (Stats.) examination at Chaudhary Charan Singh University, Meerut on 12.06.2018 and 13.06.2018.
- Appointed as an External Expert to conduct the presentation and viva of M.Sc (Stats.) at Central University of Haryana, Mahendragarh on 15.06.2018.
- Nominated as Guest of Honour in Farmer Scientist Interaction meet at CSWRI, Avikanagar on 03.07.2018.
- Nominated as a member of Selection Committee for recruiting Y.P. at CSWRI, Avikanagar on 10.04.2018.
- Appointed as an External Examiner of viva of Ph.D student at CCS HAU, Hisar on 2.08.2018.
- Nominated as a Chairman, "Boarding and Lodging Committee" for smooth conducting of CAFT program on "Recent Trends in Data Analytics and Knowledge Management" during 06.09.2018 to 26.09.2018.at ICAR-IASRI, New Delhi
- Nominated as a Member , "Course Co-ordination Committee" for smooth conducting of CAFT program on "Modern Statistical Techniques in Genetics" during 01.02.2019 to 21.02.2019 at ICAR-IASRI, New Delhi
- Nominated as Chairman, "Boarding and Lodging Committee" for smooth conducting of CAFT program on "Modern Statistical Techniques in Genetics" during 01.02.2019 to 21.02.2019. at ICAR-IASRI, New Delhi
- Nominated as a Chairman of "Boarding and Lodging Committee" for smooth conducting of International Training program on "Recent Advances in Agricultural Surveys: Remote Sensing and GIS Applications" during 11.03.2018 to 31.03.2019 at ICAR-IASRI, New Delhi
- Nominated as Panellist in the interview committee for the selection of Consultant) at ZTM & BPD Unit at ICAR-IARI, New Delhi on 18.03.2019.
- Acted as Chairman for selection of Caretaker at ICAR-IASRI and conducted DPC on 23.10.2018.
- Convener in the Broad Subject Matter Area Committee of Statistical Sciences for restructuring of Master's and Ph.D curriculum syllabi and academic regulation at National Level for the disciplines of Statistical Sciences; attended a meeting of all Chairmen and Conveners at NASC Complex, New Delhi on 09.05.2018; convened second meeting of BSMA Committee at Rajasthan Agriculture College, MPUAT, Udaipur on 24.11.2018 and 25.11.2018.
- Nominated as a Chairman, "Boarding and Lodging Committee" for smooth conducting of Training program on "Handling Large Scale Data and Data Analysis using R" during 08.10.2018 to 13.10.2018 at ICAR-IASRI, New Delhi
- Nominated as Chairman, "Boarding and Lodging Committee" for smooth conducting of Training program on "Advance Sampling Techniques with Practical Examples from NSSO & Health Surveys" during 02.10.2018 to 03.11.2018.at ICAR-IASRI, New Delhi
- Appointed as an external examiner to evaluate M.Phil. student at Department of Statistics, University of Delhi, New Delhi on 21.06.2018.
- Attend the second meeting of QRT of ICAR-IIFSR and AICRP on IFS at Rajasthan Agricultural Research Institute, Durgapura, Jaipur (Rajasthan) on 10.08.2018 and presented the progress of OSR made during last five years.
- Nominated as Member of Flying Squad by DDG, Agricultural Education, ICAR for ICAR's 23rd All India Entrance Examination on 18.08.2018.
- Appointed as a Member, Selection committee by DDG, Agricultural Education, ICAR for the selection of Research Associates in Agricultural

Education Division, ICAR, New Delhi and conducted Interview on 01.10.2018.

- Appointed as an External examiner for M.Sc (Stats.) at Chaudhary Charan Singh University, Meerut and Central University of Haryana on 07.10.2010.
- Appointed as an External examiner for conducting B.Sc (3rd) Statistics practical exam-2019 N.R.E.C College, CCS University, Meerut on 06.03.2019.
- Panelist in the judging committee in farmers fair and workshop on 29th September, 2018 at ICAR-CSWRI, Avikanagar and acted as Judge in evaluating the stalls in the fair.
- Chairman for the selection committee of Caretaker and hold a meeting in 23.10.18
- Attended QRT meeting of ICAR-IIFSR and AICRP on IFS and made a presentation on the progress of last five years on 11th October, 2018 at Rajasthan Agricultural Research Institute, Durgapura, Jaipur, Rajasthan.
- Acted as a Rapporteur in the XIV Agricultural Science Congress organized by NAAS in collaboration with the ICAR and Indian Agricultural Research Institute at New Delhi from February 20-23, 2019 on the theme "Innovations for Agricultural Transformation".
- Coordinator of ITH and Panse Hostel.
- Chairman, Food and Accommodation committee of National workshop on “Artificial Intelligence in Agriculture: Status and Prospective” organized jointly by ICAR-IASRI, ICAR-NAARM and ICAR-IIWM on 30-31 July, 2018 in NAS Complex, New Delhi.
- Member of reservation and accommodation Committee of ICAR officials constituted for ICAR Foundation Day and Award Ceremony 2018
- Member ACR upgradation committee of Senior Technical Officer at CSWRI, Avikanagar on 9th July, 2018
- Guest of honour in Scientist farmers interaction meet and Ram distribution function at ICAR-CSWRI, Avikanagar on 9th July, 2018
- Member Coordination Committee for conducting 90th Foundation day of ICAR and Award ceremony.
- Co-Convenor in accommodation committee in Krishi Unnati Mela 2018
- Member, selection committee, ITMU
- Member, selection committee, PME

Prawin Arya

- Nodal Officer of IASRI for Lok Sabha Elections-2019
- Member, Editorial Board for publication of Shankhyi kiVimarsh of ICAR-IASRI 2018-19.
- Subject area expert for restructuring of course syllabus for time series analysis.
- Chairman, Organizing Committee of Krishi Unnati Mela organized during 5-7, March, 2019.
- Welfare Officer, IASRI, New Delhi
- Member, ICAR Staff Welfare Fund Scheme of IASRI.
- Member, Institute Joint staff Council committee of IASRI.
- Controller of examination, limited departmental examination for the post of Assistant Administrative Officer conducted by IASRI, New Delhi.
- External Expert, for examination and viva-voce of M.A./M.Sc (Stats.) at Central University of Haryana, Mahendragarh on 23.11.2018 and 30.11.2018.

Sudeep

- Worked as a Core committee member for conducting the 23rd All India Entrance Examinations for Admission – 2018. Attended several meeting Agricultural Education Division and perform duties on 22 and 23 June in central control room at Ag. Education Division.
- received letter of appreciation from Secretary, DAC&FW, Ministry of Agriculture & Farmers Welfare, Government of India for developing monitoring dashboard and providing technical support for online data uploading and reporting (in KVK Portal) of Krishi Kalyan Abhiyaan, a Govt. of India initiative from Department of Agriculture, Cooperation & Farmers Welfare.

Alka Arora

- received letter of appreciation from Secretary, DAC&FW, Ministry of Agriculture & Farmers Welfare, Government of India for developing monitoring dashboard and providing technical support for online data uploading and reporting

(in KVK Portal) of Krishi Kalyan Abhiyaan, a Govt. of India initiative from Department of Agriculture, Cooperation & Farmers Welfare.

- Acted as Member of Abstracts and Poster Management Committee under Agricultural Engineering & IT team of XIV Agricultural Science Congress.
- Acted as Chairman of a contributory paper session in the National Conference on "Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere Especially in Agriculture" (COSIFHA – 2019), held during 29 – 31 January 2019 at S.V. Agricultural College, Tirupati.
- Acted as convener for the session "Advanced Statistics and Informatics in Agriculture" in the 72nd Annual Conference of Indian Society of Agricultural Statistics at ICAR-CIAE, Bhopal.
- Chairperson of the committee for Website Contents updating and management
- Member of technical committee for estimating the efforts and to decide on best mode of procurement of Oracle for next phase of ICAR-ERP
- Committee Member "to decide the services and Equipment which can be spared on, including cost of service/unit basis and put the information on the portal"
- Management Committee (MC) member of Computer Society of India, Delhi Chapter
- Member of Data Centre Management Committee.
- Co-Chairperson for the ICAS 2019 Website development committee.
- Technical committee member in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.

Prachi Misra Sahoo

- Delivered a talk regarding development of methodology for estimation of area and production of spice crops in the Training–cum-workshop of the nodal officers of State Horticulture Statistics Authority (SHOSA) at ICAR-Central Coastal Agricultural Research Institute (CCARI), Ela, Goa on 25.09.2018.
- Invited Speaker, Department of Geography, Jamia Millia Islamia, New Delhi. Delivered lecture on 'Statistics for spatial data Analysis' in the research methodology workshop on Geography and Environment with SPSS training held at Jamia Millia Islamia, under the ageis of UGC DRS-I on 2 March, 2019.
- Programme Director of an International training programme on "Recent Advances in Agricultural Surveys: Remote Sensing and GIS Applications" organized at the Institute during March 11-31, 2018 for the participants from African-Asian Rural Development Organization (AARDO) member countries.
- Editor of Agricultural Research Data Book (ARDB) 2018.
- Member Secretary, Divisional Research Committee, Division of Sample Surveys, IASRI, New Delhi.
- Invited Speaker, in the research methodology workshop on Geography and Environment with SPSS training held at Department of Geography, Jamia Millia Islamia, New Delhi.

Anshu Bharadwaj

- Chairperson of the Institute House Allotment Committee.
- Member of the committee for Inspection of International Guest House, ICAR-IASRI for Quality of Boarding. Lodging and Food services.
- Member of Data Centre Management Committee.
- Acted as Member of a committee for organizing the Hindi Shodh Patra Pratiyogita during the Hindi Pakhwada in the institute.
- Working as a member in ICAS 2019 Website development committee.
- Acted as a member of technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.

Mukesh Kumar

- Worked as Chairman for Technical Evaluation Committee of equipment.
- Worked as Transparency Officer and RTI Nodal Officer
- Worked as Co-Chairman in PAC committee.

U.B. Angadi

- Reviewed papers as Programme Coordination

member, articles submitted for conference RTIP2R 2018

- Evaluator for M.Sc. (Agricultural Statistics) thesis on "Pattern Classification of rice (Oryza) on Genomic Sequences" of University of Agricultural Sciences, Bengaluru

K.K. Chaturvedi

- Received appreciation letter for significant contribution as a resource person in the training "Next Generation Sequence Data Analysis" held at AAU, Assam during 14-16, March, 2019.
- Member, Technical Program Committee, 7th International Conference on. Reliability, Infocom Technologies and. Optimization (ICRITO 2018). (Trends and Future directions) during August 29-31, 2018.
- Member, Technical Program Committee, 9th International Conference on Quality, Reliability, Infocom Technology and Business Operations (ICQRITBO'2018) during Dec. 27-29, 2018 at Conference Centre, University of Delhi, Delhi
- Expert Member, Selection committee for selection of Research Associate in a project at NCIPM, New Delhi.
- Centre Coordinator, for smooth functioning and reporting of the ICAR-NBAIM, Mau
- Member Secretary, Swatch Bharat Abhiyan committee.
- Expert Member, Enquiry Committee to examine the lapses in performing duty by administrative personnel in the institute.
- Expert Member (Examiner), Recruitment of Adhoc Personnel for ICAR institute.
- Member, Mera Gaon Mera Gaurav Scheme Committee.
- Member, Operational management and Maintenance of IT and Non-IT resources under NABG Committee.
- Member, DPC meeting of Technical Personnel of the institute.
- Member, Committee for specifying spare of Services and Equipment on Portal for its wider usage.
- Incharge, Managing and coordinating IT and Non-IT resources of CABin
- Incharge, Video conferencing facility of CABin
- Incharge, Divisional Labs of CABin.
- Chairman, MACP of Supporting staff of the institute
- Chairman, Committee for approval payments for the work undertaken under Works section.
- Chairman, Committee for Revision of Rates for Whitewashing of Quarters.
- Chairman, Committee for Maintenance work and its certification in Krishi Niketan.
- Chairman, Spot Quotation for repair of circuit board of AC chiller.
- Chairman, Pre-vigilance Enquiry Committee
- Chairman, Technical Specification Evaluation Committee.
- Chairman, Institute Technical Expert Committee, ICAR-IASRI, New Delhi
- Chairman, Evaluation of technical bids for All-in-One Desktop.
- Chairman, Evaluation of technical specification of Blade Servers.
- Member Secretary, Website Development committee for 8th International Conference of Agricultural Statistics (8th ICAS 2019).
- Made arrangement for Webcast "PM Speech" of Krishi Unnati Mela, IARI New Delhi on 17th March 2018 in the committee room of the division.
- Member, Recruitment of Young Professional–II under CABin Scheme Project.
- Member, Technical Committee to decide the services and equipment on Knowledge Management Portal
- Member, Committee for finalization of SLA for HPC and related matters
- Member, Assessment Committee of Technical Personnel in Category-II under the functional group "Field/farm Technicians"

S. B. Lal

- Chaired a Contributed Paper Session II on 24th May, 2018 at National Workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences held during May 23-25, 2018 at Division of Forestry Statistics, Indian Council of Forestry Research and Education, Dehradun.

- Thesis Evaluator, Ph.D. Thesis for two students of BR Ambedkar Bihar University, Muzaffarpur, Bihar.
- External Examiner for setting-up of the Question Paper for the Course No. LPM 611 - Computer Applications in Livestock Production Management for the 1st Semester Final (Theory) Examination 2018-2019 at ICAR-IVRI, Bareilly.
- External examiner for a Ph.D. (Computer Science) student, at Rabindranath Tagore (AISECT) University, Bhopal in December, 2018.
- As External Examiner, visited ICAR-IVRI, Bareilly for conducting Practical Examination of the Course "Computer Applications in Livestock Production Management" of 1st Semester examination (2018-19) for MVSc/PhD students on 1st February, 2019 as
- Expert member of selection committee for the post of JRF at Centre for Conservation and Utilization of Blue Green Algae, ICAR-IARI, New Delhi on 11th December, 2018.

Shashi Dahiya

- Acted as Chairman of a contributory paper session on Statistics and Informatics held on 31st January'2019, in the National Conference on "Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere Especially in Agriculture" (COSIFHA – 2019), held during 29 – 31 January 2019 at S.V. Agricultural College, Tirupati.
- Member, Seminar Association of IASRI, since January'2018
- Member, Website Content Updating and Management Committee, for Revamped website of ICAR-IASRI.
- Member, Newsletter Preparation Committee
- Member Secretary of the "Tender Creation and Evaluation Committee for Maintenance and Support of ICAR-ERP" from July 2017 to July 2018.
- Member, Interview Board for the selection of 3 SRF (Agricultural Extension) under NASF Project "ICT based Extension Strategies for Nutrition Sensitive Agriculture in the States of UP and Odisha" held on 24th November 2018 at Division of Ag. Extension, ICAR-IARI, New Delhi.
- Member, Interview Board for the selection of 1 SRF (Computer Science) and 1 SRF (Agricultural Statistics) under the NASF Project "ICT based Extension Strategies for Nutrition Sensitive Agriculture in the States of UP and Odisha" held on 27th November 2018 and 26th December 2018 at our institute.

Md. Samir Farooqi

- Member of editorial board Sankhyiki Vimarsh of ICAR-IASRI publication.
- Member of the committee for "Request for Proposal (RFP)/Replica/ Migration" with regard to "Server and Indian NARS Statistical Computing Portal"
- Member of selection committee for RA and SRF as an outside expert by the director ICAR-NCIPM, New Delhi.
- External examiner by Department of Statistics and Operation Research, AMU, Aligarh to conduct practical examination of M.Sc. IInd semester (Statistics) STM/-2072 at AMU, Aligarh on 03-05-2018.

Pal Singh

- Committee member in Swachh Bharat Mission of our institute
- Working as a Committee member for allotment of IASRI Staff Quarters

Anu Sharma

- Chaired a session on National Conference on "Challenges and opportunities in Statistics and Informatics for Futuristic Humanosphere especially in Agriculture (COSIFHA-2019) from 29-31 January, 2019 held at Department of Statistics & Computer Application at Acharya NG Ranga Agricultural University, Tirupati, and Andhra Pradesh.
- Acted as Member of Program Committee Member for conference ICRAIE-2018 in 3rd International Advances and Innovations in Conference and Workshops on Recent Engineering (IEEE Record # 43534)
- Reviewer for many papers for ICRAIE-2018: 3rd International Conference and Workshops on Recent Advances and Innovations in Engineering, Poornima University and Malviya National Institute of Technology Jaipur, India, November 22-25, 2018

S.N. Islam

- Working as a DRC Secretary.

M. A. Iquebal

- Member, Scientific Board, Online Journal of Bioinformatics.
- Member, Editorial Board, International Journal of Genetics and Genomics
- Member, Editorial Board, Journal of Plant Sciences
- Member Editorial Board of Computational Biology and Bioinformatics
- Member, Editorial Board, International Journal of Basic and Applied Biology
- Member, Editorial Board, International Journal of Biotechnology and Biomedical Sciences
- Member, Institute QRT report (2011-16) preparation committee for reporting to current QRT team
- Member of Abstract and Poster Management team (Agricultural Education Team) in XIV Agricultural Science Congress held at New Delhi

Sarika

- Member, Editorial Board of Computational Biology and Bioinformatics.
- Working as Member, Editorial Board of Institute Newsletter
- Member of the committee for selection of RA position in DBT funded project at ICAR-NRCPB, New Delhi on 29 Nov, 2018
- Member of Abstract and Poster Management team (Biotechnology and Basic Sciences Team (Biotechnology, Plant Physiology and Biochemistry) in XIV Agricultural Science Congress held at New Delhi

Susheel Kumar Sarkar

- Rapporteur, Invited paper session of Design of Experiment in 72nd annual conference of Indian Society of Agricultural Statistics at ICAR-CIAE, Bhopal during December 13-15, 2018
- हिंदी पखवाडा के अंतर्गत मुख्य आयोजन समिति का सदस्य।
- हिंदी पखवाडा के अंतर्गत 1 सितम्बर, 2018 को काव्य गोष्ठी का संचालन।
- हिंदी पखवाडा के छायांकन समिति का अध्यक्ष द्य
- Participated in Pusa Krishi Vigyan Mela 2019 organized at IARI, New Delhi during March 5-7, 2019
- Member of Editorial board, Sankhiyaki Vimarsh

B. N. Mandal

- Member Secretary, Divisional Research Committee, Division of Design of Experiments.
- Member, Institute website content updating and management committee
- Member, Departmental Promotion Committee for Limited Competitive Departmental Promotion to AAO

Ranjit Kumar Paul

- Chairman of selection committee for selection of SRF for the project “Studying Dynamics of market integration and price transmission of agricultural commodities” on 10th April, 2018 at ICAR-IASRI.
- Worked as Rapporteur in the technical session II of the National workshop on Artificial Intelligence in Agriculture: status and prospects during 30-31 July, 2018 at NASC complex, New Delhi.
- Worked as Rapporteur in the session on Crop Insurance in 72nd national conference of Indian Society of Agricultural Statistics during 13-15 December, 2018 at ICAR-CIAE, Bhopal
- Worked as question setter and evaluator for Qualifying Examinations of M.Sc. Statistics in TNAU, Coimbatore
- Secretary, Institute Seminar Association
- Member, Mera Gaon Mera Gaurav (MGMG) Coordination Committee at ICAR-IASRI.
- DRC Secretary, Division of Statistical Genetics
- Member of PAPC of the Institute.
- Worked as Member of selection committee for selection of Young Professionals –I and II at ICAR-NCIPM on 11th April, 2018
- Worked as Member of DPC for promotion of SSS and skilled staff
- Worked as Exhibitor in the Kisan Mela at IARI, New Delhi during 05-07 March, 2019
- Subject area expert for restructuring of course syllabus for time series analysis.

- Member of the committee constituted by NAAS for assigning NAAS Score to non-impact factor scientific journals
- Member, Working Group on Artificial Intelligence and Digital Agriculture (WGAIDA)
- Member, Institute QRT report (2011-16) preparation committee for reporting to current QRT team
- The invigilator for comprehensive examination of MSc. Agricultural Statistics 2018-19 at IASRI.
- Question setter and Evaluator of comprehensive examination of MSc. Agricultural Statistics 2018-19 at IASRI
- Member of Registration committee and Publication Committee for the 8th International Conference on Agricultural Statistics (ICAS-VIII), New Delhi, 18-21 November 2019.

D. C. Mishra

- Member Secretary of Evaluation Committee for publication of "ICAR-IASRI Annual Report" in Hindi
- Working as a Member of Editorial Board for Hindi Magazine "lkaf[;dh foe'kZ"
- Working as a Center coordinator of National Research Centre on Plant Biotechnology, New Delhi for network projects under the CABin Scheme.
- Working as a Member of Institutional Work Committee
- Working as a training coordinator for student trainees at CABin.
- Working as a Member of MGMG programme and adopted five villages
- Working as Executive Member, Seminar Association of Institute
- Received appreciation letter for excellence work in publication of a Hindi Magazine named "सांख्यिकी विमर्श" for the year 2017-18 at ICAR-IASRI, New Delhi.
- Received appreciation letter for significant contribution as a resource person in the training "Next Generation Sequencing Data Analysis: A Practical Perspective" held at IGKV, Raipur during 7-9, August, 2018.
- Received appreciation letter for significant contribution as a resource person in the training "Next Generation Sequence Data Analysis" held at AAU, Assam during 14-16, March, 2019.

Soumen Pal

- Worked as a member of Institute Technical Expert Committee.
- Worked as a member of the committee for GIGW Compliance and STQC Certification of ICAR-IASRI website.
- Working as a member of Data Centre Management Committee.
- Working as a member of e-Office specification committee.
- Worked as a member in the committee for compilation of materials for QRT.
- As one of the invigilators for comprehensive-II examination of Ph.D. Agricultural Statistics on 7th September, 2018.
- Working as a member of 'Rajbhasa Karyanwayan' committee.
- Working as a member in ICAS 2019 Website development committee.
- Working as a member of 'Mera Gaon Mera Gaurav' committee.
- Worked as a member to organize stall of ICAR-IASRI in 'Krishi Vigyan Mela' during 5-7 March, 2019.
- Working as a member of technical committee in the Project 'Investments in ICAR Leadership in Agricultural Higher Education' under NAHEP Component 2.
- received letter of appreciation from Secretary, DAC&FW, Ministry of Agriculture & Farmers Welfare, Government of India for developing monitoring dashboard and providing technical support for online data uploading and reporting (in KVK Portal) of Krishi Kalyan Abhiyaan, a Govt. of India initiative from Department of Agriculture, Cooperation & Farmers Welfare.

Kaustav Aditya

- Delivered an invited talk entitled "MAPI software for collection of survey data-An experience" in the invited paper session on "Recent Advances in Sampling Techniques" at National workshop on Recent advances in statistical methods and applications in forestry and environmental science at ICFRE, Dehradun on 25th May 2018.

Sukanta Dash

- **Recognition award in** Group Discussion of ICAR-AICRP on Fruits, as an expert member, held at Assam Agricultural University, Jorhat during February 14-16, 2019
- Acted **as a Rapporteur** for Technical Session III on Unit Level Data in the Third National Workshop of Officer In-charge, Data Management (ICAR Research Data Repository for Knowledge Management) KRISHI during December 4-5, 2018 organized by KRISHI project team at NASC and ICAR-IASRI, New Delhi.
- Act as an invigilator of Ph. D. comprehensive exam of students of Agricultural Statistics.
- Act as a Special Invitee in the first meeting of Broad Subject Matter Area (BSMA) Committee for restructuring of Masters and Ph.D. curriculum, syllabi and academic regulation for the disciplines of Statistical Sciences held on Aug 10, 2018 at ICAR- IASRI , New Delhi-12
- Act as a member in the second meeting of Broad Subject Matter Area (BSMA) Committee for restructuring of Masters and Ph.D. curriculum, syllabi and academic regulation for the disciplines of Statistical Sciences held on November 24-25, 2018 at Bharatpur, Rajasthan.
- Acted as an expert member of an interview board for selecting six SRFs under a project "Plant source based environmentally safe crop protection and production technologies: Development and capacity building" under Niche Area of excellence scheme of ICAR on 30th March, 2019.
- Chairman of several committees for opening of tenders at institute
- Acted as Boarding and Lodging committee member for organizing National workshop on "Artificial Intelligence in Agriculture: Status and Prospective" organized jointly by ICAR-IASRI, ICAR-NAARM and ICAR-IIWM on 30-31 July, 2018 in NAS Complex, New Delhi.
- Participated in Pusa Krishi Vigyan Mela 2019 organized at IARI, New Delhi during March 5-7, 2019
- Member of editorial board, Sankhiky Vimarsh

Ankur Biswas

- Member, Institute Seminar Association, ICAR-IASRI
- Resource person in the Training Programme on "Agriculture and Allied Statistics" for 41st batch of ISS probationers organized by National Statistical Systems Training Academy (NSSTA), MoSPI, Greater Noida during February 18 to March 01, 2019.

Arpan Bhowmik

- Rapporteur, Technical Session V on Unit Level Data in the Third National Workshop of Officer Incharge, Data Management (ICAR Research Data Repository for Knowledge Management) KRISHI during December 4-5, 2018 organized by KRISHI project team at NASC and ICAR-IASRI, New Delhi.
- Co-Chairman, Technical Session 2 on Conservation, Sustainable Development, Crop Improvement and Management for Doubling Farmers' Income in the COBACAS 4th National Conference on Diversified Farming Systems: Sustainable Livelihood and Doubling Farmers' Income organized jointly by Coochbehar Association for Cultivation of Agricultural Science (COBACAS) and Uttar Banga Krishi Viswa Vidyalaya (UBKV) at College of Agriculture, UBKV, Majhian, Dakshin Dinajpur, West Bengal during 17-18 January, 2019.
- Scientist Representative in Institute Grievance Committee of ICAR-IASRI for the year 2018-20.
- Member, Institute Seminar Association from the Division of Design of Experiments from 2018.
- Acted as an Expert Member of an Interview board for selecting one SRF under an NASF project in Division of Agricultural Extension on 30 January, 2019.
- Acted as an External Expert of a three members assessment committee for upgradation of Ms. Shruti Khus, Ph.D. Scholar, Department of Agricultural Extension, ICAR-IARI from JRF to SRF under BSR Scheme.
- Member, Swachh Bharat Mission Coordination Committee at ICAR-IASRI.
- Member, Mera Gaon Mera Gaurav (MGMG) Coordination Committee at ICAR-IASRI.
- Member, Executive Committee of IASRI Employees Co-operative Thrift and Credit Society Limited for 2018-20.
- Member, Institute Seminar Association from Division of Design of Experiments from 2018.

Anindita Datta

- Member, Committee formed for compiling News Letter for year 2017-2018

Achal Lama

- Rapporteur, Contributory paper session, (Statistical modeling) in the 72nd Annual Conference of ISAS, held at ICAR-CIAE, Bhopal during 13-15, December, 2018.

Rajesh T.

- Rapporteur for one of the sessions in 72nd Annual Conference of Indian Society of Agricultural Statistics (ISAS), during 13-15 December 2018 at Bhopal.
- Performed role of Sector Officer for the General Election i.e. Lok Sabha 2019 in North West Delhi, Parliamentary Constituency (PC-05) from 15.03.2019 to 23.05.2019.

Anuja A R

- Rapporteur for one of the sessions in 72nd Annual Conference of Indian Society of Agricultural Statistics (ISAS), during 13-15 December 2018 at Bhopal.

Shivaswamy G.P.

- Rapporteur for one of the sessions in 72nd Annual Conference of Indian Society of Agricultural Statistics (ISAS), during 13-15 December 2018 at Bhopal.

National Workshop on "Artificial Intelligence in Agriculture" was organized by our institute during 30-31 July, 2018 for which the following committees were constituted:

Convenors:

1. Dr. Lalmohan Bhar, Director, ICAR-IASRI, New Delhi
2. Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM, Hyderabad
3. Dr. S.K. Ambast, Director, ICAR-IIWM, Bhubaneswar

Coordination Committee

1. Dr. Lalmohan Bhar, Director (A) & Head, Division of Statistical Genetics
2. Dr. Tauqueer Ahmad, Head, Div. of Sample surveys
3. Dr. K.N. Singh, Head (A), F&ASM Division
4. Dr. Anil Rai, Head (A), CABIn
5. Dr. Seema Jaggi, Head (A), Div. of Design of Experiments & Prof. (Agricultural Statistics)
6. Dr. Sudeep, Head (A), Computer Applications Division & Professor (Computer Applications)
7. Dr. Ajit, Principal Scientist & Scientist In-Charge, PME
8. Dr. A.R. Rao, Professor (Bioinformatics)
9. Mr. Arvind, Senior F&AO
10. Mrs. Poonam Singh, AAO

Food and Accommodation Committee

1. Dr. Anil Kumar, Principal Scientist (Chairman)
2. Dr. Prawin Arya, Principal Scientist
3. Dr. Sukanta Dash, Scientist
4. Sh. Gyan Singh, Technical Officer
5. Sh. Udaivir Singh, Technical Officer
6. Sh. Tanuj, Ph.D. (CA) student
7. Sh. Samir Burman, Ph.D. (Ag. Stat.) student

Administration & Finance Coordination Committee

1. Dr. Mukesh Kumar, Principal Scientist (Chairman)
2. Dr. Dwijesh Chandra Mishra, Scientist
3. Mr. Naresh kumar, Chief Technical Officer
4. Sh. R.K. Koli, DDO
5. Sh. Manos Chaudhury, AAO
6. Sh. Amit Marwari, FAO
7. Sh. Veerendra Kumar, Technical Officer
8. Mrs. Suman Khanna, Personal Assistant to Director
9. Sh. Ashok, UDC

Registration Committee

1. Dr. Amrit Kumar Paul, Principal Scientist (Chairman)
2. Dr. Arpan Bhowmik, Scientist
3. Dr. Himadri Shekhar Roy, Scientist
4. Sh. Anil Garg, Technical Officer
5. Sh. Shashank Kshandakar, Ph.D. (Ag. Stat.) student
6. Ms. Sanchita Naha, Ph.D. (CA) student

Hall Management Committee

1. Dr. Ranjit Kumar Paul, Scientist (Chairman)
2. Dr. Soumen Pal, Scientist
3. Dr. Pradip Basak, Scientist
4. Dr. Anindita Datta, Scientist
5. Sh. Subhash Chand, Technical Officer
6. Sh. Sunil Bhatia, Technical Officer
7. Sh. Dipankar Mitra, Ph.D. (Ag. Stat.) student
8. Sh. Chandan, Ph.D. (CA) student

Scientific Coordination Committee

1. Dr. Lalmohan Bhar, Director (A) & Head, Division of Statistical Genetics (Chairman)
2. Dr. Rajender Parsad, Principal Scientist (Co-Chairman)
3. Dr. Ajit, Principal Scientist & Scientist In-Charge, PME
4. Dr. Ramasubramanian V., Principal Scientist
5. Dr. Sudeep, Head (A), Computer Applications Division & Professor (Computer Applications)
6. Dr. Alka Arora, Principal Scientist
7. Dr. K.K. Chaturvedi, Senior Scientist
8. Dr. Mrinmoy Ray, Scientist

Dias Management Committee

1. Dr. Anshu Bharadwaj, Principal Scientist
2. Dr. Alka Arora, Principal Scientist

Offices in Professional Societies and Research Journals

Indian Society of Agricultural Statistics

L.M. Bhar	Secretary
A. K. Paul	Joint Secretary
Susheel Kumar Sarkar	Joint Secretary
Ranjit Kumar Paul	Executive member
Sukanta Dash	Executive member
Ankur Biswas	Executive member
Kaustav Aditya	Executive member
Anshu Bharadwaj	Executive member
M. A. Iquebal	Executive member
Sarika	Executive member

Society of Statistics, Computer and Application

Rajender Parsad	Executive President
L.M. Bhar	Joint Secretary
Hukum Chandra	Executive member
Alka Arora	Executive member
Anshu Bharadwaj	Executive member
Ranjit Kumar Paul	Executive member

Rajender Parsad

- Executive Editor of Statistics and Applications, Journal of Society of Statistics, Computers and Applications.
- Associate Editor of Journal of Statistical Theory and Practice, published by Taylor and Francis.
- Associate Editor of Agricultural Research, Journal of the National Academy of Agricultural Sciences published by Springer.
- Member of Editorial Board, Journal of Wheat Research, the Journal of Society for Advancement of Wheat Research.
- Member of Governing Body, Institute of Applied Statistics and Development Studies, Lucknow.
- Executive Council Member of Academy, National Academy of Agricultural Sciences.

Anil Kumar

- Associate Editor of Indian Research Journal of Extension Education, Society of Extension Education.
- Member of Editorial Board, International Journal of Agricultural and Statistical Sciences
- Member of Editorial Board, Society for Community Mobilization for Sustainable Development.
- Member of Editorial Board, International Journal of Essential Sciences.
- Member of Editorial Board, Progressive Research

Hukum Chandra

- Council Member, International Association of Survey Statisticians

Alka Arora

- Nomination Committee (NC) Chairman, Computer Society of India, Delhi Chapter

S.N. Islam

- Editor of the Journal : Annals of Agricultural Research

Anshu Bharadwaj

- Member of Editorial Board, American Research Journal of Computer Science and Information Technology

Shashi Dahiya

- Member of Editorial Board, International Journal of Advanced Computer Science and Applications (IJACSA).

Ranjit Kumar Paul

- Member of Editorial Board for Annual Report 2017-18, ICAR-IASRI

Soumen Pal

- Member, Editorial Board of the Journal 'RASHI'
- Member of Editorial Board for Annual Report 2017-18, ICAR-IASRI

Sukanta Dash

- Member of Editorial board of the journal Progressive Research: An International Journal.
- Member of Editorial board of Sankhyki Vimarsh, ICAR-IASRI
- Member of Editorial board of Annual Report 2017-18, ICAR-IASRI

Ravindra Singh Shekhawat

- Member of Editorial Board, MARUMEGH Kisan e-Patrika
- Associate Editor, Bioinfo Publication
- Foreign Visits

Hukum Chandra

- Visited Myanmar as Sampling Expert Member of FAO of United Nations under Global Strategy to Improve Agricultural and Rural Statistics in Myanmar, December 16-22, 2017.
- Visited Myanmar as Sampling Expert Member of FAO of United Nations under Global Strategy to Improve Agricultural and Rural Statistics in Myanmar, July 23- August 02, 2018.
- Visited Tanzania as Expert and Resource Person, Workshop on "Small Area Estimation Techniques and its Applications", EASTC, Dar es Salaam, Tanzania, December 02-08, 2018.

Tauqueer Ahmad

- visited Mexico as an Expert for imparting training to the enumerators and officials concerned for field testing of guidelines on measurement of harvest and post-harvest losses of fruits and vegetables, filling up of questionnaires for primary data collection, pre-testing of questionnaires (class room training as well as field training including demonstration of crop cutting experiments for fruits and vegetables) during 9-16 September 2018.
- visited Zambia as an Expert for imparting training to the enumerators and officials concerned for field testing of guidelines on measurement of harvest and post-harvest losses of meat and milk, filling up of questionnaires for primary data collection, pre-testing of questionnaires (class room training as well as field training) during 23-29 September 2018.

Ranjit Kumar Paul

- Visited South Dakota State University, Brookings, USA for attending two months training on "Advanced Methods for Policy Analysis in the Area of Climate Change and Crop Price Volatility" during 16 August-14 October, 2018.

Dr. Ranjit Kumar Paul receiving certificate for successfully completing his two months foreign training at South Dakota State University, Brookings, USA during 2018

- Ranjit Kumar Paul receiving certificate for successfully completing his two months foreign training at South Dakota State University, Brookings, USA during 2018

Pradip Basak and Kaustav Aditya

- Participated in the regional training workshop on "Master Sampling Frames for Agricultural Statistics" jointly organized by Regional Office of the Global strategy, Food and Agricultural Organization of the United Nations and SAARC Secretariat during 19-23 November, 2018 at Kathmandu, Nepal.

Rajeev Ranjan Kumar

- Visited Vancouver, Canada to participate in 30th International Conference of Agricultural Economists (ICAE-2018) during 28 July 2018 to 02 August 2018.

7

Linkages and Collaborations of ICAR-IASRI, New Delhi in India and Abroad including Outside Funded Projects

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
		ICAR Institutes/ SAUs		
1	Planning, designing and analysis of experiments planned on stations under All India Coordinated Research Project on Integrated Farming Systems.	ICAR-IIFSR, Modipuram.	01 April 2017	31 March 2020
2	Designing and Analysis of ON FARM Research Experiments Planned under AICRP on IFS.	ICAR-IIFSR, Modipuram.	01 April 2017	31 March 2020
3	Planning, designing and analysis of data relating to experiments for AICRP on Long Term Fertilizer Experiments.	ICAR-AICRP on Long Term Fertilizer Experiments, IISS, Bhopal	01 April 2017	31 March 2019
4	ICAR network project on transgenics in crops	ICAR-NRCPB, New Delhi	27 January 2015	31 March 2020
5	Development and assessment of educational mobile apps for improving livestock health and production.	ICAR-IVRI, Bareilly	28 June 2017	31 March 2019
6	Elucidating the mechanism of Pashmina fibre development: An OMICS approach.	SKUAST-Kashmir and ICAR-NDRI, Karnal	01 July 2015	31 December 2018
7	ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture (ICAR Headquarters EFC Scheme)	ICAR-NAARM, Hyderabad, ICAR-NBSS&LUP, Nagpur, ICAR-IARI, New Delhi, DKMA, New Delhi, ICAR-CMFRI, Kochi, ICAR-CRIDA, Hyderabad and all other ICAR institutes as Nodal Centres	24 July 2015	31 March 2020
8	Potential gene mining from salt tolerant grasses for improvement of salt tolerance in crops.	National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA), ICAR, New Delhi	01June 2017	31 March 2020

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
9	Rice-metasys: understanding rice gene network for blast resistance and drought tolerance through system biology approach.	ICAR-NRCPB, New Delhi	01 March 2018	31 March 2020
10	Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices.	ICAR-IISR, Kozhikode	05 March 2018	31 March 2020
11	Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families.	ICAR-CIFA, Bhubaneshwar	05 March 2018	31 March 2020
12	Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea.	ICAR-IIPR, Kanpur	05 March 2018	31 March 2020
13	Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in Wheat.	ICAR-IIWBR, Karnal	05 March 2018	31 March 2020
14	Computational biology approach for deciphering stress induced transcriptomic and proteomic changes rice-microbial interaction system.	ICAR-NBAIM, Mau	06 March 2018	31 March 2020
15	Investigations on stipe rust-defence response, identification of defence genes/QTLs associated with rust resistance in Wheat.	ICAR-NBPGR, New Delhi	09 March 2018	31 March 2020
16	Investigations on pathogenic microorganisms of shrimp aquaculture using metagenomic and other bioinformatic approaches.	ICAR-CIBA, Chennai	09 March 2018	31 March 2020
17	Genomic and transcriptome sequencing of coriander (Coriandrum sativum) to reveal insight of its genomic architechture and breeding targets. Colloboration with Junagadh Agricultural University, Junagadh)	Junagadh Agricultural University, Junagadh	14 March 2018	31 March 2020
18	Development of web server for phenotype analysis for cattle breeding management.	ICAR-CIRC, Meerut	12.Mach.2018	11.March.2021
19	Knowledge management system for agriculture extension services in Indian NARES. Funded by Extramural funded under Agricultural Extension Division, ICAR.	Agricultural Extension Division, ICAR.	04 March 2016	31 March 2020
20	Computational and Analytical Solutions for High-throughput Biological Data	All Bureaux /ICAR Consortium Research Platform on Genomics	04 September 2017	31 March 2020
21	Assessment of post harvest losses in fruits and vegetables and strategies for their reduction in Andman and Nicobar Islands.	ICAR-CIARI, Port Blair	01 June 2015 (Association of IASRI w.e.f. 03 October 2016)	31 August 2019
22	Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in Rice and Wheat – Phase II.	ICAR-IARI, New Delhi,	01 January 2017	31 March 2019

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
23	Management and impact assessment of farmer first project.Funded by ICAR farmer first programme under KVK scheme (ATARI-I)	ICAR- NIAP, New Delhi, ICAR-NAARM, Hyderabad, DKMA, New Delhi	14 February 2017	31 March 2020
24	Doubling farmers' income in India by 2021-22: Estimating farm income and facilitating the implementation of strategic framework.	ICAR-NIAP, New Delhi	31 March 2017	31 March 2022
25	Modeling insect pests and diseases under climate change and development of digital tools for pest management National Innovations in Climate Resilient Agriculture (NICRA).	ICAR-NCIPM, New Delhi ICAR-CRIDA, Hyderabad	20 June 2017	31 March 2020
26	Efficiency of micro irrigation in economizing water use in India-learning from potential and unexplored states. Funded by NITI Ayog	ICAR-NIAP, New Delhi BACA, Anand, Gujarat ICAR-IASRI, New Delhi	20 December 2017	31 March 2019
27	Creating a fully characterized genetic resource pipeline for mustard improvement programme in India.	PAU, Ludhiana, National Agricultural Science Fund (NASF)	01 January 2017	31 December 2019
		Government of India		
28	Study to test the developed alternative methodology for estimation of area and production of horticultural crops. (CHAMAN program under MIDH)	Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MoA), Government of India.	16 September 2014	31 July 2018
29	Pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanthan Committee Report	Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.	16 February 2015	31 August 2018
30	Investigation of Causes of Divergence between Official and Trade Estimates of Jute Production.	Directorate of Economics & Statistics (DES), Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.	01 September 2015	31 July 2018
31	Stochastic differential equation models and their applications to agriculture.	Science and Engineering Research Board (SERB), New Delhi.	06 November 2015	05 November 2018
32	Forecasting Agricultural output using Space Agrometeorology and Land based Observations (FASAL). Funded by IMD, New Delhi.	IMD, New Delhi	13 April 2016	31 May 2018
33	Incomplete split-plot designs: construction and analysis. Funded by SERB.	Science and Engineering Research Board (SERB), DST, New Delhi.	16 August 2016	11 August 2019

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
34	Energy Audit Survey of AICRP on Energy in Agriculture & Agro-based Industries: Sampling Design and Analysis.	ICAR-All India Coordinated Research Project on Energy in Agriculture & Agro-based Industries (ICAR-AICRP on EAAI	01 June 2018	31 May 2021
35	Improving the usability of buffalo spermatozoa by sperm surface remodelling and immune acceptance in female reproductive tract.	NASF, ICAR, New Delhi	12 July 2018	11 July 2021
36	Molecular Markers for Improving Reproduction of Cattle and Buffaloes (MMIRCB).	Bill & Milinda Gates Foundation (BMGF).	19 September 2018	30 September 2023
37	Genomics assisted crop improvement and management.	ICAR, New Delhi	26 September 2018	31 March 2021
38	Crop science Integrated sampling methodology for crop yield estimation using Remote Sensing, Field surveys and Weather parameters for crop insurance.	Ministry of Agriculture & Farmers Welfare, Govt. of India.	28 September 2018	28 February 2019
39	Characterization, evaluation, genetic enhancement and generation of genomic resources for accelerated utilization and improvement of minor pulses.	DBT, Govt. of India	24 October 2018	23 October 2021
40	ICT based extension strategies for nutrition sensitive agriculture in the states of UP and Odisha.	NASF, ICAR, New Delhi	01 November 2018	31 March 2020
41	Application of Next-Generation Breeding, Genotyping, and Digitalization Approaches for Improving the Genetic Gain in Indian Staple Crops.	ICAR-IARI, New Delhi	22 January 2019	21 January 2023
42	Investments in Indian Council of Agricultural Research leadership on Agricultural Higher Education under the National Agricultural Higher Education Project (NAHEP)	NAHEP, ICAR, New Delhi	28 February.2019	31 March 2020
43	Plant source based environmentally safe crop protection and production technologies: Development and capacity building	ICAR-IARI, New Delhi	27 March.2019	06 February 2022
Consultancy Studies				
44	Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Haryana State.	DAC, Ministry of Agriculture, Govt. of India	06 August 2015	05 May 2018
45	Study on field testing of the developed guidelines on estimating post harvest losses of horticultural crops, livestock products and fish and fish products. Funded by Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.	Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.	17January 2018	31October 2018

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
46	Customization and Implementation of Academic Management System (AMS) for Post Graduate and Under Graduate Education at UHS	University of Horticultural Sciences, Bagalkot	10 July 2017	09 July 2018
47	Customization and Implementation of Academic Management System for Post Graduate & Under Graduate Education at Birsa Agricultural University (BAU), Kanke, Ranchi.	Birsa Agricultural University (BAU), Kanke, Ranchi.	24 February 2018	23 February.2019
48	Customization and Implementation of Academic Management System for Post Graduate & Under Graduate Education at University of Agricultural Sciences, Dharwad.	University of Agricultural Sciences, Dharwad	24 February 2018	23 February.2019
49	Customization and Implementation of Academic Management System for Post Graduate & Under Graduate Education at Balasahib Sawant Konkan Krishi Vidyapeeth, Dapoli.	Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	24 February 2018	23 February.2019

8

Publications

Research Papers

1. Aditya, K., Bhowmik, A., Biswas, A. and Das, S. (2018). Calibration estimators under two stage sampling design when population level auxiliary information was not available. *Journal of the Society for Application of Statistics in Agriculture and Allied Sciences-Rashi*, **2(2)**: 01-06.
2. Aditya, K., Chandra, H., Bharadwaj, A. and Rama. (2018). Development of software for digitization of collected data under a pilot study to estimate crop area and production based on the sample sizes recommended by professor Vaidyanathan committee report. *Journal of the Indian Society of Agricultural Statistics*, **72(1)**:15-26.
3. Aditya, K., Chandra, H., Sud, U.C. and Gupta, A.K. (2018). Estimation of seed feed wastage ratio of major food grain crops in Odisha. *Journal of the Indian Society of Agricultural Statistics*, **72(3)**:201-204.
4. Ahirwar, R. N., Mishra, V. K., Chand, R., Budhlakoti, N., Mishra, D.C., Kumar, S., Singh, S. and Joshi, A. K. (2018). Genome-wide association mapping of spot blotch resistance in wheat association mapping initiative (WAMI) panel of spring wheat (*Triticum aestivum L.*). *PLoS ONE*, **13(12)**: e0208196.
5. Alam, W., Ray, M., Kumar, R. R., Sinha, K., Rathod, S. and Singh, K. N. (2018). Improved ARIMAX model based on ANN and SVM approaches for forecasting rice yield using weather variables. *Indian Journal of Agricultural Sciences,* **88 (12):** 1909-1913.
6. Alam, W., Sinha, K., Kumar, R. R., Ray, M., Rathod, S., Singh, K.N. and Arya, P. (2018). Hybrid linear time series approach for long term forecasting of crop yield. Indian *Journal of Agricultural Sciences*, **88 (8):** 1275-1279.
7. Anjoy, P., Chandra, H. and Basak, P. (2018). Estimation of disaggregate-level poverty incidence in Odisha under area-level hierarchical bayes small area model. *Social Indicators Research*, **144(1)**: 251-273.
8. Anokhe, A., Mandel, B., Kumar, R., Sharma, K., Ranjan, R. and Subramanian, S. (2018). Biochemical charecterisation of lipase in host specific *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) population collected from different agro ecological zone. *Journal of Entomology and Zoology Studies*, **6(6)**: 1304-1310.
9. Anuja, A. R., Kar, A., Kumar, P., Jha, G. K. and Singh, B. K. (2018). Analysis of factors triggering distress migration in Bundelkhand region of central India. *Economic Affairs*, **63(4)**: 1061-1065.
10. Arora, S., Sehgal, M., Srivastava, D. S., Arora, S. and Sarkar, S. K. (2019). Rice pest management with reduced risk pesticides in India. *Environmental Monitoring and Assessment*, 191: 241. http://krishi.icar.gov.in/jspui/handle/123456789/17706
11. Aswal, K., Jaggi, S., Varghese, E. and Varghese, C. (2018). Neighbour balanced designs for diallel cros experiments. *Journal of the Indian Society of Agricultural Statistics*, **72(2)**: 89-96.

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- Submitted drought transcriptome of Black Pepper crop (Collaborative work of ICAR-IASRI, New Delhi and ICAR-IISR, Kohzikode under CABin Scheme) BioProject: PRJNA515366; BioSamples: SAMN10754251 and SAMN10754252 (ICAR-IASRI: Sarika, Ankita Negi, Mir Asif Iquebal, UB Angadi, Anil Rai and Dinesh Kumar).
- Submitted metagenome data (In collaborative work by ICAR-IASRI, New Delhi and Central University, Mizoram), Group 1: BioProject: PRJNA486882; BioSample: SAMN09867606, SAMN09867607, SAMN09867608; SRA: SRR7777243, SRR7777244, SRR7777245
- Submitted metagenome data, (In collaborative work by ICAR-IASRI, New Delhi and Central University, Mizoram) Group 2: BioProject: PRJNA488863; BioSample: SAMN09943958, SAMN09943959; SRA: SRR7867912, SRR7867913
- Submitted metagenome data, (In collaborative work by ICAR-IASRI, New Delhi and Central University, Mizoram) Cave Sample: BioProject: PRJNA489154; BioSample: SAMN09949180; SRA: SRR7867915

Copyrights Received during 2018-19

Sr. No.	Name of Technology (Software)/Literary Work	Author(s)	Copyright Registration Number	Copyright Granted on
1.	Software for Estimation of Acreage under paddy in North Eastern Hilly Region	Prachi Misra Sahoo Anil Rai H.V. L. Bathla Tauqueer Ahmad Sameer Farooqi	SW-11725/2018	24.09.2018
2.	Software for small area estimation	Hukum Chandra Kaustav Aditya S.B. Lal	SW-10788/2018	31.05.2018
3.	Vortal for Training Program Management under Capacity Building Program- CBP Vortal	Alka Arora Sudeep Marwaha	SW-10580/2018	01.05.2018
4.	Antimicrobial Prediction server for cattle	Sarika M.A. Iquebal Vasu Arora Anil Rai Dinesh Kumar	SW-10688/2018	16.05.2018
5.	TomsatDb: Tomato Microsatellite Database	M.A. Iquebal Sarika Vasu Arora Nidhi Verma Anil Rai Dinesh Kumar	SW-10689/2018	16.05.2018
6.	PipeMicroDb: Pigeonpea Microsatellite Database	Sarika Vasu Arora M.A. Iquebal Anil Rai Dinesh Kumar	SW-10687/2018	16.05.2018
7.	TamiRPred: Putative miRNA Discovery Tool in Wheat (*Triticum aestivum* L.)	Sarika M.A. Iquebal Vasu Arora Ulavappa B. Angadi Rajender Singh Pradeep Sharma Sonia Sheoran G.P. Singh Anil Rai Ratan Tiwari Dinesh Kumar	SW-10685/2018	16.05.2018
8.	BuffsatDb: Buffalo Microsatellite Database	Sarika Vasu Arora M.A. Iquebal Anil Rai Dinesh Kumar	SW-10802/2018	04.06.2018

Sr. No.	Name of Technology (Software)/Literary Work	Author(s)	Copyright Registration Number	Copyright Granted on
9.	Antimicrobial Prediction server for Fish	Sarika Samar Fatma Vasu Arora M.A. Iquebal S. Nandi J.K. Sundaray P. Jayasankar Anil Rai Dinesh Kumar	SW-10838/2018	07.06.2018
10.	VIS*Ta*: Variety Identification System for *Triticum aestivum* (Wheat)	M.A. Iquebal Rajender Singh C.N. Mishra Sarika Deepender Kumar Nishu Raghav Surinder Paul Sonia Sheoran Pradeep Sharma Arun Gupta Vinod Tiwari Ulavappa B. Angadi Neeraj Kumar Anil Rai G.P. Singh Dinesh Kumar Ratan Tiwari	SW-10795/2018	31.05.2018
11.	TaSSRDb: *Triticum aestivum* SSR Database	Sarika Sonia Sheoran Vasu Arora Ulavappa B. Angadi M.A. Iquebal Nishu Raghav Bharti Aneja Deependra Kumar Rajender singh Pradeep Sharma G.P. Singh Anil Rai Ratan Tiwari Dinesh Kumar	SW-11115/2018	12.07.2018
12.	Sample Survey Resources Server	V.K. Gupta U.C. Sud Anshu Bharadwaj Hukum Chandra Rajender Parsad	SW-9073/2017	18.05.2017

9

Consultancy, Methodological & Computational Support

Consultancy services

Study on field testing of the developed guidelines on estimating post-harvest losses of horticultural crops, livestock products and fish and fish products

(Tauqueer Ahmad, Anil Rai, Prachi Misra Sahoo, Ankur Biswas, Man Singh and Kaustav Aditya)

Under Institutional Consultancy mode funded by FAO of the United Nations (FAO), Rome this study has been carried out. Under this study, two countries namely Mexico and Zambia were identified by FAO for field testing of the three guidelines for estimating post-harvest losses of horticultural crops, livestock products and fish and fish products respectively. Questionnaires were designed for all the three products and were finalized after discussion with FAO. CAPI version of the developed PAPI questionnaires was developed with FAO's assistance.

Class room as well as field training was imparted to the Nodal officers and Enumerators for field testing on post-harvest losses of fruits and vegetables (primary data collection) in Mexico and of livestock products (meat and milk) in Zambia (Fig. 9.1). Pre-testing of questionnaires was done for both the commodities

Fig. 9.1: Field testing of developed guidelines at Mexico and Zambia

before starting the data collection work in respective countries. Data collection was carried out using Computer Assisted Personal Interviewing (CAPI) method. Appreciation email has been received from FAO, Rome for successful conduct and on-time (as per LoA) completion of the study during a short span of time.

Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Madhya Pradesh State

(Tauqueer Ahmad, UC Sud (till 31.07.2017), Prachi Misra Sahoo, Anil Rai, Kaustav Aditya, Raju Kumar, Man Singh and Neelam Chandra)

This project under Institutional Consultancy mode is funded by Madhya Pradesh State Govt. Under this project, data entry, scrutiny of data entered and data analysis were completed. Data analysis was carried out using data analysis software developed under CHAMAN project. Output tables were prepared. Area and production estimates of fruits and vegetables for all the districts surveyed in the State were found to be reliable.

Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Haryana State

(Tauqueer Ahmad, UC Sud (till 31.07.2017), Prachi Misra Sahoo, Anil Rai, Ankur Biswas, Vandita Kumari, Man Singh, and Neelam Chandra)

This project under Institutional Consultancy mode is funded by Haryana State Govt. Under this project, scrutiny of entered data and data analysis were completed. Data analysis was carried out using data analysis software developed under CHAMAN project. Output tables were prepared. Area and production estimates of fruits and vegetables for all the districts surveyed of the State were found to be reliable. Data analysis for non-surveyed districts in the State was carried out using various modeling techniques namely Regression analysis, ARIMA, ARIMAX, PCR and LASSO. Output tables for non-surveyed districts were also prepared.

Customization and Implementation of Academic Management System (AMS) for Post Graduate and Under Graduate Education at UHS Bagalkot

[Sudeep, AK Choubey (till 20.01.2018)]

Academic Management System (AMS) for University of Horticultural Sciences (UHS), Bagalkot, Karnataka has been deployed during October 2017, and continues to be customized as per their needs

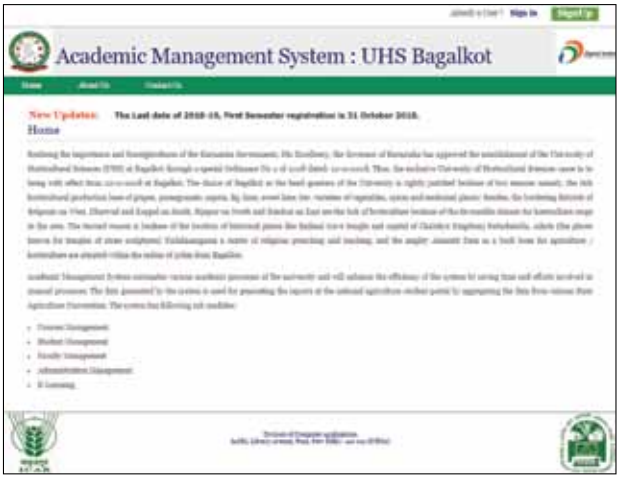

Fig. 9.2: Home page of Academic Management System for Post Graduate and Under Graduate Education at UHS, Bagalkot

Fig. 9.3: Listing of Students – Discipline-wise in AMS for PG and UG Education at UHS, Bagalkot

(Figs…). The AMS automates various academic processes of the university and enhances the efficiency of the overall system by saving time and efforts reducing manual processes. The system can be accessed at https://amsuhs.icar.gov.in.

The data collated by the system is used for generating the reports that are being used by the respective users of the system directly, viz. Students, Professors, Faculties, Controller of Examination, Head of Departments & Deans etc. The first batch of students admitted via AMS is the batch of 2017-18 of M.Sc. (Horticulture) and Ph.D. Since then, all the university students (both UG & PG) are admitted through the AMS only.

Regular SKYPE/LYNC meetings have been conducted with UHS Team from time to time to provide support and for gathering requirements for further customization.

The most recent development encompasses the following functionalities:

- Additional Examiner for Qualifying Examination and Thesis submission. The feature empowers the Dean, PGS to assign Additional & External Examiner for classified delegation of roles for activities like:
  - Qualifying Examination, and
  - Thesis submission
- Online Fee-submission (using SBI ePay)

  The feature to collect different categories and types of fees, by students, has been implemented and is being tested by the UHS and ICAR-IASRI Team.

Fig. 9.4: Online Fee Submission by student using ePay in AMS for PG and UG Education at UHS, Bagalkot

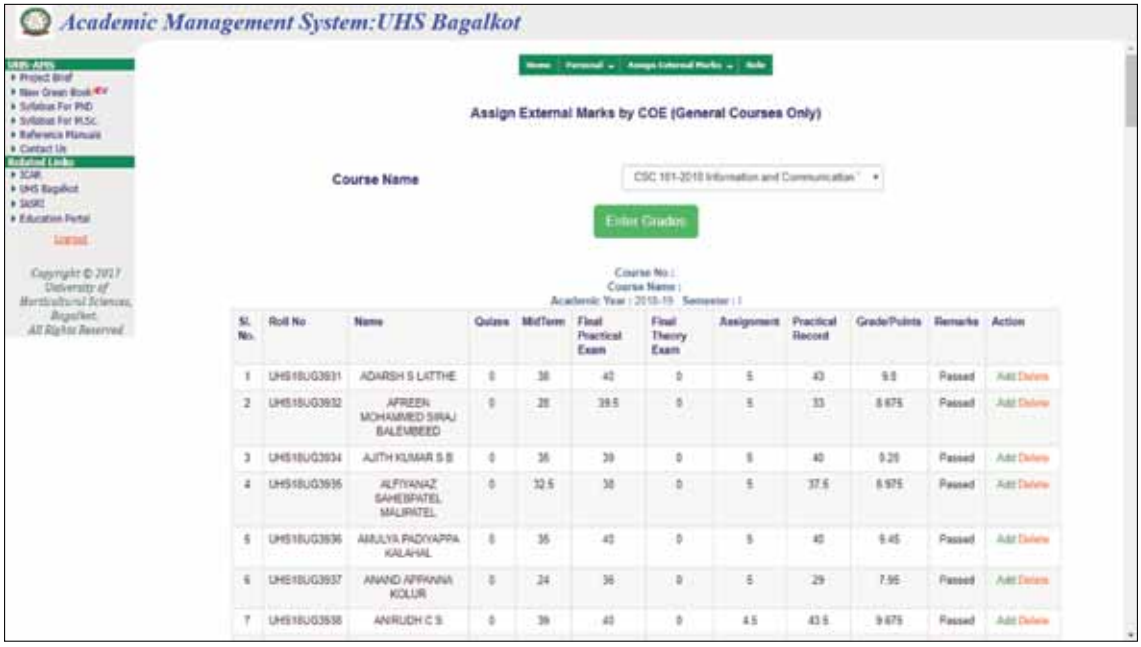

Fig. 9.5: Course-wise examination marks uploading feature, User Role: CoE in AMS for PG and UG Education at UHS, Bagalkot

Significant methodological support and computational activities

Strengthening Statistical Computing for NARS: Platform for statistical computing

Statistical computing methods enable to answer quantitative biological questions from research data and help plan new experiments in a way that the amount of information generated from each experiment is maximized. Widespread use of computers and specialized high end statistical software packages have helped and greatly improved the ability of researchers to analyze and interpret voluminous data. Developments in computerized statistical analysis have enhanced the ability of researchers to come up with better conclusions. This has helped in improving their statistical, computer-related and networking skills of the researchers. For exploiting and sustaining these developed skills, availability of proper computing and infrastructure facilities to agricultural research in National Agricultural Research System (NARS) is of utmost consequence for improving their skills. The statistical computing support would be useful in improving the quality of agricultural research and make it globally competitive and acceptable by way of publications in International refereed Journals. The present platform for statistical computing, also known as "NARS Statistical Computing Portal", available at http://www.iasri.res.in/sscnars/, therefore, targets at providing technical support on the component of statistical computing by applications of general purpose statistical software package that help in undertaking appropriate, sophisticated and computationally involved statistical analysis of data keeping in mind also the accuracy and precision of analysis. It has been created to enable a healthy statistical computing environment for the benefit of the scientists in NARS by way of providing advanced, versatile, and innovative and state-of the art high end statistical packages and aiding them to draw meaningful and valid inferences from their research.

During the period under report, the following activities have been done.

SAS licenses for the year 2018-19 have been received. SAS license files have been uploaded on Resources Page of the Indian NARS Statistical Computing Portal (http://stat.iasri.res.in/sscnarsportal/public) under the link SAS License 2018-19.

Technical support was provided to Scientists/ Faculty of 18 NARES organizations regarding accessibility of Indian NARS Statistical Computing Portal and downloading of license files, updated IP addresses. The details are: (i) Dr. J. Mallikarjuna, Scientist (Entomology), ICAR-National Institute of Biotic Stress Management, Raipur regarding installation of SAS through Team Viewer and gave a demo on SAS Enterprise guide; (ii) Dr. Sabina Islam, Scientist, Division of Vegetable Science, ICAR- IARI, New Delhi regarding use of Indian NARS Statistical Computing Portal; (ii) Sh. Manjunatha G.A., Ph.D. Student, Department of Plant Breeding and Genetics, Kerala Agricultural University was advised to use Indian NARS Statistical Computing Portal for the analysis of data from augmented designs; (iii) Sh. Sanjeev Mathur, Assistant Chief Technical Officer ICAR-NBAGR, Karnal regarding installation of JMP Genomics 5.1.; (iv) Dr N Subhash, Nodal officer ICAR-IIFSR, Modipuram for use of Indian NARS Statistical Computing Portal; (v) Dr. Latika Sharma, MPUAT, Udaipur regarding SAS Code for analysis of data generated through a split plot design; (vi) NRC Grapres, Pune regarding downloading of License files and License files were sent to Institute of Agricultural Sciences, BHU, Varanasi and (vii) Dr. D. Karunakaran, ICAR-NIANP, Bengaluru was provided technical support on Hotfix installation for SAS Enterprise Guide 4.2. (Solution: Use the link http://ftp.sas.com/techsup/download/hotfix/HF2/A53.html#33359 and Download: A53013wn.exe and run it).

The portal is being extensively used throughout NARES and thus it continues to help the researchers in analyzing their data in an effective manner. Based on the user logged information, the total number of logged in users from Indian NARES during April 01, 2018- March 31, 2019 are 95,098 which is on an average more than 260 logged in per day (Fig.).

Statistical Computing Lab was used for (i) JMP genomics on 13th April, 2018 Computational and Statistical Advances for Analysis of Biological Data

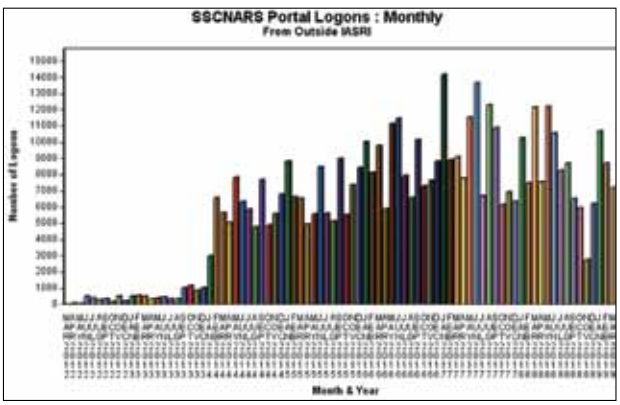

Fig. 9.6: Bar diagram of user logged information regarding NARS Statistical Computing Portal

in Agriculture during March 24-April 13, 2018; (ii) one day session (July 18, 2018) of CAFT "Emerging Issues in Markets, Institutions and Resource use planning for Sustainable Agriculture" organized by Division of Agricultural Economics, ICAR-IARI, New Delhi during July 12- August 01, 2018; (iii) Recent trends in Data Analytics and Knowledge Management (on September 10, 2018 and September 14, 2018 half day each); (iv) Handling large Scale Data and Data Analysis using R for the Indian Statistical Officers, Ministry of Statistics and Programme Implementation, Govt. of India organized at ICAR-IASRI, New Delhi during October 08-13, 2018; (v) Advanced Sampling Techniques with Practical Examples for the Indian Statistical Officers, MoSPI, Govt. of India during October 29- November 03, 2018; (vi) Advances of Experimental Designs and Analysis during 06-26 December, 2018; (vii) Experimental Designs and Statistical Data Analysis during January 03-09, 2019; (viii) Winter School on Recent Advances in Statistical Techniques for Data Analysis in Agriculture during January 10-30, 2019; (ix) Modular Course on Basic Statistical Methods in Agriculture for Afghanistan National Agricultural Sciences and Technology University Students under International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy" from February 03-23, 2019 at ICAR-IASRI, New Delhi; (x) Unit Level Data Repository for AICRPs during February 03-23, 2019; (xi) Half a day session on 27.02.2019 on Recent Advances in Modelling and Forecasting for Agricultural Data Analysis during February 23-March 15, 2019; (xii) Recent Advances in Agricultural Surveys: Remote Sensing and GIS Applications sponsored by AARDO organized during March 11-31, 2019 (except March 18-19, 2019) and (xiii) ICAR KRISHI Portal: A Central Research Data Repository during March 18-19, 2019.

Sensitization of Researchers and Feedback were also done. The details are given subsequently. Dr. Arup Kumar Sharma, Nodal Officer, Assam Agriculture University, Jorhat, informed that during 2016-17, 20 students (05 M.Sc. from College of Fishery, Raha and 15 students from Livestock Production Technology, Veterinary Surgery, Veterinary Medicine Extension education, Parasitology, Pharmacology and microbiology, College of veterinary Science) utilized SAS Software for their thesis. Besides, at faculty level also Project in-charge on Elephant Project requested us to process data for project report. Website of the project is being maintained and updated regularly. The website has been updated by including updated list of new Nodal Officers nominated from (i) ICAR-CIRCOT, Mumbai; (ii) ICAR-NRC on Seed Spice, Ajmer. Website is registered under google analytics on November 15, 2010. Till March 31, 2019, there were 123441 page views across 724 cities of 98 countries. During April 01, 2018 to March 31, 2019, there were 10,207 page views across 259 cities of 57 countries and average time on each page was 3.07 minutes (Fig.).

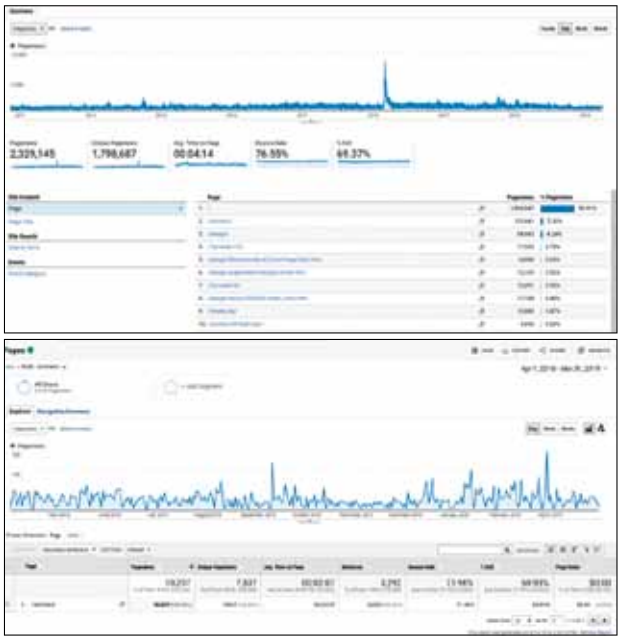

Fig. 9.7: Screenshot of number of page views NARS Statistical Computing Portal

Strengthened Design Resources Server

Design Resources Server is in fact a Design of Experiments Server created with an objective to disseminate research in Design of Experiments among peers over the globe. The server aims to spread the advances in theoretical, computational, and statistical aspects of Design of Experiments among the mathematicians and statisticians in academia and among the practicing statisticians involved in advisory and consultancy services. One of the goals of the server is to help the experimenters in agricultural sciences, biological sciences, social sciences and industry in planning and designing their experiments. The site makes available design theory and the actual layout of the designs through web. Electronic books on design of experiments and advances in data analytical techniques are also available on the server. Exposition to software packages useful in the statistical analysis of data followed by statistical principles on various topics and their real life applications are also available.

During the period under report, the following activities have been done.

- For dissemination of research in Design of

Experiments, Design Resources Server (www.iasri.res.in/design) was further strengthened by adding the links of online modules of generation of following designs through their catalogue: (i) Incomplete block designs for incomplete two-factor factorial experiments at http://iasri.res.in/design/IFE/IFE.htm; (ii) Nearly balanced treatment incomplete block designs at http://iasri.res.in/design/nbtib/NBTIB.htm; (iii) Nearly balanced bipartite block designs at http://iasri.res.in/design/nbbpb/NBBPB.htm (Fig.).

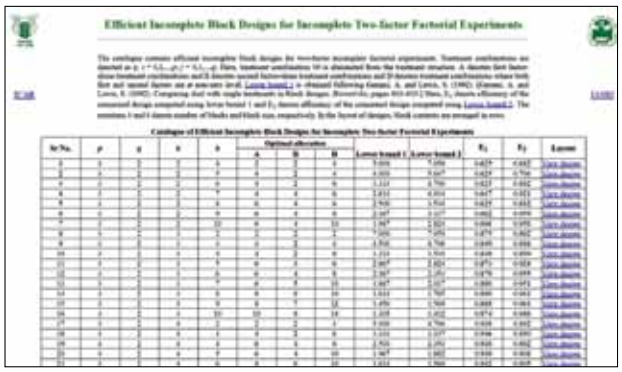

Fig. 9.8: Incomplete Block Designs for Incomplete Two-factor Factorial Experiments

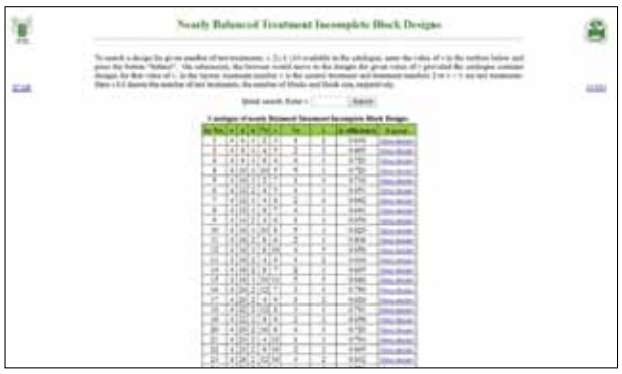

Fig. 9.9: Nearly balanced treatment incomplete block designs

- Usage of the Server has increased over time. The server has a facility of "Ask a Question" through which a lot of questions are being received and answered. More than 15 questions asked during this period, were answered for providing e-advisory services. Till

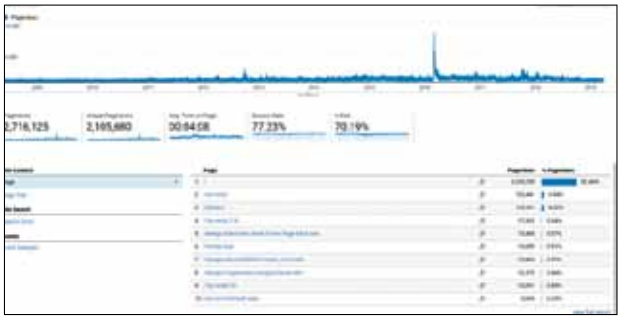

Fig. 9.10: Screenshot of number of page views Design Resources Server

March 31, 2019, there were 1,54,629 page views and 996 cities of 123 countries. During April 01, 2018 to March 31, 2019, Google Analytics gave 10,902 page views across 432 cities of 87 countries. Average time taken on page is 3.33 minutes

ICAR Personnel Management System (PMS)

ICAR Personnel Management Information System has been designed, developed and implemented across ICAR (Fig.). The system has been designed using n-tier architecture of web development using .NET technology for application layer and MS SQL Server as database layer. The system is accessible at http://pms.icar.gov.in.

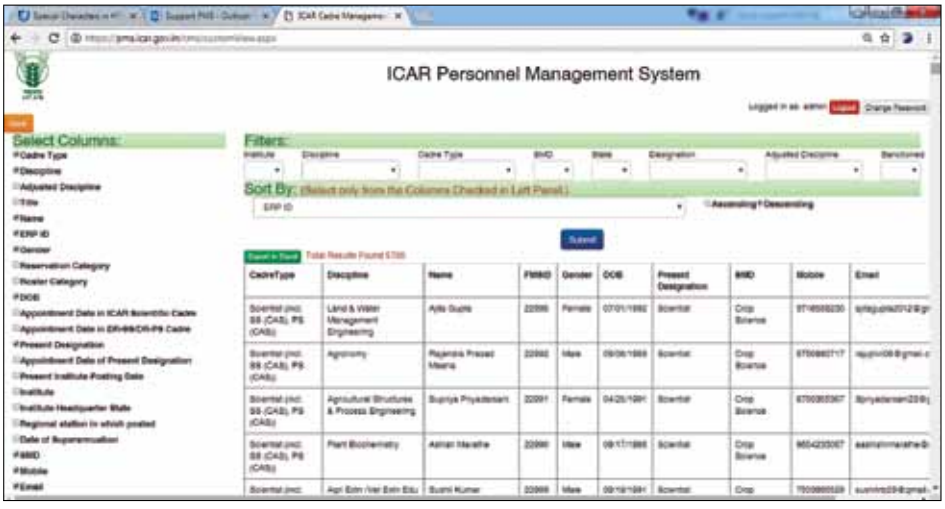

Fig. 9.11: Select & Search Filter in PMS

During the period under report, the following activities have been done.

- Administrative and financial cadre personnel information has been added in PMS. Functionality like Manage transfer cycle, Manage cadre type, Manage sanction strength and Block/ unblock institute-wise vacancy were done. MIS Reports were developed for Admin/Finance personnel list with various filters and Cadre-wise vacancy page. As per the revised guidelines, Mutual Transfer Policy has been incorporated in Admin Transfer cycle, based on their ERP ID. 'To be deemed vacant' option also considered for admin transfer cycle.
- Two phases of Admin Transfer Cycle during 22-29 Oct 2018 (15 applied) and Finance Transfer Cycle during 01-07 Nov 2018 (15 applied) were opened.
- Functionality like update Retirement status and Block discipline and institute-wise vacancy were implemented for 2018 Transfer cycle. Transfer cycle 7-16 May 2018 was managed and total 139 applications were received for the same.
- KVK institute information added and accordingly, sanction strength updated in system for KVK Transfer cycle (14-Sep-2018). A total of six applications were received.
- HYPM Accounts (191) were created for FOCARS personnel. FOCARS 107, 108 and 109 batches postings were respectively held on 26 June, 2018 (24 Posted), 26 September, 2018 (135 Posted) and 26 March, 2019 (30 Posted).
- In PMS, Parameters has been Encrypted for Security reasons.
- Annual Immovable Property Return Cycle has been activated for the year 2019.
- Support was provided across ICAR institutes to resolve issues reported from time to time like programming bug, deletion of wrongly uploaded AIPRs, change in sanctioned strength of institutes, discipline names, ERP ID, ICAR Email etc.

Indian Council of Agricultural Research - Portal

ICAR-Portal is an integrated system which provides information on all institutions/ Regional Centres and KVKs under a single platform. This system has reduced the dependence of administration on the use of Institutional, Regional Centres and KVKs during cultivation of Institutional data and financial/ budgeting data. It also provides information on AICRP projects, major achievements, RAC/IRC/ IMC/QRT meetings, land assets and RMPs which provide a Master Monitoring system to higher authority or nodal officers to keep an eagle eye on the institute activities as well as the Institutional network and availability of employees in a particular institute. The portal can be accessed through url: https://iims.icar.gov.in/.

During the period under report, the following activities have been done.

- Created new form for Nodal Officer (Admin Officer, PME Incharge, Finance Officer, Extension Activity Incharge) to display their details on institute profile.
- Reporting module for internal monitoring has been created and uploaded on the portal.
- Advanced search functionality has been created.
- Dashboard functionality has been developed.
- Expired session functionality has been created and new webpage has been created which redirects after session timeout period.
- User Login page has been redesigned and developed.
- LDAP Login and authentication functionality has been developed.
- User manual has been prepared and available at the portal download section .
- The portal has been opened for all institutes to upload the data.
- Support has been provided to all users to resolve the queries over email and phone.
- Data is being entered by institutes. The summary of data is available on Dashboard.
- The user can login using the @icar.gov.in Email ID as User ID to ICAR Portal for the Nodal Officers of all the Institutes.
- A query based testing webpage is developed to check the data updated on the portal for the Android application for DG, Secretary and DDG's of ICAR.
- Work on the ICAR splash for the portal has been initiated.

Review of IT System in ICAR

- Coordination of the ICT Roadmap of ICAR has been initiated by our institute. The following activities have been done so far.
- Coordinated the ICT Roadmap activity with M/s KPMG personnel.
- First draft of inception report for ICT Roadmap has been prepared.
- M/s KPMG prepared the GAP analysis report and presented in a meeting held on August14, 2018 at Krishi Bhawan under Chairmanship of Secretary, DARE and DG, ICAR.
- The draft report has been submitted and presented in a meeting held on February 14, 2019 at Krishi Bhawan under Chairmanship of Secretary, DARE and DG, ICAR.

Agricultural Research Data Book (ARDB) 2018

The Agricultural Research Data Book (ARDB 2018) published by the Division of Sample Surveys, , which is twenty-first in the series, comprises of 173 tables organized into 10 sections namely, Natural Resources, Agricultural Inputs, Animal Husbandry, Dairying and Fisheries, Horticulture, Production and Productivity, Agricultural Engineering & Produce Management, Export & Import, India's Position in World Agriculture, Investment in Agricultural Research & Education and Human Resources under National Agricultural Research System (NARS). For depicting state-wise data, thematic maps were prepared using Geographical Information System (GIS) (Fig.).

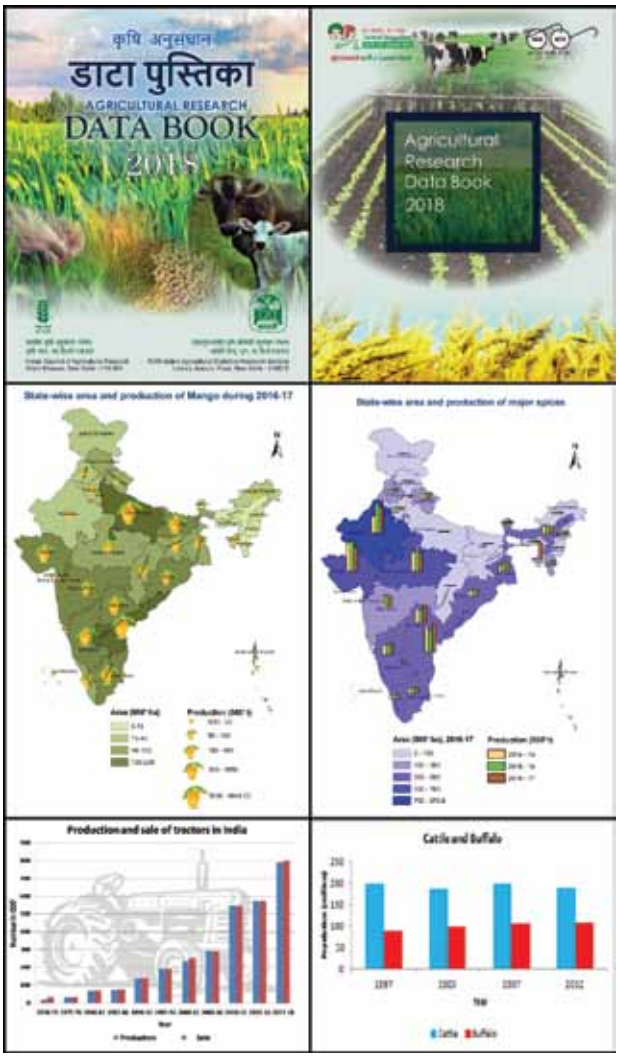

Fig. 9.12: Cover page of Agricultural Research Data Book (ARDB 2018) and thematic maps cum other diagrams depicting state-wise data

ASHOKA (Advanced Supercomputing Hub for Omics Knowledge in Agriculture)

The High Performance Computing (HPC) facility has been created to help the biologists in performing the bioinformatics data analysis. The computing jobs are being submitted through GUI based National Agricultural Biocomputing portal as well as Command Line Interface (CLI). This system is also equipped with modern age open source software tools, pipelines, workflows as well as CLC Genomics Workbench and other proprietary software. The computer intensive analytical support is also being continuously provided to NARES institutions. Large numbers of databases, web servers and software pipelines have been developed by the centre. These software tools are being widely used by various stakeholders.

Videoconferencing facility

The videoconferencing facility is useful in providing the interactive virtual platform for interaction among various researchers and personnel. This facility has been used to conduct online meetings and interactions among scientists and researchers to discuss various issues pertaining to project proposals, monitoring of progress as well as other day to day official matters of mutual interest.

10

RAC, IMC, IRC and QRT

Institute Research Committee (IRC)

The Institute Research Committee (IRC) is an important forum to guide the scientists in the formulation of new research projects and it also prioritizes and reviews the progress of on-going research projects periodically. It also monitors the follow up action on the recommendations of the Quinquennial Review Team (QRT) and Research Advisory Committee (RAC) in respect of technical programmes of the Institute. Director, ICAR-IASRI is the Chairman and In-Charge, PME cell is the Member Secretary of the IRC. During the period 2018-19, 29 new research projects were approved and progress of 134 on-going research projects were reviewed. Also, 10 research projects were declared complete.

Two meetings (89th and 90th) of the IRC were held during October 30-31, 2018 and May 16-17, 2019 respectively.

In the 89th meeting, 16 new research projects (05 Institute funded and 11 outside funded) were approved and progress of 61 ongoing research projects (26 Institute funded, 03 in collaboration with other Institutes and 32 outside funded) were discussed and 04 research projects were declared as complete.

In the 90th meeting, 13 new research projects (04 Institute funded, 09 outside funded) were approved and progress of 73 on-going research projects (28 Institute funded, 03 in collaboration with other Institute and 42 outside funded) were reviewed and 06 research projects were declared as complete.

Institute Management Committee (IMC)

The 67th Meeting of the Institute Management Committee (IMC) was held on 19th February, 2019. The following members were present:

1.	**Dr. L.M. Bhar,** Director (A), ICAR-IASRI	Chairman
2.	**Mr Rajya Kumar Agrawal,** Non-Governmental Member	Member
3.	**Dr Sunil Archak,** Principal Scientist, ICAR-NBPGR, New Delhi	Member
4.	**Dr Rajni Jain,** Principal Scientist, ICAR-NIAP, New Delhi	Member
5.	**Dr Amit Kar,** Principal Scientist & Head(A), Division of Agricultural Economics, ICAR-IARI, New Delhi	Member
6.	**Dr. P. S. Pandey,** Assistant Director General (EP&HS), ICAR, New Delhi	Member
7.	**Mrs Sanjeevan Prakash,** DDF(II), ICAR, New Delhi	Member
8.	**Mr. Vijay Kumar,** Head of Office, ICAR-IASRI	Member Secretary
9.	**Dr. Tauqueer Ahmad,** Head, Division of Sample Surveys, ICAR-IASRI	By invitation
10.	**Dr. K.N. Singh,** Head(A), Division of F&ASM, ICAR-IASRI	By invitation

11.	**Dr. Anil Rai,** Head(A), CABin, ICAR-IASRI	By invitation
12.	**Dr. Seema Jaggi,** Head(A), Division of Design of Experiments and Incharge, TAC, ICAR-IASRI	By invitation
13.	**Dr. Ajit,** Principal Scientist & In-Charge-PME Cell, ICAR-IASRI	By invitation
14.	**Dr. Hukum Chandra,** National Fellow (ICAR)	By invitation
15.	**Dr. A.R. Rao,** Principal Scientist and Professor (Bioinformatics)	By invitation
16.	**Dr. Sudeep,** Head(A), Division of Computer Applications, ICAR-IASRI	By invitation
17.	**Mr. Subhash Chand,** ACTO, ICAR-IASRI	By invitation
18.	**Mr. Yogesh Kadian,** Administrative Officer, ICAR-IASRI	By invitation
19.	**Mrs. Usha Jain,** STO, ICAR-IASRI	By invitation
20.	**Mr. Amit Kumar Marwari,** AF&AO, ICAR-IASRI	By invitation

The important issues discussed are as below:

At the outset, Dr. L.M. Bhar, Director (A), ICAR-IASRI, welcomed all the members of the IMC. The Proceedings of 66th IMC meeting were confirmed. In the meeting, Dr. P.S. Pandey, ADG(EP&HS), ICAR suggested that the staff quarters of our institute at Krishi Niketan, Paschim Vihar be maintained and repair be done so that the quarters is in good condition. He opined that necessary action be taken towards its intense repairing and renovation. Having discussed the agenda in meeting thoroughly, committee members recommended that the Institute may process this issue with ICAR for necessary decision/ action on the matter. He also suggested sending a proposal for including the names of our staff in the central pool of government quarters located at Delhi.

The members appreciated the action taken of the minutes of the previous meeting. Dr. Ajit, Incharge, PME cell made a presentation on Institute Research activities, including completed research projects and ongoing projects. The members appreciated the research activities especially technologies developed and copyrights received.

Dr. Seema Jaggi, Principal Scientist and Training & Administration Incharge gave a presentation on the training and teaching activities of the institute. The house was satisfied with the teaching and training activities going on at IASRI. The IMC members suggested that a Mobile App may be developed on Mera Gaon Mera Gaurav in order to be helpful for the farmers for them getting relevant information directly in their mobiles in a handy and convenient manner. Also the members suggested that a training program on Artificial Intelligence be imparted by the institute, as this is the need of the hour. The list of equipment to be procured for the financial year 2018-19 of EFC with tentative cost and justification was discussed and considered for approval of the members. The Committee agreed to the agenda item as proposed. Budget Estimate for the year 2018-19 and actual expenditure incurred upto 31.01.2019 was presented before the members. While going through the expenditure, the members took a note on the amount spent. The members were assured for full utilization of funds in time. The Grievance committee was re-constituted. The progress of the work done in Hindi at the institute was appraised to the IMC team and it was appreciated by the team.

Research Advisory Committee (RAC)

The 19th meeting of the Research Advisory Committee (RAC) of ICAR-IASRI was held on 8th May, 2018 under the Chairmanship of Professor R.B. Singh. The following were present:

1.	**Prof. R.B. Singh,** Chancellor, CAU, Imphal Former-Chairman, ASRB and Former-Director, IARI	Chairman
2.	**Dr. A.K. Nigam** Consultant Advisor, IASDS, Bengaluru	Member
3.	**Dr. Sangeeta Verma** Principal Advisor Department of Consumer Affairs, Krishi-Bhavan, New Delhi	Member
4.	**Dr. S.D. Sharma** Former-Vice Chancellor, DSVV, Haridwar and Former-Director, IASRI	Member

5.	**Dr. V.K. Gupta** Former ICAR-National Professor, New Delhi	Member
6.	**Dr. P. S. Pandey** Assistant Director General (EP&HS), ICAR, New Delhi	Member
7.	**Dr. L.M. Bhar,** Director (A), ICAR-IASRI	Member
8.	**Dr. Ajit,** Principal Scientist & In-Charge-PME Cell, ICAR-IASRI	Member Secretary
9.	**Dr. Sudeep Marwaha,** Head(A), Division of Computer Applications, ICAR-IASRI	By invitation
10.	**Dr. Anil Rai,** Head(A), CABin, ICAR-IASRI	By invitation
11.	**Dr. K.N. Singh,** Head(A), Division of F&ASM, ICAR-IASRI	By invitation
12.	**Dr. Seema Jaggi,** Head(A), Division of Design of Experiments and Incharge, TAC, ICAR-IASRI	By invitation
13.	**Dr. Tauqueer Ahmad,** Head, Division of Sample Surveys, ICAR-IASRI	By invitation
14.	**Dr. Rajender Parsad,** Principal Scientist, ICAR-IASRI	By invitation
15.	**Dr. A.R. Rao,** Principal Scientist and Professor (Bioinformatics)	By invitation
16.	**Dr. Hukum Chandra,** National Fellow (ICAR)	By invitation
17.	**Dr. A.K. Paul,** Principal Scientist, ICAR-IASRI	By invitation

Dr. Alok Bhattacharya Professor, School of Life Sciences, JNU, New Delhi and Member-Research Advisory Committee, could not attend the meeting because of personal reasons.

At the outset, Dr. L.M. Bhar, Director (A), ICAR-IASRI, welcomed all the members of the RAC and made a brief presentation about the major achievements of the Institute. This was followed by deliberations of members of RAC. Thereafter, all the Heads of the Divisions presented the research achievements of their respective Divisions. There was a healthy and constructive discussion and interaction on the research, teaching and training activities of the Institute. All the members unanimously complimented the Director and Heads of Divisions for an excellent research output, teaching and training activities of the Institute and for doing an excellent work for NARES. They also expressed that the Institute is progressing very well and must continue to play an important role in NARES.

From the day long deliberations, presentations and discussion, the following action points emerged:

Recommendation-1	Efforts should be made to develop indices related to agriculture viz. hunger-index, food-index, drought-index, nutritional index, farmers' income-index, soil-health index, obesity index etc.
Recommendation-2	ICAR-IASRI should focus its efforts on innovative, non-trivial, application oriented research with renewed vigour and zeal. ICAR-IASRI should take up pilot study on homogeneity of agricultural practices and reducing the number of CCEs (crop-cutting-experiments). Efforts should be made to find out an alternative to CCEs, utilizing the applications of RS and GIS for forecasting area and production.

Recommendation-3	A committee be constituted to deliberate on MSP (minimum support price) of important agriculture commodities taking into consideration the past studies conducted by the Institute on cost of cultivation, in relation to doubling farmers' income by 2022.
Recommendation-4	The number of scientific positions at IASRI should not be reduced, rather it should be further strengthened so as to commensurate with the challenging programmes that IASRI is undertaking.
Recommendation-5	The number of on-going projects at the Institute may be reduced and efforts be made to develop mega projects, consisting of scientists across Divisions and across disciplines, keeping in view the need and constraints of the farming community in mind.
Recommendation-6	For delivering the services required by the Council, enough infrastructure as well as technical manpower be strengthened so that both research and research based services can be delivered by the Institute. Moreover, the Service-Expenditures (viz. AMC of ASHOKA and ICAR-Data Centre) which are huge and significant are at present being drawn from IASRI Budget, leaving only a petty Budget-portion for IASRI as a whole (including CABin as well). These Service Expenditures should be put under ICAR-Headquarter funds and not as part of IASRI fund.
Recommendation-7	A document on ASHOKA must be published at the earliest possible. Also, a document highlighting the accomplishments/ achievements of the two AICRP-Projects running in collaboration with PDFRS, Modipuram (On-Farm and On-Station research) may also be published. Each Division must prepare a Critical Report in context of the need of the country, divisional outputs with facts and figures and overall divisional achievements with their impacts in economic and social terms. Overall, a comprehensive document on IASRI must be brought out highlighting its own importance. This document should include the success stories of last 25-50 years and uniqueness/ impact of our research. A committee be constituted to undertake this task on priority.

Quinquennial Review Team (QRT)

Quinquennial Review Team (QRT) for the period of 2011-12 to 2018-19 at ICAR-IASRI, New Delhi is in place for reviewing the activities of our institute. The QRT consists of the following members:

1.	**Dr. G.C. Manna** Ex-DG, CSO, Ministry of Statistics & Programme Implementation, Govt. of India, New Delhi	Chairman
2.	**Dr. Ashish Kumar** Ex Senior Economic Advisor, Ministry of Road Transport, Highways & Shipping, Govt. of India, New Delhi	Member
3.	**Prof. Rita Saha Ray** Professor, Indian Statistical Institute, Kolkata, West Bengal	Member
4.	**Prof. N. Balakrishna** Professor, Cochin University of Science and Technology (CUSAT), Kochi, Kerala	Member
5.	**Prof. B. V. S. Sisodia** Former Professor & Head, Department of Agricultural Statistics, Narendra Dev University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh	Member
6.	**Dr. Sridhar Sivasubbu** Principal Scientist , CSIR-Institute of Genomics and Integrative Biology (IGIB), Mathura Road, New Delhi	Member
7.	**Dr. Hukum Chandra** National Fellow & Principal Scientist, ICAR-IASRI, New Delhi	Member Secretary

The QRT conducted its meetings on November 16-17, 2018 and April 24, 2019 and interacted with the Scientists of the institute. Finalization of recommendations has been initiated by the team.

11

Paper Presentations and Participation in Conferences/Workshops & other Events

Papers presented

- 61st Annual Maize Workshop (AICRP on Maize) held at Hill Agricultural Research and Extension Center, CSHPKV, Bajaura (HP) during April 07-09, 2018
  - Rajender Parsad. Design and analysis of multi-location varietal trials (Invited talk).
- National Workshop on Sustainability of Indian Agriculture: Socio-Economic Perspective organized at NASC Complex, New Delhi by ICAR-NIAP, New Delhi on November 27, 2018
  - Rajender Parsad and B.M.K. Raju. Methodology for constructing composite index for sustainable agriculture (Invited Talk).
- Twenty-Seventh International Conference of Forum for Interdisciplinary Mathematics (FIM) in conjunction on Interdisciplinary Mathematics, Statistics and Computational Techniques organized by Department of Statistics, University of Jammu, Jammu during November 02-04, 2018
  - Rajender Parsad. Significance of factorial experiments and web resources in agricultural research (Plenary Talk).
- 72nd Annual Conference of Indian Society of Agricultural Statistics on Statistics, Informatics and Engineering Interventions - A Roadmap to Transform Indian Agriculture towards Prosperity during December 13-15, 2018
  - Garima Singh and B. N. Mandal. On block designs for comparing test treatments with control(s). (presented in the students' session)
  - Anindita Datta, Seema Jaggi, Cini Varghese, Eldho Varghese, Mohd Harun and Arpan Bhowmik. Mating plans for breeding programmes using generalized row- column designs (invited talk)
  - Eldho Varghese, Seema Jaggi, T.V. Sathianandan, Arpan Bhowmik and Cini Varghese. Cost-efficient response surface designs (invited talk)
  - Cini Varghese, Akhilesh Jha, Mohd. Harun, Eldho Varghese and Seema Jaggi. Affine resolvable partially balanced incomplete block designs. (invited talk)
  - Himadri Ghosh. Richards Stochastic differential equation modeling and forecasting under random diffusion.
  - R. K. Paul. Wavelet based hybrid time series models and their applications.
  - P.K. Meher. Measuring nucleotide associations: A statistical approach.
  - H. S. Roy. Expression quantitative trait loci analysis in Barley.
  - Raju Kumar and T. Ahmad. Outlier(s) imputation of survey data using calibration approach.
  - Raju Kumar, U.C. Sud, A. Biswas and D. Singh. Estimation of Population Ratio using Calibration Approach
  - A.R. Rao. Computational approaches to understand host pathogen interactions in foot-and-mouth disease (FMD) of cattle
  - S.B. Lal. Apache Spark for Bioinformatics Applications
  - Sarika Jaiswal, MA Iquebal, UB Angadi, Anil Rai and Dinesh Kumar. Development of computational tool for microsatellite DNA marker

- M.A Iquebal,, Sarika Jaiswal, Dinesh Kumar and Anil Rai. Computational approach for breed and variety identification using molecular markers
- Sarika Jaiswal, M.A. Iquebal, Anil Rai and Dinesh Kumar. Agri-germplasm phenotype and genotype data management: Computational Approaches and Challenges
- Soumen Pal. Data Sharing across Applications using Web API: Case Study of Mobile App and Web Portal
- Shashi Dahiya. Learning Analytics for Academic Performance Evaluation - A Case Study .
- Achal Lama, K N Singh and Bishal Gurung. Comparative study between ARIMAX and Bayesian ARIMAX model
- Rajesh T., Alka Singh, K.N. Singh, Harish Kumar H.V., A. R. Anuja and G.P. Shivaswamy. Impact of RKVY Expenditure on State Plan Agricultural Expenditure: A Co-integration Analysis
- D C Mishra, Samarendra Das, Sudhir Srivastava, Neeraj Budhlakoti, K K Chaturvedi, Sanjeev Kumar, Anil Rai. Application of Data Mining Techniques in Bioinformatics
- K.K. Chaturvedi. Big Data Handling in Agriculture: HPC, Hadoop or Spark.
- S. Guha, and H. Chandra. Improved Estimation of Finite Population Mean involving two auxiliary variables in two phase sampling with subsampling the nonrespondent.
- S. Islam, and H. Chandra. Small Domain Inference Combining Data from Two Independent Surveys.
- V. Kumari, H. Chandra, L.M. Bhar and K. Aditya. Calibration approach based estimation of regression coefficient using auxiliary data.
- K. Aditya. Estimation of crop yield at district level from reduced sample size of villages out of population.
- Soumen Pal. Data Sharing across Applications using Web API: Case Study of Mobile App and Web Portal (invited talk).
- Alka Arora. E-governance of Krishi Kalyan Abhiyan using KVK Portal in the Souvenir of the Conference.
- SN Islam. Application of AI in developing expert system on wheat crop management
- Shashi Dahiya. Learning Analytics for Academic Performance Evaluation - A CaseStudy.
- Sudeep Marwaha. Artificial Intelligence in Agriculture
- Mrinmoy Ray, K N Singh, Ramasubramanian V. and Ranjit Kumar Paul. A hybrid wavelet based ANN-WNN model for forecasting Indian monsoon rainfall
- A.R. Rao. “Computational approaches to understand host pathogen interactions in foot-and-mouth disease (FMD) of cattle” in a session on “Bioinformatics and Data mining”
- S.B. Lal. Apache Spark for Bioinformatics Applications
- Sarika. Development of computational tool for microsatellite DNA marker
- M.A. Iqubal. Computational approach for breed and variety identification using molecular markers.
- Soumen Pal. Data Sharing across Applications using Web API: Case Study of Mobile App and Web Portal’
- Shashi Dahiya. Learning Analytics for Academic Performance Evaluation - A Case Study
- S.N. Islam. Application of AI in developing expert system on wheat crop management
- Ramasubramanian, V., M. Ray,, S. Rathod,, K.N Singh,. and R.S Shekhawat,. Statistical modeling and forecasting.
- S. Barman, Ramasubramanian, V. and M Ray. Comparative performance of Bagging and Boosting in Classification and Regression Trees (CART)
- Mukesh Kumar, Sudeep Marwaha, Soumen Pal, Rupasi Tiwari, Triveni Dutt, Avanaksh S. Sambyal and Harish Kumar. IVRI-PashuPrajanan App: A Tool for Knowledge Dissemination on Animal Reproduction

- Tenth International Triennial Calcutta Symposium on Probability and Statistics (Celebrating the Birth Centenary of Prof. H. K. Nandi) organized jointly by the Calcutta Statistical Association and the Department of Statistics, Calcutta University during December 27-30, 2018 at the Department of Statistics, Calcutta University, Kolkata, India.
  - Shyamsundar Parui, Rajender Parsad, B.N. Mandal and Sukanta Dash. Block designs for incomplete factorial treatment structure with two factors (Invited Talk)
  - B.N. Mandal, Sukanta Dash and Rajender Parsad. Incomplete split plot designs: construction and analysis (Contributed Paper).
  - Sukanta Dash and B N Mandal. On the construction of balanced latin hypercube designs. (contributed talk)

- Seema Jaggi, Shwetank Lall, Eldho Varghese, Cini Varghese and Arpan Bhowmik. An algorithmic approach to construct D-optimal saturated designs for logistic model (Invited Talk)
- Arpan Bhowmik, Seema Jaggi, Eldho Varghese and Cini Varghese. Response surface designs with minimum level changes (contributed talk)
- Himadri Ghosh. Von Bertalanffy growth modeling under random environment using stochastic differential equation
- Pradip Basak, U. C. Sud and Hukum Chandra. Calibration Estimation of Finite Population Regression Coefficient under Two-stage Sampling Design Using Single Auxiliary Variable.
- Soumen Pal. Modelling and Forecasting of Non-parametric Time-series with Correlated Errors using Simple Data Driven Bandwidth Choice.
- Mrinmoy Ray, K N Singh, Ramasubramanian V. Parameters estimation of ARIMA-intervention model using genetic algorithm
- K. Aditya, and H. Chandra. Estimation of crop yield from reduced sample size of villages selected out of population at district level.
- Mrinmoy Ray, K N Singh, Ramasubramanian V. Parameters estimation of ARIMA-Intervention model using Genetic Algorithm.
- S.B. Lal. Computational Issues of Genome Assembly

- National Conference on Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere especially in Agriculture and 21st Annual Conference of Society of Statistics, Computer and Applications held at Department of Statistics and Computer Applications, S.V. Agricultural College, Tirupati during January 29-31, 2019

  - Shyamsundar Parui, Rajender Parsad and B.N. Mandal. Efficient designs for incomplete factorial experiments for two factors with unequal block sizes (presented in M.N. Das Memorial Young Scientist Award 2019 Session on January 30, 2019)
  - B.N. Mandal, Sukanta Dash and Rajender Parsad. Construction of second order orthogonal Latin hypercube designs with four factors (Invited Talk)
  - Sukanta Dash, B.N. Mandal and Rajender Parsad. On the construction of nested orthogonal Latin hypercube designs (Invited talk).
  - Susheel Kumar Sarkar and Sanjeev Panwar. Repeated Measurements analysis with missing observations (invited talk)
  - Eldho Varghese, Arpan Bhowmik, Seema Jaggi, Cini Varghese and T.V. Sathianandan. Experimentation Order in Multi-Factor Experiments (Invited Talk)
  - D C Mishra, Samarendra Das, Md. Samir Farooqi, Neeraj Budhlakoti, K K Chaturvedi, S. B. Lal, Sanjeev Kumar, S. N. Rai, Anil Rai Informative Gene Selection: Algorithms and Techniques
  - P.K. Meher. Secondary structure information coupled with the sequence-derived features improves splice site recognition in A. thaliana: A machine learning-based approach.
  - R. K. Paul. Statistical Modelling of Climatic Variables using Wavelet Technique"
  - Alka Arora. Analysis and Evaluation of Training Effectiveness under Capacity Building Program of ICAR: A Case Study.
  - S. Dahiya, A. Bharadwaj. Decision Tree based Online Classification and Visualization
  - Anu Sharma. Machine Learning for Binning of Metagenomics Data
  - Mukesh Kumar, Anshu Bharadwaj, Soumen Pal, Rajni Jain, Shiv Kumar, Chetna Gupta and Rama. Knowledge Dissemination of Farmer FIRST programme through FFP Portal
- 1st International conference on Biological Control: Approaches and Applications

  - Richa Varshney, Neeraj Budhlakoti and R. Chandish Ballal. Geocoris ochropterus Fieber: a potential predator
- 13th International Conference on Dryland Development: Converting Dryland Areas from Grey into Green organized by International Dryland Development Commission (IDDC) and Arid Zone Research Association of India (AZRAI) and hosted by ICAR-CAZRI at Jodhpur during February 11-14, 2019

  - Rajender Parsad and A. Dhandapani. Big data in Indian agricultural research and development (Invited talk during Satellite Symposium on Big Data in Dryland Agriculture).
- Sixth Group Discussion of ICAR-AICRP on Fruits held at Assam Agricultural University, Jorhat, during February 14-16, 2019

  - Rajender Parsad and Sukanta Dash. Information System for AICRP on Fruits (Invited talk).

- 34th Annual Workshop of AICRP on PHET organized at Tamil Nadu Agricultural University, Coimbatore during March 12-15, 2019
  - Rajender Parsad, Piyush Kothyari, Arpan Bhowmik, Chandra Sekhar and S.K. Tyagi. Information System for AICRP on PHET (Invited Talk).
- COBACAS 4th National Conference on Diversified Farming Systems: Sustainable Livelihood and Doubling Farmers' Income organized jointly by Coochbehar Association for Cultivation of Agricultural Science (COBACAS) and Uttar Banga Krishi Viswa Vidyalaya (UBKV) at College of Agriculture, UBKV, Majhian, Dakshin Dinajpur, West Bengal during January 17-18, 2019
  - Rahul Kumar Gupta, Arpan Bhowmik, Seema Jaggi, Anindita Datta, Kaustrav Aditya and Souvik Paul. Modeling of Occurrence of Neonatal Diarrhea in Young Goats through Distribution Approach. (Lead Lecture)
- International Conference on Global Environmental Challenges, Human Health and Sustainable Development held during January 11-13, 2019 at The Convention Centre, JNU, New Delhi
  - Gaurav Singh, Neelam Patel, Tanu Jindal, Sumit Pal and Arpan Bhowmik. Assessment of water quality using pollution index of River Hindon, Uttar Pradesh, India (Poster Presentation)
- XIV Agricultural Science Congress "Innovations for Agricultural Transformation" held during 20-23 February, 2019 at NASC Complex and IARI campus organized by National Academy of Agricultural Sciences, New Delhi and ICAR-Indian Agricultural Research Institute, New Delhi
  - Bisworanjita Biswal, Subhas Babu, S.L. Meena, B.N. Mandal, Kirttiranjan Baral (2019). Changes in soil microbial health in upland rice under diverse nutrient management condition in NEH region. (poster presentation)
  - Anindita Datta, Seema Jaggi, Cini Varghese, Eldho Varghese, Arpan Bhowmik, and Md. Harun. Generalized row-column designs for comparing test treatments with a control in agricultural experiments (poster presentation)
- V Biennial Workshop of AICRP on IFS organized at University of Agricultural Sciences, GKVK campus, Bengaluru during 20-22 December, 2018.
  - Anil Kumar and Susheel Kumar Sarkar. Progress on statistical analysis techniques for on-station experiments of cropping and farming system
  - Cini Varghese. Progress on statistical analysis techniques for on-farm nutrient response and farming system experiments (OFR 1, 2 &3)
- National Symposium on "Integrated Farming Systems for 3Es" organized at University of Agricultural Sciences, GKVK campus, Bengaluru during December 23-24, 2018.
  - Cini Varghese. Advances in FSR on the topic Statistical analysis methodology for farmer participatory FSR (Lead Lecture)
- Nextgen genomics, biology, bioinformatics and technologies (NGBT-2018)" organised by SciGenom Research Foundation, during 30 September-02 October 2018 at Jaipur, Rajasthan.
  - P.K. Meher, Learning models and sequence encoding schemes for prediction of splice sites: analysis, comparison and results.
- National conference of Indian Society of Agricultural Marketing during 22-24 November, 2018 at Institute for Social and Economic Change, Bengaluru.
  - R. K. Paul. Volatility and Spillover in Onion Prices in Major Markets of Karnataka, India.
- Symposium on "Advances in Agro meteorology for Managing Climatic Risks of Farmers"during 11-13 February, 2019 at JNU, New Delhi.
  - R K Paul. Trends and Magnitude of Climatic Variability across Locations from Different Agro Climatic Zones of India.
- International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019
  - P Anjoy, and H Chandra. (2019). Analysis of District and Social Group-Wise Disparity in Poverty in Chhattisgarh using Small Area Estimation Approach.
- National Conference on "Recent Developments in Statistics and their -Applications to the Society", Ahmednagar, January17-18, 2019. Presented as an Invited talk.
  - H Chandra. Small Area Estimation of Proportions under a Spatial Dependent Aggregated Level Generalized Linear Mixed Model.

- International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019. Presented as an Invited talk.
  - H Chandra. Small area prediction of counts under a spatial non-stationary generalized linear mixed model.
- National Conference on "Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere especially in Agriculture", Tirupati, January 29-31, 2019. Presented as an Invited talk.
  - H Chandra. Small area prediction of counts under a spatial non-stationary generalized linear mixed model.
- International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019.
  - S Guha. and H Chandra. Finite population mean estimation using two auxiliary variables in double sampling in the presence of nonresponse
- 3rd International Symposium on Aquaculture and Fisheries Education(ISAFE3): Fisheries Education for Sustainable Blue Economy, May, 16-18, 2018, Mumbai, India at ICAR- CIFE, Mumbai.
  - Ramasubramanian, V., P.S. Ananthan, and K.N. Singh. An analysis of students' perception about Indian fisheries education.
  - P. S. Ananthan, Ramasubramanian, V., , M. Krishnan Josephine, M., Nisar, U. and H. Fernando. Are fisheries graduates of India employable? Results from a cross-country study on career choices and employ ability.
  - J. Sahoo, P.S. Ananthan, Ramasubramanian, V. and N. Qureshi. Valuing human capital generated by Universities: A case study of ICAR-CIFE.
- GAF7 - Expanding the Horizons, The 7th Global Conference on Gender in Aquaculture & Fisheries at Asian Institute of Technology, Bangkok, Thailand during 18-21 October 2018.
  - P. Gautam, P. S. Ananthan, A. Sharma and Ramasubramanian, V. Human Development of Small Scale Fishers in Indian Reservoirs: A Gender Based Assessment.
  - T. Velumani, P.S. Ananthan, Ramasubramanian, V. and Rama Krishna. Is fishing gendered? Women as equal partners in Krishna Raja Sagar (KRS) reservoir fisheries, India.
- Workshop on "Applications of Spatio-Temporal Models", University of Hyderabad, Hyderabad, January 31 to February 01, 2019. Presented as an invited lecture.
  - H Chandra. Small area estimation under spatial models.
- National workshop on "Big Data Analysis with R", Rabindranath Tagore University, Bhopal, March 15, 2019. Presented as an invited lecture.
  - H Chandra. Statistical computing using R.
- Training programme on "Survey Research Methodology for Researchers and Faculty", ICMR-NIMS, New Delhi, October 08-10, 2018.
  - H Chandra. Small area estimation of district level prevalence of diarrhoea disease among under-five children
- Workshop on "Small Area Estimation Techniques and its Applications", Eastern Africa Statistical Training Centre, Dar Es. Salaam, Tanzania, December 03-07, 2018. Presented as an invited lectures.
  - H Chandra. Small area estimation techniques-an overview and appraisal different approaches.
- Indian Institute of Technology, Delhi. September 26, 2018. Delivered guest seminar lecture.
  - H Chandra. Spatial Non-Stationary Generalized Linear Mixed Model for Counts.

National workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences, Dehradun, May 22-24, 2018. Presented as an invited talk.

- H Chandra. Small area estimation of forestry parameters for the state of Maharashtra in India.

- Conference on "Challenges and Technological Solutions for Enrollment &Loss Assessment under Pradhan Mantri Fasal Bima Yojna", Mussorie, May 18, 2018. Presented as an invited talk.
  - H Chandra. Crop yield estimation using small area estimation techniques.
- The International Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, December 27-30, 2018. Presented as an Invited talk.
  - H Chandra. Small area prediction of counts under a spatial non-stationary generalized linear mixed model.

- The International Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, December 27-30, 2018.
  - V. Kumari, H Chandra, and K. Aditya. Estimation of Regression Coefficient using Calibration Approach with Multi Auxiliary Variables
- International Conference on Emerging Methodologies in Theoretical & Applied Statistics (EMTAS) to be held at Banaras Hindu University, Varanasi, Uttar Pradesh during 18-20 September, 2019
  - Raju Kumar and L.M. Bhar. Identification of outliers in incomplete Multi-Response Experiments in Presence of Masking
- National Workshop on improvement of Agriculture Statistics organized by the Department of Agriculture & Farmers Welfare, Panchkula, Haryana during February, 5-6, 2019
  - Raju Kumar. Various activities covered by ICAR-IASRI and latest techniques of agricultural statistics.
- National workshop on recent advances in statistical methods and Applications in Forestry and environmental science at ICFRE, Dehradun on 25th May 2018.
  - K Aditya. MAPI software for collection of survey data-An experience
- National Workshop Recent Advances in Statistical Methods and Applications in Forestry and Environmental Science (RASMAFES), FRI, Dehradun, May 23-25, 2018.
  - V Kumari, and H Chandra. Calibration Estimation of Regression Coefficient using Multi Auxiliary Variables.
- The International Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, December 27-30, 2018. Presented as an Invited talk.
  - V Kumari, and H Chandra and, K Aditya. Estimation of Regression Coefficient using Calibration Approach with Multi Auxiliary Variables.
- International Symposium on "Advances in Agrometeorology for Managing Climatic Risks of Farmers (INAGMET-2019)", JNU, New Delhi, February 11-13, 2019.
  - V Kumari, and H Chandra and, K Aditya. Neural network based crop forecast model through simulated weather data.
- First National Genetics Congress held at ICAR-IARI, New Delhi during December 14-16, 2018
  - Ram Narayan Ahirwara, Vinod Kumar Mishra , Ramesh Chand, Neeraj Budhlakoti, Dwijesh Chandra Mishra, Sundeep Kumar, Arun Kumar Joshi. Genome-wide Association Mapping of Spot blotch Resistance in Wheat Association Mapping Initiative (WAMI) Panel of Spring Wheat (Triticum aestivum L.)
  - A.R. Rao. Leaping forward towards a blend of population genetics and modern day genomics
- International Conference on Emerging Trends in Biomaterial, Bio-imaging, Bioscience, Bioinformatics, Biomedical Engineering, Cancer Biology, Stem Cell Research, Cell Apoptosis and Applied Biotechnology (BCS-2018) held at Jawaharlal Nehru University, New Delhi on October 13, 2018
  - Aamir Khan, Johnson George K, Rahul Singh Jasrotia, Sharon Aravind, U. B. Angadi, Mir Asif Iquebal, Manju KP, Umadevi P., Anil Rai, Dinesh Kumar " Plant Virus Interaction Mechanism and Associated Pathways in Mosaic Disease of Small Cardamom (*Elettaria cardamomum* Maton) by RNA-Seq Approach
  - Sarika J. Transcriptomic signature reveals mechanism of flower bud distortion in witches'-broom disease of soybean (Glycine max)
- 4th International Group Meeting(IGM) held at CSKHPKV, Palampur during February 14-16, 2019
  - Sundeep Kumar, Amit Kumar Singh, Divya Chauhan, Neeraj Budhlakoti, D.C. Mishra, S.C. Bhardwaj, O.P. Gangwar, Subodh Kumar, Anjan Kumar Pradhan and Monendra Grover. Transcriptome analysis to identify gene and pathways associated with yellow rust resistance in wheat
- National Workshop on Computation for Biomedicine and Healthcare held at IIIT Delhi on December 12, 2018.
  - A.R. Rao. Machine learning Algorithms in Agri-genomics domain: some applications
- Workshop on Metagenomics in Fisheries Research held at ICAR-CIFRI, Barrackpore during December 1-2, 2018
  - A.R. Rao. Deep learning and metagenomics: Some thoughts for students and research scholars

- International Conference of Asia Pacific Federation for Information Technology in Agriculture (AFITA) and World Congress on Computers in Agriculture (WCCA) on Research Frontiers in Precision Agriculture held at IIT Mumbai during October 24-26, 2018.
  - Mukesh Kumar. Decision Support System for evaluating agricultural activities on ergonomics parameters
  - S.N. Islam. Expert System Shell for Developing Multi Crop Expert Systems
- A panel co-integration analysis" in 30th International Conference of Agricultural Economists (ICAE-2018) during 28th July 2018 to 02 August 2018 at Vancouver, Canada.
  - Rajeev Ranjan kumar. Relationship between agricultural growth and energy consumption in Indian agriculture:

Poster Presentations

- 10th International triennial Calcutta symposium on Probability and statistics held during 27-30 December, 2018 at University of Calcutta, West Bengal
  - R. K. Paul, Dipankar Mitra. Modelling and forecasting of price of rice in India using long memory time series model.
- XIV Agricultural Science Congress during 20-23 February, 2019 at NASC complex, New Delhi.
  - R. K. Paul. Machine Learning Techniques for Prediction of Sterility Mosaic Disease Incidence in Pigeonpea.
- An Ensemble Based Clustering Approach For Metagenomics Data in proceedings of XIV Agricultural Science Congress at New Delhi from February 20-23, 2019 on the theme "Innovations for Agricultural Transformation
  - Dipro Sinha, Anu Sharma, Anil Rai, D. C. Mishra, S. B. Lal and R. K. Paul. abstract No. 378
  - Ritwika Das, Anil Rai and Anu Sharma. abstract no. 364

Lectures Delivered

Hukum Chandra

- Invited Speaker, Conference on "Challenges and Technological Solutions for Enrollment & Loss Assessment under Pradhan Mantri Fasal Bima Yojna", Mussoorie, 18th May 2018.
- Invited Speaker, Indian Institute of Technology, Delhi. Delivered guest lecture on "Spatial Non-Stationary Generalized Linear Mixed Model for Counts", Department of Mathematics, IIT Delhi, September 26, 2018.
- Invited Speaker, International Conference on Emerging Innovation in Statistics and Operation Research 2018, Rohtak, Dec 27-30, 2018.
- Invited Speaker, International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019.
- Invited Speaker, National Conference on "Recent Developments in Statistics and their -Applications to the Society", Ahmednagar, January17-18, 2019.
- Invited Speaker, workshop on "Small Area Estimation Techniques and its Applications", Eastern Africa Statistical Training Centre, Dar Es. Salaam, Tanzania, December 03-07, 2018.
- Delivered lectures in the Session on "Statistical Computing Using R Software" during National workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences, Dehradun, 22-24 May 2018.
- Delivered lectures on "Introduction on Statistics", Institute of Valuer, New Delhi, May 15, 2018.
- Delivered invited guest lecture on "Spatial Non-Stationary Generalized Linear Mixed Model for Counts", Department of Mathematics Seminar Series, Indian Institute of Technology (IIT), Delhi, September 26, 2018.
- Delivered lecture in the training programme on "Survey Research Methodology for Researchers and Faculty", ICMR-NIMS, New Delhi during October 08-10, 2018.
- Delivered lectures in the workshop on "Small Area Estimation Techniques and its Applications", Eastern Africa Statistical Training Centre, Dar Es. Salaam, Tanzania, December 03-07, 2018.
- Delivered lectures in the workshop on "Applications of Spatio-Temporal models", University of Hyderabad, Hyderabad, January 31 to February 01, 2019.
- Delivered lectures in the workshop on "Statistical Computing Using R", Department of Statistics, Punjab University, Chandigarh, February 28 to March 01, 2019.

- Delivered lectures in the National workshop on "Big Data Analysis with R", Rabindranath Tagore University, Bhopal, March 15, 2019.

Prachi Misra Sahoo

- Invited Speaker, Department of Geography, Jamia Millia Islamia, New Delhi. Delivered lecture on 'Statistics for spatial data Analysis' in the research methodology workshop on Geography and Environment with SPSS training held at Jamia Millia Islamia, under the ageis of UGC DRS-I on 2 March, 2019.
- Delivered a talk regarding development of methodology for estimation of area and production of spice crops in the Training–cum-workshop of the nodal officers of State Horticulture Statistics Authority (SHOSA) at ICAR- Central Coastal Agricultural Research Institute (CCARI), Ela, Goa on 25.09.2018

Kaustav Aditya

- Delivered a talk on Agricultural Statistics Systems in India-An Overview in one day Workshop entitled "Building Evidence in Agriculture-Reviewing data systems and the way forward" Jointly organized by International Growth Centre (IGC), Asian Development Research Institute (ADRI) and ICAR-IASRI, New Delhi at Hotel Maurya, Patna, Bihar on 15th February, 2019.
- Delivered a lecture entitled "Country Experience on Master Sampling Frame: India", on 21st November, 2018 in Regional Training for SAARC Countries on Master Sampling Frames for Agricultural Statistics in Kathmandu, Nepal during 19-23 November, 2018.

Ankur Biswas

- Invited lecture delivered on "Horticulture Statistics" on 28.02.2019 in the Training Programme on "Agriculture and Allied Statistics" for 41st batch of ISS probationers organized by National Statistical Systems Training Academy (NSSTA), MoSPI, Greater Noida during February 18 to March 01, 2019.

Anil Rai

- Delivered following lectures in international training program on "Recent Advances in Agricultural Surveys: Remote Sensing and GIS Applications" for the participants of AARDO countries on 'GPS and Indian Navigation system', 'Big data analytics in RS and GIS' and Super-computing through ASHOKA during March 11-31, 2019.
- Delivered lecture on "Bioinformatics Techniques is Biological Data Mining" at National Workshop-cum-training program on "Bioinformatics Techniques is Biological Data Mining from March 25-27, 2019. AKMU, ICAR-IARI, New Delhi

Dinesh Kumar

- Delivered invited lectures and conducted practical sessions on following topics CAFT programme on Gene Mining Approaches and In Silico Functional Analyses at ICAR-Central Institute of Fisheries Education, Mumbai during December 3-23, 2018

A.R. Rao

- Deliver a talk on "Leaping forward towards a blend of population genetics and modern day genomics" in a technical Session on "Application of bioinformatics and statistical tools in genetics" organized under 1st National Genetics Congress on "Genetics for sustainable food, health and nutrition security" held during 14-16 December, 2018 at ICAR-IARI, New Delhi
- Deliver talk on "Machine learning Algorithms in Agri-genomics domain: some applications" in a Session on "Genomics for Health care" organized under National Workshop on Computation for Biomedicine and Healthcare" at IIIT Delhi on 12 December 2018.
- Deliver talk on "Deep learning and metagenomics: Some thoughts for students and research scholars" in the Workshop on "Metagenomics in Fisheries Research" held at ICAR-Central Inland Fisheries Research Institute, Barrackpore during 1-2 December, 2018.

K.K. Chaturvedi

- Delivered a talk on "Working with Linux for NGS data analysis" in Workshop cum training at AAU Jorhat during 13-15 March 2019.
- Delivered a lecture on "ASHOKA: Supercomputing platform for bioinformatics" in CAFT training program "Next Generation Sequencing and its applications in Crop Sciences" during 28th August to 17th September 2018 at ICAR-NRCPB, New Delhi on 15th Sept. 2018.

- Delivered invited talk on "Application of bioinformatics in agricultural food processing" on 13th August 2018 in CAFT program "Sot Computing Tools for Applications in Food and Agricultural Processing" at ICAR-CIAE Bhopal during August 1-21, 2018

S.B. Lal

- Delivered talk on the topic "Big Data in R and R Hadoop at Dept. of CSE & IT, Rabindranath Tagore University, Bhopal during 15-16 March, 2019.
- Invited talk on "Internet of Things (IoT) in Forestry and Environmental sciences" at National Workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences held during May 23-25, 2018 at Division of Forestry Statistics, Indian Council of Forestry Research and Education, Dehradun, Uttarakhand
- Delivered lecture on "Applications of ANN in food and agricultural processing" on 10th August, 2018 in 21-days CAFT training programme on "Soft Computing Tools for Applications in Food and Agricultural Processing" organized at ICAR-CIAE, Bhopal during August 01 – 21, 2018.
- Delivered lecture on "Handling Large Scale Data and Data Analysis using R" held during October 08-13, 2018 for the participants of the Indian Statistical Services Officers of the Ministry of Statistics & Programme Implementation, Govt. of India, prepared and delivered a lecture on Data mining in R on 11.10.2018.

Sarika

- Delivered Invited lecture and hands-on following topics at ICAR Winter school on Omic technologies and modern breeding approaches for conservation and productivity enhancement of indigenous cattle to be held at ICAR- CIRC, Meerut during November 1-21, 2018.

U.B Angadi

- Delivered lecture on Web based tool and mobile apps for wheat variety identification using throughput SNP genotyping data, in proceedings of national conference "Advanced Research Methodologies in social Science" during 26-28 February 2019 at University of Agricultural Sciences, Dharwad.
- Delivered lecture on Ferns Based Naive Bayesian Novel Method for Qualitative and Quantitative Data Analysis,, in proceedings of national conference "Advanced Research Methodologies in social Science" during Feb 26th to 28th 2019 at University of Agricultural Sciences, Dharwad.

M.A. Iquebal

- Delivered invited lectures and conducted practical sessions on following topics CAFT programme on Gene Mining Approaches and In Silico Functional Analyses during December 3-23, 2018 at ICAR-Central Institute of Fisheries Education, Mumbai
- Delivered invited lecture on "Molecular Marker Discover and its application in agriculture" and "Insilico prediction of antimicrobial prediction" during Winter School on "Bioinformatics Tools and Techniques in Agriculture" at College of Biotechnology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut on March 26, 2019.

Anu Sharma

- Delivered an invited talk on Computational Aspects of Metagenomics and MetaProteomics in Workshop on Metagenomics in Fisheries Research from 01-02 December, 2018.

D.C. Mishra

- Delivered an invited lecture on the topic "Overview of Next Generation Sequencing Data and Its Application in Agriculture" in training programme entitled "Advancement of physiological strategies for Crop Improvement against abiotic stresses" on 27, August, 2018 at ICAR-CSSIR, Karnal.
- Delivered various lectures in the training entitled "Next Generation Sequence Data Analysis" at Department of Agricultural Biotechnology, Assam Agricultural University, Jorhat during 14-16, March, 2019
- Delivered lectures in the training entitled "Next Generation Sequencing (NGS) Data Analysis: A Practical Perspective" held at IGKV, Raipur during 7-9, August, 2018.

Neeraj Budhlakoti

- Delivered lectures on the topics Genome Wide Association Study and conducted practical session on Introduction to BLAST, Genome

Assembly and Annotation and GWAS in Training Programme entitled "Next Generation Sequencing (NGS) Data Analysis: A Practical Perspective" at IGKV, Raipur during 7-9, August, 2018.

S.N. Islam

- Delivered lecture on TMIS organized for the HRD nodal officers of ICAR institutes at ICAR-NAARM, Hyderabad on 16th March, 2019.

Ramasubramanian, V.

- Delivered a presentation on the topic entitled "Statistical methodologies for agricultural data analysis and decision making" in the Workshop entitled "Building Evidence in Agriculture: Reviewing Data Systems and the Way Forward" at Hotel Maurya, Patna on 15.02.2019.
- Delivered a talk on "Think Equal; Build Smart; Innovate for change" in the function held on the occasion of International Women's Day on 08.03.2019 at our institute

Participation

- National workshop on Artificial Intelligence in Agriculture: status and prospects during 30-31 July, 2018 at NASC complex, New Delhi.
  - A.K. Paul, R.K. Paul, Himadri Shekher Roy, Sudeep, Alka Arora, Mukesh Kumar, Anshu Bharadwaj, Shashi Dahiya, Sangeeta Ahuja, Soumen Pal, S.N. Islam and Pal Singh, Prawin Arya , Ramasubramanian V., Sudeep Marwaha, Soumen Pal, Sukanta Dash, Anil Kumar, Rajender Parsad, Sukanta Dash, Seema Jaggi, and Arpan Bhowmik, Cini Varghese.
- National Conference on "Challenges and Opportunities in Statistics and Informatics for Futuristic Humanosphere Especially in Agriculture (COSIFHA)" in Conjunction with 21st Annual Conference of Society of Statistics, Computer and Applications (SSCA) scheduled to be held during 29 -31 January 2019, at S.V. Agricultural College, Tirupati, ANGRAU, Andhra Pradesh.
  - R.K. Paul, Mukesh Kumar and Alka Arora, Hukum Chandra, Pradip Basak, Shashi Dahiya, Alka Arora, Mukesh Kumar, Rajender Parsad, B.N Mandal, Sukanta Dash, Seema Jaggi, and Arpan Bhowmik.
- 72nd Annual Conference of the Indian Society of Agricultural Statistics, New Delhi held at ICAR-Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal - 462 038, Madhya Pradesh during 13-15 December, 2018.
  - Rajender Parsad, B.N Mandal, S.K Sarkar, Anindita Datta, Seema Jaggi, Cini Varghese, Mohd Harun, Arpan Bhowmik, A.K.Paul, Himadri Ghosh, Himadri Shekher Roy, Anuja A. R., Shivaswamy G.P. , Hukum Chandra, Achal Lama, Rajesh T., Mukesh Kumar, Alka Arora, Shashi Dahiya, Soumen Pal, S.N. Islam, Ramasubramanian V., Tauqueer Ahmad, Prachi Misra Sahoo, Vandita Kumari Choudhary, Kaustav Aditya, Raju Kumar, Deepak Singh, Shashi Dahiya, Sudeep Marwaha, Mrinmoy Ray, K. N. Singh, Ranjit Kumar Paul, Mir Asif Iquebal, Sarika, Dinesh Kumar, Anil Rai, A.R. Rao, K.K. Chaturvedi, S.B. Lal, D.C. Mishra, L.M. Bhar
- Hindi workshop on Academic writing with LATEX on March 25, 2019.
  - Shivaswamy G.P. , Rajesh T. , Pal Singh, Kaustav Aditya, Anshu Bharadwaj, Soumen Pal, Sukanta Dash, Cini Varghese, Seema Jaggi, Arpan Bhowmik, Sunil K. Yadav, Susheel K. Sarkar, Anindita Dutta, Mrinmoy Ray
- Tenth International Triennial Calcutta Symposium on Probability and Statistics (Celebrating the Birth Centenary of Prof. H. K. Nandi) organized jointly by the Calcutta Statistical Association and the Department of Statistics, Calcutta University during December 27-30, 2018 at the Department of Statistics, Calcutta University, Kolkata, India
  - Rajender Parsad, B.N Mandal, Sukanta Dash, Seema Jaggi, Arpan Bhowmik, Soumen Pal, Mrinmoy Ray**,** Ranjit Paul, Himadri Ghosh, H.S. Roy
- 61st Annual Maize Workshop (AICRP on Maize) held at Hill Agricultural Research and Extension Center, CSHPKV, Bajaura (HP) during April 07-09, 2018 (attended on April 09, 2018)
  - Rajender Parsad
- National Workshop on Sustainability of Indian Agriculture: Socio-Economic Perspective organized at NASC Complex, New Delhi by ICAR-NIAP, New Delhi on November 27, 2018
  - Rajender Parsad
- Twenty-Seventh International Conference of Forum for Interdisciplinary Mathematics (FIM) in conjunction on Interdisciplinary Mathematics, Statistics and Computational Techniques organized by Department of Statistics, University

of Jammu, Jammu during November 02-04, 2018

➢ Rajender Parsad

- 13th International Conference on Dryland Development: Converting Dryland Areas from Grey into Green organized by International Dryland Development Commission (IDDC) and Arid Zone Research Association of India (AZRAI) and hosted by ICAR-CAZRI at Jodhpur during February 11-14, 2019

➢ Rajender Parsad

- Sixth Group Discussion of ICAR-AICRP on Fruits held at Assam Agricultural University, Jorhat, during February 14-16, 2019

➢ Sukanta Dash

- 34th Annual Workshop of AICRP on PHET organized at Tamil Nadu Agricultural University, Coimbatore during March 12-15, 2019

➢ Rajender Parsad

- COBACAS 4th National Conference on Diversified Farming Systems: Sustainable Livelihood and Doubling Farmers' Income organized jointly by Coochbehar Association for Cultivation of Agricultural Science (COBACAS) and Uttar Banga Krishi Viswa Vidyalaya (UBKV) at College of Agriculture, UBKV, Majhian, Dakshin Dinajpur, West Bengal during 17-18 January, 2019

➢ Arpan Bhowmik

- V Biennial Workshop of AICRP on IFS organized at University of Agricultural Sciences, GKVK campus, Bengaluru during 20-22 December, 2018.

➢ Cini Varghese and Susheel K Sarkar

- National Symposium on "Integrated Farming Systems for 3Es" organized at University of Agricultural Sciences, GKVK campus, Bengaluru during 23-24 December, 2018.

➢ Cini varghese

- Workshop on "ICAR KRISHI Geoportal: A Digital Platform for Sustainable Agriculture' on March 07-08, 2019 at ICAR-NBSS&LUP, Nagpur.

➢ Susheel Kumar Sarkar and Sukanta Dash

- National conference of Indian Society of Agricultural Marketing during 22-24 November, 2018 at Institute for Social and Economic Change, Bengaluru.

➢ R.K. Paul

- Workshop at NASC Complex, New Delhi organized by NRAA and CRIDA during 11-12 December, 2018.

➢ R.K. Paul

- Advanced Methods for Policy Analysis in the Area of Climate Change and Crop Price Volatility" during 16th August-14th October, 2018 at South Dakota State University, Brookings, USA.

➢ R.K. Paul

- "International workshop on genomic selection in Aquaculture", which was organised at ICAR-CIFE Mumbai, during 16-18 January, 2019.

➢ P.K. Meher, Himadri Shekhar Roy

- "Crop diversification towards high value crops: Status, determinants and its impact on farmers' welfare in eastern India" in the XIV Agricultural Science Congress 2019 held at NAAS complex, New Delhi during 20th to 23rd February, 2019

➢ Anuja A R, Prawin Arya

- 30th International Conference of Agricultural Economists (ICAE-2018) during 28th July 2018 to 02nd August 2018 at Vancouver, Canada.

➢ Rajeev Ranjan kumar

- "Conclave - Innovating Indian Agriculture Towards A New Green Revolution " held on Feb 01, 2019 at the Leela Palace, Chanakyapuri, New Delhi.

➢ Wasi Alam

- 21 days Training Workshop on "Advances in Simulation Modelling and Climate Change Research towards Knowledge Based Agriculture" under ICAR-HRM Programme held during 13th November– 3rd December, 2018 at CESCRA, IARI and New Delhi.

➢ Wasi Alam

- "Innovating Indian Agriculture -Towards A New Green Revolution" held at Leela Palace, Chanakyapuri, New Delhi on.

➢ Prawin Arya

- Video Conference meeting with JS and state mandi board and APMC officers..

➢ Prawin Arya

- User Conference organized by Esri India during 10-11 September, 2018 at Gurugram.

➢ Mukesh Kumar

- India Data Summit organized on 11th September 2018.

➢ Alka Arora

- International Conference of Asia Pacific Federation for Information Technology in Agriculture (AFITA) and World Congress on Computers in Agriculture (WCCA) on Research Frontiers in Precision Agriculture held at IIT Mumbai during October 24-26, 2018
  - Mukesh Kumar and Anshu Bharadwaj
- Brainstorming workshop of Component 2 under NAHEP for finalizing the action plan for Agriculture Education Digital Information System (AEDIS) at NASC Complex on 3rd November, 2018.
  - Sudeep Marwaha, Alka Arora, Mukesh Kumar Anshu Bharadwaj, Shashi Dahiya, Soumen Pal
- Workshop on All India Survey on Higher Education (AISHE) for the year 2018-19 on 8th February, 2019 at Scope Complex, CGO, Lodhi Road New Delhi.
  - Alka Arora
- "National Consultation on ICT in Agriculture" workshop for all Computer Scientists of ICAR, jointly organized by DKMA & ADG (ICT), ICAR on March 06, 2019 at NASC Complex, New Delhi.
  - Alka Arora, Sudeep Marwaha, Anshu Bharadwaj, Mukesh Kumar, Shashi Dahiya, Mr. S.N Islam, Mr. Pal Singh participated in
- Moderator for the session "Sectoral Group Discussion"
  - Alka Arora
- 24th Annual Conference of AICRP for PHET for Launching the Information System on AICRP for PHET developed under KRISHI held at TNAU Coimbatore during 12-15 March, 2019
  - Mukesh Kumar, Dr Rajender Parsad
- Hindi Workshop " Sampling techniques for Agricultural surveys and Statistical analysis of survey data" during 22-27 February,2019
  - Pal Singh
- Annual Zonal Action Plan Workshop of KVKs, Zone-VII at ICAR-ATARI, Zone – VII, Umiam, Meghalaya during 1-2 March, 2019.
  - Soumen Pal
- Workshop Cum Training for KVKs of Punjab, Haryana and UP on Production Practices Survey at Krishi Vigyan Kendra, ICAR-National Dairy Research Institute, Karnal during 27-28 March, 2019.
  - Soumen Pal
- Hindi Workshop कृषि में संगणक अनुप्रयोग वद 25जी July, 2018: सी.बी.पी. वोर्टल : भा.कृ.अनु.प. द्वारा प्रायोजित प्रशिक्षण कार्यक्रम के ऑनलाइन प्रबन्धन हेतु सूचना तंत्र
  - Alka Arora
- 3rd International Symposium on Aquaculture and Fisheries Education (ISAFE3; 16-18 May, 2018) during 17-18 May, 2018 at ICAR- CIFE, Mumbai
  - Ramasubramanian V.
- "Building Evidence in Agriculture: Reviewing Data Systems and the Way Forward" on 15 February, 2019 at Hotel Maurya, Patna
  - Ramasubramanian V.
- FASAL Workshop on 24.05.2018 organized by Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture and Farmers Welfare, Govt. of India
  - Tauqueer Ahmad
- Crop Insurance Review workshop on 04.09.2018 organized by the Credit Division, DACFW, MoAFW, Govt. of India
  - Tauqueer Ahmad and Prachi Misra Sahoo
- Startup Conclave on 16.10.2018 organized by ICAR at NASC Complex New Delhi.
  - Tauqueer Ahmad
- Training–cum-workshop of the nodal officers of State Horticulture Statistics Authority (SHOSA) at ICAR- Central Coastal Agricultural Research Institute (CCARI), Ela, Goa on 25.09.2018
  - Prachi Misra Sahoo
- National conference on "Challenges & Technological Solutions for Enrolment & Loss Assessment under Pradhan Mantri Fasal Bima Yojna", Mussoorie, May 17-19, 2018.
  - Hukum Chandra
- National workshop on "Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences", ICFRE, Dehradun, May 22-24, 2018.
  - Hukum Chandra
- International Conference on "Emerging Innovations in Statistics & Operations Research (EISOR 2018)", Rohtak (Haryana), December 27-30, 2018.
  - Hukum Chandra
- International Conference on "Computer Age Statistics in the Era of Big and High Dimensional Data", Pune, January 03-05, 2019.

➢ Hukum Chandra

- National Conference on Recent Developments in Statistics and their -Applications to the Society, Ahmednagar, January17-18, 2019.

➢ Hukum Chandra

- 14th Agricultural Science Congress, ICAR-IARI, New Delhi, February 20-23, 2019.

➢ Hukum Chandra

- Spatial Non-Stationary Generalized Linear Mixed Model for Counts, Indian Institute of Technology, Delhi. September 26, 2018.

➢ Hukum Chandra

- Survey Research Methodology for Researchers and Faculty, ICMR-NIMS, New Delhi, October 08-10, 2018.

➢ Hukum Chandra

- Workshop entitled "Building Evidence in Agriculture-Reviewing data systems and the way forward" Jointly organized by International Growth Centre (IGC), Asian Development Research Institute (ADRI) and ICAR-IASRI, New Delhi at Hotel Maurya, Patna, Bihar on 15th February, 2019.

➢ Kaustav Aditya

- National workshop on recent advances in statistical methods and Applications in Forestry and environmental science at ICFRE, Dehradun on 25th May 2018.

➢ Kaustav Aditya

- National Workshop on improvement of Agriculture Statistics organized by the Department of Agriculture & Farmers Welfare, Panchkula, Haryana during February, 5-6, 2019.

➢ Raju Kumar

- International Conference on Emerging Methodologies in Theoretical & Applied Statistics (EMTAS) to be held at Banaras Hindu University, Varanasi, Uttar Pradesh during 18-20 September, 2019

➢ Raju Kumar

- Regional training workshop on "Master Sampling Frames for Agricultural Statistics" jointly organized by Regional Office of the Global strategy, Food and Agricultural Organization of the United Nations and SAARC Secretariat during 19-23 November, 2018 at Kathmandu, Nepal.

➢ Pradip Basak

- National Workshop Recent Advances in Statistical Methods and Applications in Forestry and Environmental Science (RASMAFES), FRI, Dehradun, May 23-25, 2018.

➢ Vandita Kumari Choudhary

- International Conference on "Emerging Innovation in Statistics & Operations Research (EISOR-2018)", M.D. University, Rohtak, December 27-30, 2018.

➢ Vandita Kumari Choudhary

- International Symposium on "Advances in Agrometeorology for Managing Climatic Risks of Farmers (INAGMET-2019)", JNU, New Delhi, February 11-13, 2019.

➢ Vandita Kumari Choudhary

- workshop on Output-Outcome Monitoring Framework of NITI Aayog, organized by DMEO, Niti Aayog, New Delhi on 18th May' 2018.

➢ Sudeep Marwaha and Shashi Dahiya

- National Consultation on ICT in Agriculture workshop for all Computer Scientists of ICAR, jointly organized by DKMA & ADG (ICT), ICAR on March 06, 2019 at NASC Complex, New Delhi.

➢ Alka Arora, Sudeep Marwaha, Anshu Bharadwaj, Mukesh Kumar, Shashi Dahiya, S.N Islam, Pal Singh

Meetings Attended

Seema Jaggi

- Attended the Foundation Day and Annual General Body Meeting of National Academy of Agricultural Sciences (NAAS) at NASC Complex during June 4-5, 2018.
- Foundation Day and Annual General Body Meeting of NAAS at NASC Complex during June 4-5, 2018.

Rajender Parsad

- QRT meeting of CRIDA, AICRP on AM and AICRP on DA held at GKVK UAS Bengaluru during June 18-19, 2018.
- Participated in Workshop on Fine-tuning the Proforma for Ranking ICAR Institutes organized by NAAS at ICAR-NAARM, Hyderabad on July 20, 2018.
- Participated in Brainstorming Session on Development of Proforma for Ranking ICAR

Institutes organized by NAAS at New Delhi on July 28, 2018.

- Doctoral Committee Meeting in Statistics for presentation of synopsis of the Ph.D. students of Department of Statistics, School of Sciences, IGNOU, New Delhi on January 04, 2019.
- 34th Annual Workshop of AICRP on PHET organized at Tamil Nadu Agricultural University, Coimbatore during March 12-15, 2019.
- National Consultation on ICT in Agriculture organized at Lecture Hall, Second Floor, NASC Complex, DP Shastri Marg, New Delhi on March 06, 2019.
- 61st Annual Maize Workshop (AICRP on Maize) held at Hill Agricultural Research and Extension Center, CSHPKV, Bajaura (HP) during April 07-09, 2018 (Attended on April 09, 2018)
- QRT meeting of ICAR-CRIDA Hyderabad, AICRP on AM and AICRP on DA held at AAU, Jorhat during April 21-22, 2018.
- Attended ICAR-CRIDA QRT Meeting held on August 16-18, 2018 at ICAR-CRIDA, Hyderabad.
- National Workshop on Sustainability of Indian Agriculture: Natural Resource Perspective with Special Reference to Soil organized by ICAR-NIAP New Delhi on September 08, 2018 at ICAR Lecture Hall, NASC Complex, New Delhi.
- Launch of Centre of Excellence for Data Analytics and Workshop on Data Analytics in Government organized by NIC, MEITY, Govt. of India at India Habitat Centre on September 28, 2018.
- ICAR-CRIDA QRT Meeting held on September 04-05, 2018 at NASC Complex, New Delhi. Meeting to discuss Dashboard for AI in Agriculture Project in 10 aspirational districts being developed by NITI Aayog jointly with IBM held on September 26, 2018 at NITI Aayog. The meeting was chaired by Dr. J.P. Mishra, Adviser (Agri/Land Resources/Food Processing), Niti Aayog.
- Participated in National Workshop on Sustainability of Indian Agriculture: Socio-Economic Perspective organized at NASC Complex by ICAR-NIAP, New Delhi on November 27, 2018.

Cini Varghese, Sukanta Dash and Arpan Bhowmik

- Attended a meeting for refinement of OFR 2 and OFR 3 data sheets of AICRP-IFS organized at ICAR-IIFSR, Modipuram during 17-24 August, 2017 on 18th August, 2018 and 21st August, 2018.
- Attended second meeting of QRT of ICAR-IIFSR, Modipuram (including AICRP on IFS) at Rajasthan Agriculture Research Institute, Durgapura-Jaipur during October 10-11, 2018.

Anil Kumar

- Attended a Meeting on 26th June, 2018 under the chairmanship of special secretary, DARE and secretary, ICAR

B N Mandal

- Attended a meeting for fertilizer requirement assessment of different States of India at KAB-II on 10/08/2018 on the invitation of DAC, Ministry of Agriculture and Farmers' Welfare.

Sukanta Dash

- Participated a Sixth Group Discussion of ICAR-AICRP on Fruits held at Assam Agricultural University, Jorhat, during February 14-16, 2019.

Susheel Kumar Sarkar and Sukanta Dash

- Participated in two day Workshop on ICAR KRISHI Geoportal: A Digital Platform for Sustainable Agriculture on March 07-08, 2019 at ICAR-NBSS&LUP, Nagpur.

Seema Jaggi and Rajender Parsad

- Participated in Agri-Startup and Entrepreneurship Conclave on Unleashing Potentials in Agriculture for Young Agripreneurs (UPAYA) organized by Indian Council of Agricultural research at NASC Complex, New Delhi during October 16-17, 2018.

Ranjit Kumar Paul

- Attended Executive Council Meeting of ISAS at Krishi Bhawan chaired by DG ICAR on 20.11.2018
- Attended one meeting at Krishi Bhawan on 20th March, 2019 chaired by Joint Secretary, DMI, Ministry of Agriculture regarding the procedure of collecting the data for Agmarknet.

- Attended the Annual Action plan (2019-20) meeting for the KVKs under ICAR-ATARI, Umiam during March 1-2, 2019 at Umiam.
- Attended the 25th Annual General Body meeting of the National Academy of Agricultural Sciences during 4-5 June, 2018 at NASC complex

A. R. Anuja, R. Roy Burman, Ramasubramanian V., Shivaswamy G. P. and Rajesh T.

- Attended meeting on Impact assessment of MGMG on 26.02.2019 at Division of Ag. Extension, ICAR- IARI, New Delhi.

Ravindra Singh Shekhawat

- Attended meeting organized by Commission for Scientific and Technical Terminology, MHRD, GOI, New Delhi, from 12-16th June, 2018.
- Attended meeting organized by Commission for Scientific and Technical Terminology, MHRD, GOI, New Delhi, from 30th July-3rd August, 2018.

Tauqueer Ahmad

- Convened Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team on 17.04.2018 regarding the progress and monitoring of two FAO funded projects being conducted at ICAR-IASRI; also on 07.06.2018
- Attended PMC meeting of the project entitled "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report" held on 23 April 2018 at AERC, Anand, Gujarat as Member, PMC.
- Attended MIDH Annual Action Plan meeting held on 02.05.2018 under the Chairpersonship of Principal Adviser, MoAFW, Govt. of India at Krishi Bhawan, New Delhi.
- Chaired a Screening Committee meeting for conducting screening for the post of 11 MTS and 1 Driver on contract basis through third party held on 5 May 2018 at ICAR-IASRI, New Delhi as Chairman, Screening Committee; Second Screening Committee meeting on 10 May 2018
- Attended TAC meeting relating to Crop Insurance (PMFBY) on 11.05.2018 held at Krishi Bhawan New Delhi; also on 29.06.2018; 13.08.2018; 27.12.2018; 22.01.2019; 19.03.2019
- Attended meeting relating to Agricultural Insurance projects on 14.05.2018 held at Krishi Bhawan New Delhi.
- Attended National Fund, ICAR meeting on 16.05.2018 held at NASC Complex, New Delhi.
- Attended DAHDF meeting held on 24.05.2018 under the Chairpersonship of Adviser (AHS), MoAFW, Govt. of India at DAHDF office, Shadipur, New Delhi.
- Attended last Review Committee meeting of CHAMAN project held on 12.06.2018 under the Chairpersonship of Smt. Sudha P. Rao, Principal Adviser, DACFW, MoAFW, Govt. of India at Krishi Bhawan, New Delhi in which progress of the project till date was presented.
- Attended Award Committee meeting of CSO held on 13.06.2018 at Patel Bhawan, New Delhi as Award Committee member.
- Attended a meeting with DDG (NAD) and her team held on 14.06.2018 at Patel Bhawan, New Delhi regarding Seed, Feed and Wastage project conducted by the Institute.
- Attended a meeting with DDG (Agril. Edn.), Director, ICAR-NIAP, ADG (EP&HS) and US (Edn. Div.) on 18.06.2018 regarding redeployment of scientists from ICAR-IASRI to NIAP, New Delhi.
- Attended meeting with officials of Revenue Board, Rajasthan held on 26.06.2018 at ICAR-IASRI under the Chairmanship of Director regarding methodology for estimation of area and production of horticultural crops as per recommendations of their HLCC. The methodology developed by IASRI was explained to them and future direction was suggested.
- Attended Technical Working Group-1 (TWG-1) meeting held on 29.06.2018 at World Bank office, Lodi State, New Delhi as member, TWG-1. TWG-1 is constituted by the MoAFW, Govt. of India for technical discussion and future direction on implementation of PMFBY including improvement of methodology for crop insurance using new technology with World bank support.
- Convened Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team and Mexico team from Mexico Statistics Office on 29.06.2018 regarding discussion on Operational plan for field testing of guidelines

on Post Harvest Losses of fruits and vegetables in Mexico under FAO funded project being conducted at ICAR-IASRI.

- Attended a meeting with officials and Field Investigators (FIs) of six districts held on 05.07.2018 at Rose Garden, Bhopal under the Chairmanship of Commissioner cum Director, Department of Horticulture, Bhopal, Madhya Pradesh.
- Convened Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team and Finland team on 10.07.2018 regarding the operational plan for field testing of PHL in Fish in Finland.
- Convened Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team and Mexico team on 12.07.2018 regarding the planning of survey for field testing of PHL in Fruits and vegetables in Mexico.
- Attended a meeting with trade organizations held on 20.07.2018 at Kolkata.
- Attended meeting on presentation of report of the study entitled 'Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Programme under MIDH' organized by Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture and Farmers Welfare (MoAFW) on 24 August, 2018 in Ministry of Agriculture and Farmer Welfare.
- Attended Trade related meeting following WTO norms held on 14.08.2018 at Udyog Bhawan, New Delhi as a nominated member.
- Attended a meeting with Director, MNCFC on 15.10.2018 at MNCFC, New Delhi regarding discussion on Crop Insurance project.
- Attended a meeting regarding erp-phase-II under the Chairmanship of DDG (Engg.) at Krishi Bhawan on 01.11.2018 as Officiating Director, ICAR-IASRI.
- Attended Technical Committee of Direction (TCD) meeting held on 13.11.2018 at TSIRD, Hyderabad which was organized by Department of Animal Husbandry, Dairying & Fisheries (DADF), MoAFW, Govt. of India.
- Attended a meeting under the Chairmanship of Sh. P.K. De, Adviser (Stat.), DADF, MoAFW, Govt. of India held on 29.11.2018 in which a detailed discussion on the project proposal on on- line solution of Integrated Sample Survey (ISS) submitted to DADF was made.
- As Officiating Director, attended a meeting under the Chairmanship of DG, ICAR and Secretary, DARE in DG's Committee Room at Krishi Bhawan, New Delhi on 30.01.2019 in which progress of ERP project was reviewed and possibility of launching ERP-II project was discussed in detail.
- Attended a meeting on 31.01.2019 at Agriculture Department, Bhopal, Madhya Pradesh (M.P.) under the Chairmanship of Additional Director, Agriculture Department, Bhopal to discuss the plan for carrying out the on-going Crop Insurance study during Rabi season 2018-19 and mainly to take M.P. State on-board for the smooth conduct of the study.
- Attended Directors' Conference in the forenoon of 1st February 2019 held at NASC Complex, New Delhi as Officiating Director.
- Attended a meeting on 06.02.2019 at Agriculture Department, Lucknow, Uttar Pradesh (U.P.) under the Chairmanship of Director, Agricultural Statistics and Crop Insurance, Lucknow to discuss the plan for carrying out the Crop Insurance on-going study during Rabi season 2018-19 and mainly to take U.P. State on-board for the smooth conduct of the study.
- Attended Assessment Board meeting of T-II on 07.02.2019 at ICAR-IASRI as member of the Committee.
- Attended a meeting held on 11.02.2019 at Agriculture Department, Murena, M.P. under my Chairmanship in which details of the Crop Insurance study was shared and training for Crop Cutting Experiments was imparted to the primary workers, supervisors and other higher officers of the district.
- Attended a meeting organized by DES, MoAFW, Govt. India to discuss the methodology for obtaining Minimum Support Price (MSP) for minor millets 20.03.2019 held on 20.03.2019 at Krishi Bhawan, New Delhi as nominee of Director, ICAR-IASRI.

Hukum Chandra

- Attended Meeting of Technical Advisory Committee to consider the yield data of Paddy crop arrived from RST for Kharif 2017 season in Chhattisgarh and yield data of multipicking crops of Karnataka for Kharif Season, DAC&FW, Krishi Bhawan, New Delhi, May 09, 2018.
- Attended project management committee (PMC) meeting of the project "Pilot Study for Developing State Level Estimates for Crop Area and Production on the basis of Sample Size Recommended by Prof. Vaidyanathan Committee Report" followed by field visit, Gujrat during April 23-25, 2018.
- Attended meeting with the Officials of DES, Govt of Karnataka to discuss the results of Karnataka generated from the project titled "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report", Bangluru, September 17-18, 2018.
- Attended meeting review meeting of "Pilot studies for optimization of crop cutting experiments in PMFBY" (represent Director ICAR-IASRI as expert group member) at MNCFC, New Delhi, November 22, 2018.
- Attended project presentation meeting on "Pilot Study for "Developing State Level Estimates of Crop Area and Production on the Basis of Sample Sizes Recommended by Professor Vaidyanathan Committee Report" under the chairmanship of Sr, Economic & Statistical Adviser, DES, Krishi Bhawan, New Delhi, January 08, 2019.
- As Expert Member, attended Departmental Promotion Committee (DPC) meeting for the assessments of the Scientist in the discipline of Agricultural Statistics at ICAR-CIFRI, Barrackpore, West Bengal, November 15, 2018.
- As Expert Member, attended meeting with Madras Institute of Development Studies and Department of Economics and Statistics, Govt. of Tamil Nadu, Chennai, November 28, 2018.
- Attended Expert Committee meeting on Sampling Methodology for the Tamil Nadu Household Panel Survey (TNHPS), Madras Institute of Development Studies, Chennai, April 06-07, 2018.
- Attended meeting with Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture and Farmers Welfare, New Delhi, April 10, 2018.
- Attended Expert meeting on Energy Management in Agricultural held at the TNAU, Coimbatore during May 02-03, 2018.
- As Expert Group Member, attended Technical Advisory Committee for the Coverage Evaluation Survey, Ministry of Health and Family Welfare, Govt of India, New Delhi on June 06, 2018.
- As Expert Member of Advisory Committee of the TNHPS, attended meeting in Madras Institute of Development Studies, June 26, 2018, Chennai; also on March 11, 2019
- As Expert Member, attended Convergence Workshop on "Uttar Pradesh Development Report", Lucknow, Uttar Pradesh, July 19, 2018.
- Attended Launching Ceremony of "All India Rural Financial Inclusion Survey" report 2016-17, NABARD, India Habitat Centre, New Delhi, August 16, 2018.
- Attended meeting of "Core Group of Experts on Normalization", National Testing Agency, Department of Higher Education, Ministry of Human Resource Development, Govt of India, Gautam Budh Nagar, Noida, U.P., August 17, 2018.
- Attended 5th meeting of Subcommittee for "Sampling Methods" (MSD 3:6), Bureau of Indian Standards, New Delhi, September 12, 2018.
- Attended meeting of the Group of Experts for deliberating the national factsheet prepared by pooling data from DLHS-4 and AHS, New Delhi, September 26, 2018.
- As Expert Member of Advisory Committee of the TNHPS, attended joint meeting of Madras Institute of Development Studies and Department of Economics and Statistics, Govt. of Tamil Nadu, Chennai, September 28-29, 2018.
- Attended Advisory Committee meeting on "Assessment of Zero Budget Natural Farming in Andhra Pradesh", Centre for Economic and Social Studies, Hyderabad and Govt of Andhra Pradesh, to finalize sample design, questionable design and other related activities, October 05, 2018.

- Attended meeting of the Core Group on Normalization at National Testing Agency, Gautam Budh Nagar, Noida, February 16, 2019.
- Attended meeting of Training Programme Approval Committee at CSO, MoSPI, , New Delhi, Feb 19, 2019.
- As Member, attended 22nd meeting of Management and Systems Division Council, Bureau of Indian Standards, New Delhi, March 13, 2019.
- As Expert Member, attended Departmental Promotion Committee meeting at ICAR-Central Inland Fisheries Research Institute, Barrackpore, March 26, 2019.

Prachi Misra Sahoo

- Attended Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team on 17.04.2018 and 29.06.2018 regarding the progress and monitoring of two FAO funded projects being conducted at ICAR-IASRI.
- Attended MIDH Annual Action Plan meeting held on 02.05.2018 under the Chairpersonship of Principal Adviser, MoAFW, Govt. of India at Krishi Bhawan, New Delhi.
- Attended meeting relating to Agricultural Insurance projects on 14.05.2018 held at Krishi Bhawan New Delhi.
- Attended DAHDF meeting held on 24.05.2018 under the Chairpersonship of Adviser (AHS), MoAFW, Govt. of India at DAHDF office, Shadipur, New Delhi.
- Attended last Review Committee meeting of CHAMAN project held on 12.06.2018 under the Chairpersonship of Smt. Sudha P. Rao, Principal Adviser, DACFW, MoAFW, Govt. of India at Krishi Bhawan, New Delhi in which progress of the project till date was presented.
- Attended Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team and Finland team on 10.07.2018 regarding the operational plan for field testing of PHL in Fish in Finland.
- Attended Video Conference meeting with Food and Agriculture Organization of the United Nations (FAO), Rome Statistics Division team and Mexico team on 12.07.2018 regarding the planning of survey for field testing of PHL in Fruits and vegetables in Mexico.
- Attended a meeting with trade organizations held on 20.07.2018 at Kolkata.
- Attended meeting on presentation of report of the study entitled 'Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Programme under MIDH' organized by Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture and Farmers Welfare (MoAFW) on 24 August, 2018 in Ministry of Agriculture and Farmer Welfare.
- Attended Skype meeting with FAO officials under the project "Study on field testing of the developed guidelines on estimating post-harvest losses of horticultural crops, livestock products and fish and fish products" on 06 & 29 August, 2018.
- Attended a meeting with Director, MNCFC on 15.10.2018 at MNCFC, New Delhi regarding discussion on Crop Insurance project.
- Attended Review meeting of pilot studies on Crop Insurance held on 22.11.2018 and presented the progress of the Crop Insurance project till date.
- Attended a meeting related to the project proposal on on-line solution of Integrated Sample Survey (ISS) under the Chairmanship of Sh. P.K. De, Adviser (Stat.), DADF, MoAFW, Govt. of India on 29.11.2018 in which a detailed discussion regarding the study was made.

Kaustav Aditya

- Attended a Project Management Committee (PMC) meeting under the project "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report" at Agro Economic Research Centre (AERC), Vallabh Vidya Nagar, Anand, Gujarat during 23-24 April 2018.
- Attended a PMC meeting on 24th August, 2018 of the project entitled "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report".

Pradip Basak

- Attended Technical Advisory Committee (TAC) meeting on 7th February, 2019 at Krishi Bhawan, New Delhi to discuss on the issue of prevented sowing of Jalore and Barmer district of Rajasthan under PMFBY kharif 2018
- Attended Technical Advisory Committee (TAC) meeting on 6th March, 2019 at Krishi Bhawan, New Delhi to discuss the issues of pending claims in 200 villages of Ramanathapuram of Tamil Nadu State under PMFBY.

Sudeep Marwaha

- Annual Conference of VCs of AUs & Directors of ICAR Institutes and launched the FVMS module and TMIS. Various functionalities of TMIS &FVMS were also presented 31 Jan. to 1st Feb. 2019 at NASC Pusa, New Delhi.
- 3rd Interactive meet of Nodal Officers of SAUs/ DUs/CUS and presented the functionalities of Education Portal during 4-5 May. 2018 at Port Blair.
- Two days Mission Meeting of NAHEP (on implementation support and review mission). Dr. Edward Bresnyan and his team, officials of the World Bank were also present 6-7 Dec. 2018.
- 3rd National Supercomputing Mission (NSM) Executive Board Meeting on 8th Sept. 2018 at Electronics Niketan, New Delhi
- Meeting on 'BSMA Committee for Statistical Sciences' to discuss various issues relating to revision of existing ICAR PG and Ph.D. syllabi under Statistical Sciences category along with the aspects connected to its implementation across the country on 10th Aug. 2018 at IASRI, New Delhi.
- Collaboration work plan for the years 2017-18 between ICAR-CABI with representative of CABI, London on 11th April 2018 at Krishi Bhawan, New Delhi.
- Meeting with Vice-Chancellor of Birsa Agricultural University, Ranchi on implementation of Academic Management System at BAU, Ranchi on 24th April 2018 at NASC Pusa New Delhi.
- Meeting Chaired by DG, ICAR for conduct of online entrance exam for UG, PG etc. for admission to academic session 2018-19 on 26th April 2018 at Krishi Bahwan, New Delhi.
- Research Advisory Committee meeting on 8th May 2018 at IASRI, New Delhi.
- Smart India Hackathon 2018 Award Meeting on 26th April 2018 at AICTE Hq. New Delhi
- Meeting with KVK Project team from CIMMYT India and USA, on 25th Oct. 2018 at Extension Division, KAB-1, Pusa New Delhi

Anil Rai

- Consultative meeting on "Development of Roadmap on Genomic Selection on Cattle and Buffaloes and Modalities for National Genetic Evaluation System (NGES)" at NASC, Complex New Delhi-110012 during January 18-19, 2019
- Interaction meeting of ICAR Experts with AI team of IBM under the Chairmanship of D.G. ICAR at ICAR, New Delhi on March 11, 2019
- IMC of ICAR-NIAP, New Delhi on March 16, 2019
- Review meeting and brainstorming meeting on "Metagenomics in Brackish Water Fisheries" on March 8, 2019 at ICAR-CIBA, Chennai.
- Attended Interaction meeting of ICAR Experts with AI team of IBM under the Chairmanship of D.G. ICAR on March 11, 2019 at ICAR, New Delhi.
- Visited "Central Statistical Office (CSO), Lusaka Zambia" under FAO Rome project for imparting training to enumerators and officials involved in field testing of guidelines on estimation of losses of meat and milk, preparation of questionnaire for field data collection, pre-testing of the questionnaire during September 23-29, 2018.
- Attended meeting of the Board Subject Matter Committee (BSMA) members for "Revision of syllabi for courses of Master's and Ph.D degree disciplines at all SAUs and Deemed Universities under ICAR" of Plant Biotechnology and Bioinformatics courses on November 24, 2018 at NRC-PB, New Delhi

A.R. Rao

- Attended interaction meeting of ICAR Experts with AI team of IBM under the Chairmanship of D.G. ICAR at ICAR, New Delhi on March 11, 2019

- Attended 409th Academic Council meeting of PG School, IARI held at IARI, New Delhi on 7th February 2019
- Attended 29th BTISnet Coordinators meeting held by DBT at ICGEB, New Delhi
- Broad Subject Matter Committee (BSMA) meeting held at ICAR-NRCPB, New Delhi on 12-11-2018
- 130th Meeting of Professors of teaching disciplines held at ICAR-IARI on 31-07-2018

M.A. Iquebal

- Organized and attended meeting with CIRC, Meerut Scientists regarding Genomic Portal development on October 13, 2018.
- Attend Twinning research and development (CFTP) 2017-18 meeting at Conference Room 2nd Floor NER-BPMC, A -258, S. B. House, Defence Colony, New Delhi- 110024 for presentation of the research project entitled "Molecular characterization, development of molecular markers and metabolite analysis of Tree bean (Parkia roxburghii) landraces of North-East India (Ref. No. BT/42/NE/2013)" on June 11, 2018.
- Attended meeting regarding presentation of research project entitled "Improving the usability of buffalo spermatozoa by sperm surface remodeling and immune acceptance in female reproductive tract" for funding by NASF, ICAR, New Delhi at NASC, New Delhi on June 16, 2018.
- Attended meeting with team of Scientists from ICAR-National Dairy Research Institute, Karnal on July19, 2018.

Sarika

- Attended meeting with CIRC, Meerut Scientists regarding Genomic Portal development on October 13, 2018.
- Attended meeting regarding presentation of research project entitled "Improving the usability of buffalo spermatozoa by sperm surface remodeling and immune acceptance in female reproductive tract" for funding by NASF, ICAR, New Delhi at NASC, New Delhi on June 16, 2018.
- Meeting organized with scientists from ICAR-NDRI, Karnal regarding discussion on NASF project.
- Attended meeting with team of Scientists from ICAR-National Dairy Research Institute, Karnal on July19, 2018.

Alka Arora

- attended a meeting to discuss the RFP for implementation ICAR-ERP under the Chairmanship of Special Secretary, DARE & Secretary, ICAR on 13th August, 2018 at Krishi Bhawan, New Delhi.
- attended meeting of committee for website updation as chairperson.
- visited CISH, Lucknow for assessment evaluation of Scientist.

Mukesh Kumar

- Attended a meeting for implementation plan and budget of e-office under the Chairmanship of Special Secretary, DARE & Secretary, ICAR on 26 July, 2018 at Krishi Bhawan, New Delhi
- Attended a meeting to discuss the RFP for implementation ICAR-ERP under the Chairmanship of Special Secretary, DARE & Secretary, ICAR on August 13, 2018 at Krishi Bhawan, New Delhi
- Attended the Kick-off meeting of the ICT roadmap for ICAR activity on June 01, 2018 under the Chairmanship of Secretary (DARE) & DG (ICAR) on 01 June, 2018 at Krishi Bhawan, New Delhi
- Attended a meeting to discussed the Gap Analysis Report prepare by KPMG personnel on ICT Roadmap for ICAR under the Chairmanship of Secretary, DARE & DG, ICAR on August 14, 2018 at Krishi Bhawan, New Delhi
- Attended the Zonal Review Meeting of the Farmer FIRST Programme (FFP) held on 19th December, 2018 at ICAR-ATARI, Jodhpur

Shashi Dahaiya

- Attended a workshop on Output-Outcome Monitoring Framework of Niti Aayog, organized by DMEO, Niti Aayog, New Delhi on 18th May' 2018.

Soumen Pal

- attended a meeting at DBT Mission, New Delhi on 21st May, 2018 regarding the MIS integration of DARE DBT Portal and DBT Bharat Portal.
- attended a meeting at KAB-II with DDG (Ag. Extension) and ADG (Ag. Extension) regarding implementation of DBT functionality in KVK Portal on 4th September, 2018
- attended a meeting at KAB-I with ADG (EP & HS) and Nidhi Verma, Principal Scientist, Education Division, ICAR regarding production data approval policy in DBT DARE Portal on 18th September, 2018.
- Attended a meeting on KVK Portal and KVK Mobile App at ICAR-ATARI, Kolkata during 15-16 January, 2019.
- attended interactive meet on KVK Portal and KVK Mobile App with Programme Assistants (Computer) and Subject Matter Specialists (SMSs) of 5 Krishi Vigyan Kendras (KVKs) at Howrah Krishi Vigyan Kendra (KVK), West Bengal during 23-24 January, 2019.

Sudeep, Alka Arora, Mukesh Kumar and Mr. SN Islam

- Attended a meeting for reviewing the progress of implementation of ICAR-ERP and future strategy for ICAR-ERP solution under the Chairmanship of Secretary (DARE) & DG (ICAR) on 28 June, 2018 at Krishi Bhawan, New Delhi

Mukesh Kumar, Dr Sudeep Marwaha, Dr Alka Arora, Dr SN Islam and Dr Soumen Pal

- Attended the ICT Wing meeting at ICAR Hq under the Chairmanship of DG, ICAR held on 3rd January, 2019.

Sudeep Marwaha and Shashi Dahaiya

- attended meeting with Director(Finance) and Sh. Anand Trivedi, Consultant DMEO, NITI Aayog regarding development of software for result framework of ICAR, DARE on 14.5.18 at 2.30 PM

Sudeep Marwaha and Soumen Pal

- attended a meeting at Krishi Bhawan, New Delhi on 30th May, 2018 under the chairmanship of Additional Secretary, DAC&FW regarding implementation plan for reporting of activities under Krishi Kalyan Abhiyaan Programme into KVK Portal.

Soumen Pal and Sudeep Marwaha

- attended a meeting at Krishi Bhawan, New Delhi on 29th June, 2018 with Additional Secretary, DAC&FW regarding reporting of activities under Krishi Kalyan Abhiyaan Programme into KVK Portal.

Soumen Pal and Alka Arora

- attended a meeting with Mr. Rajesh Srivastava, Technical Director, NIC regarding accessing of Agmarknet data through web service at CGO Complex, New Delhi on 12th September, 2018.

Soumen Pal, Alka Arora and Sudeep

- attended a meeting at Krishi Bhawan with Joint Secretary, (Policy & FW), Ministry of Agriculture & Farmers Welfare regarding implementation of Krishi Kalyan Abhiyaan Phase II reporting in KVK Portal on 14th September, 2018.

Sudeep, Alka Arora and Soumen Pal

- attended a meeting at KAB-I with DDG (Ag. Extension), Randhir Singh (ADG, Ex. Extension) and P. Adhiguru along with CIMMYT team regarding integrating Cereal Systems Initiative for South Asia (CSISA) project into KVK Portal on 23rd and 24th October, 2018.

Alka Arora, Sudeep and L.M. Bhar

- attended a meeting at Krishi Bhawan in the chairmanship of DG (ICAR) regarding discussion on contents of MoU between ICAR and TCS on 23rd October, 2018.

Soumen Pal and Sudeep

- attended a meeting at KAB-II with ADG (EP & HS) and Nidhi Verma, Principal Scientist, Education Division, ICAR regarding production data uploading policy in DBT DARE Portal by the stakeholders on 26th October, 2018.

Soumen Pal and Alka Arora

- attended a meeting with Mala Mittal, Technical Director, NIC at CGO Complex, New Delhi regarding accessing of Agmarknet data through web service into KVK Portal on 29th October, 2018.

Sudeep, Alka Arora, Mukesh Kumar, S. N. Islam and Soumen Pal

- attended a meeting under the chairmanship of DG, ICAR on 3rd January, 2019 at Krishi

Bhawan, New Delhi to discuss the way forward for Information Communication Technology wing of ICAR Hq.

Some more articles in Hindi

- Lama, A., Singh, K. N., Gurung, V., Sekhawat, R. S. and Roy, H. S. (2018). Observation of Time Series Model. *Bhartiya Krishi Anusandhan Patrika*, 33 (1&2), 58-61.
- सुमीत सौरव, सिनी वर्गीस, मो. हारून, सीमा जग्गी एवं देवेन्द्र कुमार (2018). संवेदी परीक्षणों में परीक्षण उत्पादों की दो नियंत्रण उपचार से तुलना हेतु संतुलित अभिकल्पनाएं। भारतीय कृषि अनुसंधान पत्रिका, 33(3), 218–220.
- अखिलेश झा, सिनी वर्गीस, सीमा जग्गी, मो. हारून एवं देवेन्द्र कुमार (2018). तीन प्रतिकृतियों वाली असमान खण्ड आकारों में समाधेय आंशिक संतुलित अपूर्ण खण्ड (2) अभिकल्पनाओं की नई श्रंखला। भारतीय कृषि अनुसंधान पत्रिका, 33(3), 161–164.
- अखिलेश झा, सिनी वर्गीस, सीमा जग्गी, मो. हारून एवं देवेन्द्र कुमार (2018). आदेशात्मक सहवासी प्रभावों हेतु समाधेय खण्ड अभिकल्पनाएं। भारतीय कृषि अनुसंधान पत्रिका, 33(2), 113–115.
- अर्पण भौमिक, सीमा जग्गी, एल्दो वर्गीस, सुनील कुमार यादव, मोहम्मद हारुन, सिनी वर्गीस, अनिंदिता दत्ता एवं उदयवीर सिंह (2018). विविधता के दो स्त्रोतों के अंतर्गत पशु परीक्षणों के लिए प्रवृत्ति मुक्त अभिकल्पनाएँ। भारतीय कृषि अनुसंधान पत्रिका, 33(3), 200–202.

12

Conferences, Workshops, Meetings and Seminars organized

Seema Jaggi, Rajender Parsad and Anindita Datta

- Coordinated the three months (12 November, 2018 – 11 February, 2019) Professional Attachment Training for ARS Probationers of the discipline of Agronomy on Design of Experiments and Data Analysis at ICAR-IASRI.

Rajender Parsad, Sukanta Dash and Arpan Bhowmik

- Organized a Modular Course on Basic Statistical Methods in Agriculture for the Participants of 3rd Batch of Afghanistan National Agricultural Sciences and Technology University Students under International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy" from February 04-23, 2019 at ICAR-IASRI, New Delhi (the complete programme was coordinated by Professor Anupam Verma and organized at IARI, New Delhi).

Rajender Parsad, Susheel Kumar Sarkar, Sukanta Dash and Arpan Bhowmik

- Organized a Training-Cum-Workshop on Unit Level Data Repository for AICRPs during February 25-26, 2019 under KRISHI project

Rajender Parsad, Anil Kumar, Anshu Bhardwaj, Susheel Kumar Sarkar and Sukanta Dash

- Organized a two days' Workshop on ICAR KRISHI Portal - A Central Research Data Repository during March 18-19, 2019 at ICAR-IASRI, New Delhi

Rajender Parsad

- Organized one day Worskhop on ICAR- KRISHI Portal: A Central Research Data Repository at ICAR- NRC for Banana, Tiruchirapalli on 25 March, 2019.

B. N. Mandal

- A Hindi workshop on "Academic writing with LaTeX" has been organized by the Division of Design of Experiments with the cooperation of Hindi Unit of the institute on 25 March 2019.
- Rajender Parsad, Mukesh Kumar, Anshu Bharadwaj, Anil Kumar, Susheel Kumar Sarkar, Sukanta Dash and Arpan Bhowmik
- Organized III National Workshop of Officer Incharge, Data Management during December 04-05, 2018 at ICAR-IASRI, New Delhi

L.M. Bhar, Amrit Kumar Paul &

Susheel Kumar Sarkar

- Organized 72nd annual conference of Indian Society of Agricultural Statistics at ICAR-CIAE, Bhopal during December 13-15, 2018 as Secretary/Joint Secretaries, Organizing Committee.

Anuja A. R.

- Organizer cum exhibitor of ICAR-IASRI stall in *PusaKrishiVigyan Mela*-2019, organized by ICAR-IARI, New Delhi during 05-07 March, 2019.

Mrinmoy Ray, Achal Lama and Harish kumar, H.V.

- Organized training on "Time Series Analysis, Forecasting techniques and R software" for students of ICAR- CIFE, Mumbai during September 10, 2018 to September 29, 2018 at ICAR-IASRI, New Delhi.

L.M. Bhar

- Organized jointly with Director ICAR-NAARM, Hyderabad and Director ICAR-IIWM, Bhubaneswar the National Workshop on Artificial Intelligence in Agriculture: Status and prospects at NASC complex, New Delhi during 30-31 July, 2018.

Prachi Misra Sahoo

- Organized a six day Hindi workshop entitled "कृषि सर्वेक्षणों के लिए प्रतिदर्श तकनीकें एवं प्रतिदर्श आँकड़ों का सांख्यिकीय विश्लेषण" at ICAR-Indian Agricultural Statistics Research Institute, New Delhi during February 22-27, 2018.

Kaustav Aditya

- Organized a PMC meeting of the project entitled "Pilot study for developing State level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee report" as a Member Secretary of organizing committee on 24 August, 2018.

Pal Singh and Dr Sudeep Marwaha

- Organized One day Hindi Workshop on विषय ''कृषि में संगणक का अनुप्रयोग'' on 25 July, 2018

Mukesh Kumar, Sudeep, Rakesh Saini and Vijay Kumar

- Organized Sensitization training cum workshop on "Implementation of e-Office in ICAR Institutes" during 23 -24 January, 2019

Neeraj Budhlakoti

- Organized Next Generation Sequencing (NGS) Data Analysis: A Practical Perspective at IGKV, Raipur during 7- 9 August, 2018.

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Distinguished Visitors

1. **Dr. Trilochan Mohapatra**
   Secretary (DARE) & Director General (ICAR)
   Krishi Bhavan, New Delhi
2. **Dr. N.S. Rathore**
   Deputy Director General
   Indian Council of Agricultural Research
   New Delhi
3. **Dr. A.K. Singh**
   Deputy Director General (Horticultural Science and Crop Science)
   Indian Council of Agricultural Research
   New Delhi
4. **Dr. Joykrushna Jena**
   Deputy Director General (Fisheries Science and Animal Science)
   Indian Council of Agricultural Research
   Krishi Bhawan, New Delhi
5. **Dr. P.S. Pandey**
   Assistant Director General (EP&HS)
   Indian Council of Agricultural Research
   New Delhi
6. **Dr. T. Janakiram**
   Assistant Director General (Horticulture)
   Indian Council of Agricultural Research
   New Delhi
7. **Dr. G. Venkateshwarlu**
   Assistant Director General (EQA&R)
   ICAR Krishi Anusandhan Bhawan-II
   New Delhi
8. **Prof. R.B. Singh,**
   Former Chancellor, CAU, Imphal
   Former-Chairman, ASRB and
   Former-Director, IARI, New Delhi
9. **Prof. Parmendra Kumar Dashora**
   Former Vice Chancellor
   University of Kota
   Kota, Rajasthan
10. **Dr. S.D. Sharma**
    Former-Vice Chancellor DSVV,
    Haridwar and Former-Director, IASRI
    New Delhi
11. **Dr. V.K Bhatia**
    Ex-Director
    ICAR-Indian Agricultural Statistics Research Institute
    New Delhi
12. **Dr. Ch. Srinivasa Rao**
    Director
    ICAR-National Academy of Agricultural Research Management
    Rajendranagar, Hyderabad, Telangana
13. **Dr. S.K. Ambast**
    Director
    ICAR-Indian Institute of Water Management
    Chandrasekharpur
    Bhubaneswar, Odisha
14. **Dr. Jyoti Misri**
    Principal Scientist, Animal Science
    Indian Council of Agricultural Research
    New Delhi
15. **Dr. Ravinder Singh**
    Professor MCD Biology
    University of Colorado, USA
16. **Dr. A.K. Singh**
    Director Research (A) and Head, Division of Genetics
    Indian Agricultural Research Institute
    New Delhi

14

संस्थान में हिन्दी के प्रगामी प्रयोग की रिपोर्ट

भा.कृ.अनु.प.–भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में हिन्दी के प्रगामी प्रयोग में महत्वपूर्ण अभिवृद्धि हो रही है। संस्थान द्वारा समस्त प्रशासनिक कार्य शत–प्रतिशत हिन्दी में और यथाआवश्यक द्विभाषी हो रहा है। राजभाषा नीति को संस्थान में सुचारु रूप से कार्यान्वित किया जा रहा है। भारत सरकार, गृह मंत्रालय, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों को संस्थान में लगभग पूरा कर लिया गया है।

भारत सरकार, राजभाषा विभाग की नगर राजभाषा कार्यान्वयन समिति (उत्तरी दिल्ली) द्वारा वर्ष 2017–18 के दौरान राजभाषा कार्यान्वयन कार्य में उत्कृष्ट निष्पादन हेतु मध्यम वर्ग के कार्यालयों में संस्थान को तृतीय पुरस्कार से सम्मानित किया गया। इसके अतिरिक्त, वर्ष 2017–18 के दौरान संस्थान द्वारा प्रकाशित हिन्दी पत्रिका ''सांख्यिकी विमर्श : 2017–18'' को उत्कृष्ट गृह पत्रिका पुरस्कार के अन्तर्गत द्वितीय पुरस्कार प्रदान किया गया।

भारत सरकार, राजभाषा विभाग की नगर राजभाषा कार्यान्वयन समिति (उत्तरी दिल्ली) द्वारा संस्थान में हिन्दी के प्रगामी प्रयोग से सम्बन्धित मार्च 2018 एवं सितम्बर 2018 को समाप्त छःमाही रिपोर्टों के आधार पर संस्थान को ''उत्कृष्ट श्रेणी'' में वर्गीकृत किया गया।

भारत सरकार, गृह मंत्रालय, राजभाषा विभाग के उत्तरी क्षेत्रीय कार्यान्वयन कार्यालय–। (दिल्ली) के उप–निदेशक (कार्यान्वयन) द्वारा संस्थान में राजभाषा नीति/अनुदेशों के कार्यान्वयन की स्थिति का जायजा लेने के लिए 11 जुलाई 2018 को तथा कृषि अनुसंधान एवं शिक्षा विभाग, कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार के सहायक निदेशक (राजभाषा) द्वारा 04 अक्टूबर, 2018 को संस्थान के राजभाषा सम्बन्धी निरीक्षण किये गये। दोनों निरीक्षण सफलतापूर्वक सम्पन्न हुए।

संस्थान द्वारा राजभाषा विभाग को प्रेषित 2017–18 अवधि की तिमाही हिन्दी प्रगति रिपोर्टों में दिये गये आँकड़ों की जाँच के लिए गृह मंत्रालय, राजभाषा विभाग, उत्तरी क्षेत्रीय कार्यान्वयन कार्यालय–। (दिल्ली) के उप–निदेशक (कार्यान्वयन) द्वारा 08 अक्टूबर 2018 को संस्थान का दौरा किया गया। दौरा/जाँच सफलतपूर्वक सम्पन्न हुआ।

संस्थान के समस्त कर्मियों को 02 वर्ष की अवधि में कम से कम एक बार हिन्दी कार्यशाला में सहभागिता करने का अवसर मिलने की अनिवार्यता के संबंध में भारत सरकार, गृह मंत्रालय, राजभाषा विभाग द्वारा 29 फरवरी 2016 के कार्यालय ज्ञापन सं. 12019/81/2015–रा.भा.(का–2)/पार्ट–2 द्वारा निर्धारित लक्ष्य की प्राप्ति के लिए, संस्थान द्वारा 21 सितम्बर 2016 से 08 अक्टूबर 2018 के दौरान राजभाषा हिन्दी के साथ–साथ संस्थान से संबंधित विभिन्न विषयों पर हिन्दी कार्यशालाओं का आयोजन कर संस्थान के समस्त कर्मियों को कम से कम एक बार हिन्दी कार्यशाला में प्रशिक्षित किया गया। इस प्रकार संस्थान द्वारा राजभाषा विभाग द्वारा निर्धारित उपरोक्त लक्ष्य उक्त अवधि के लिए पूरा किया।

प्रतिवेदनाधीन अवधि के दौरान संस्थान के विभिन्न वर्गों के कर्मियों के लिए छः हिन्दी कार्यशालाएँ आयोजित की गयीं। पहली कार्यशाला 05 जून 2018 को 'राजभाषा नियम एवं अनुपालन' विषय पर आयोजित की गयी जिसमें संस्थान के विभिन्न वर्ग के कर्मियों ने सहभागिता की।

इस कार्यशाला में हिन्दी एकक की प्रभारी, सुश्री ऊषा जैन द्वारा प्रतिभागियों को राजभाषा नियम/अधिनियम, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों इत्यादि के सम्बन्ध में जानकारी उपलब्ध करायी गयी। इस कार्यशाला में 03 अधिकारियों तथा 20 कर्मचारियों ने सहभागिता की। दूसरी कार्यशाला 25 जुलाई 2018 को संस्थान के संगणक अनुप्रयोग प्रभाग द्वारा ''कृषि में संगणक का अनुप्रयोग'' विषय पर आयोजित की गयी। इस कार्यशाला में 08 वक्ताओं द्वारा विषय से सम्बन्धित विभिन्न उप–विषयों पर हिन्दी में व्याख्यान दिये गये। इस कार्यशाला में 13 अधिकारियों द्वारा सहभागिता की गयी। तीसरी कार्यशाला संगणक अनुप्रयोग प्रभाग द्वारा 08 अक्टूबर, 2018 को ष्ई.आर.पी. के प्रशासनिक मॉड्यूलष विषय पर आयोजित की गयी। इस कार्यशाला में प्रतिभागियों को विषय के संबंध में जानकारी उपलब्ध करायी गयी। इस कार्यशाला में 07 अधिकारियों एवं 04 कर्मचारियों ने सहभागिता की। चौथी कार्यशाला हिन्दी एकक की प्रभारी, सुश्री ऊषा जैन द्वारा 11 दिसम्बर 2018 को ष्राजभाषा संबंधी वार्षिक कार्यक्रम एवं हिन्दी यूनिकोड का उपयोगष विषय पर आयोजित की गयी। इस कार्यशाला में 04 अधिकारियों एवं 23 कर्मचारियों द्वारा सहभागिता की गयी। पाँचवीं कार्यशाला 22 से 27 फरवरी 2019 के दौरान प्रतिदर्श सर्वेक्षण प्रभाग के वैज्ञानिक, डॉ. राजू कुमार, श्री दीपक सिंह एवं डॉ. अंकुर विश्वास द्वारा ''कृषि सर्वेक्षण के लिए प्रतिदर्श तकनीकें एवं प्रतिदर्श आँकड़ों का सांख्यिकीय विश्लेषण'' विषय पर आयोजित की गयी जिसमें 09 वक्ताओं द्वारा विषय से सम्बन्धित विभिन्न उप–विषयों पर व्याख्यान दिये गये। इस कार्यशाला में 04 अधिकारियों एवं 05 कर्मचारियों द्वारा सहभागिता की गयी। छठी कार्यशाला परीक्षण अभिकल्पना प्रभाग के वैज्ञानिक, डॉ. बी.एन. मंडल द्वारा 25 मार्च 2019 को ''लाटेक के साथ शैक्षणिक लेखन'' विषय पर आयोजित की गयी। इस कार्यशाला में 18 अधिकारियों एवं 01 कर्मचारी द्वारा सहभागिता की गयी। उक्त वैज्ञानिक/तकनीकी विषयों पर आयोजित हिन्दी कार्यशालाओं में अनेक वक्ता हिन्दीतर थे जिन्होंने बड़ी निपुणता से हिन्दी में व्याख्यान दिये। इन कार्यशालाओं के आयोजकों/वक्ताओं द्वारा प्रतिभागियों को व्याख्यानों की सामग्री, मैनुअल के रूप में, हिन्दी भाषा में उपलब्ध करायी गयी।

संस्थान में प्रशासनिक कार्य के साथ–साथ वैज्ञानिक प्रकृति के कार्यों में भी हिन्दी का उपयोग हो रहा है। संस्थान के वैज्ञानिक प्रभागों द्वारा आयोजित प्रशिक्षण कार्यक्रमों की संदर्भ पुस्तिकाओं में कवर पेज, आमुख एवं प्राक्कथन द्विभाषी रूप में प्रस्तुत करने के साथ–साथ कुछ हिन्दी के व्याख्यान भी शामिल किये गये। वैज्ञानिकों द्वारा अपनी परियोजना रिपोर्टों में कवर पेज, आमुख, प्राक्कथन एवं सारांश द्विभाषी रूप में प्रस्तुत किये गये। संस्थान के वैज्ञानिकों द्वारा हिन्दी में वैज्ञानिक विषयों पर हिन्दी कार्यशालाओं का आयोजन किया गया। इसके अतिरिक्त, संस्थान में एम.एससी. तथा पीएच.डी. के विद्यार्थियों द्वारा अपने शोध–प्रबन्धों में सार द्विभाषी रूप में प्रस्तुत किये गये। वैज्ञानिकों एवं तकनीकी कर्मियों द्वारा शोध–पत्र हिन्दी में प्रकाशित किये गये।

प्रतिवेदनाधीन अवधि में संस्थान में राजभाषा कार्यान्वयन समिति की बैठकें नियमित रूप से आयोजित की गयीं। इन बैठकों में राजभाषा अधिनियम, 1963 की धारा 3(3) के अनुपालन को सुनिश्चित करने, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम की विभिन्न मदों, राजभाषा विभाग एवं परिषद् मुख्यालय से समय–समय पर प्राप्त निदेशों का अनुपालन सुनिश्चित करने, कार्यशालाओं के नियमित आयोजन, हिन्दी पत्रिका के प्रकाशन, हिन्दी पखवाड़े के आयोजन इत्यादि पर विस्तार से चर्चा हुई।

राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों को पूरा करते हुए संस्थान के अधिकारियों/कर्मचारियों द्वारा समस्त पत्राचार हिन्दी में अथवा द्विभाषी रूप में किया गया। संस्थान के विभिन्न वैज्ञानिक प्रभागों तथा प्रशासनिक अनुभागों द्वारा आयोजित बैठकों की कार्यसूची तथा कार्यवृत्त शत–प्रतिशत हिन्दी में अथवा द्विभाषी रूप में जारी किये गये। संस्थान में अपना कार्य शत–प्रतिशत हिन्दी में करने के लिए 12 अनुभागों को विनिर्दिष्ट किया गया है। गृह मंत्रालय, राजभाषा विभाग द्वारा जारी विभिन्न नकद पुरस्कार योजनाएँ संस्थान में लागू हैं तथा संस्थान के कर्मियों ने इन योजनाओं में भाग लिया।

संस्थान में कार्यरत सभी हिन्दीतर अधिकारियों/कर्मचारियों द्वारा हिन्दी ज्ञान सम्बन्धी प्रशिक्षण पूरा किया जा चुका है। आज तक की स्थिति के अनुसार, संस्थान में अब कोई ऐसा हिन्दीतर अधिकारी/कर्मचारी शेष नहीं रह गया है जिसे हिन्दी ज्ञान सम्बन्धी प्रशिक्षण दिया जाना शेष हो।

इसके अतिरिक्त, 'हिन्दी शिक्षण योजना' के अन्तर्गत संस्थान में हिन्दी आशुलिपि के प्रशिक्षण का लक्ष्य पूरा है। अभी तक हिन्दी टंकण के प्रशिक्षण का लक्ष्य भी पूरा था परन्तु दिसम्बर 2018 से संस्थान में कुछ कनिष्ठ लिपिकों की नियुक्ति हुई है जिन्हें 'हिन्दी शिक्षण योजना' के अन्तर्गत हिन्दी टंकण का प्रशिक्षण दिलवाने संबंधी कार्रवाई चल रही है। इसके अतिरिक्त, राजभाषा विभाग से प्राप्त दिशा–निर्देशों के अनुसरण में वर्ग 'घ' से वर्ग 'ग' में गये कर्मियों में से वर्ग 'ग'

श्रेणी के लिए निर्धारित शैक्षिक योग्यता रखने वाले कर्मियों को रोस्टरबद्ध कर उन्हें भी केन्द्रीय हिन्दी प्रशिक्षण संस्थान से हिन्दी टंकण का प्रशिक्षण दिलवाया जा चुका है। इनमें से केवल 01 कर्मी द्वारा टंकण परीक्षा उत्तीर्ण की जानी शेष है।

संस्थान की वेबसाइट पर 'हिन्दी सेवा लिंक' उपलब्ध है। जिसमें सांख्यिकीय एवं प्रशासनिक शब्दावली के वर्ण क्रमानुसार कुछ शब्द, कुछ द्विभाषी प्रपत्र, दैनिक काम–काज के प्रयोग में आने वाली कुछ टिप्पणियाँ, द्विभाषी पदनाम, वाक्यांश इत्यादि सामग्री उपलब्ध है। संस्थान के कर्मियों द्वारा अपना दैनिक कार्य हिन्दी में सरलता से करने के लिए इस सेवा का उपयोग किया जाता है।

संस्थान द्वारा प्रकाशित हिन्दी पत्रिका, 'सांख्यिकी–विमर्श' के चौदहवें अंक का प्रकाशन मार्च 2019 में किया गया। इस पत्रिका में संस्थान में सम्बन्धित वर्ष में किये गये अनुसंधानों व अन्य कार्यों के संक्षिप्त विवरण, राजभाषा से सम्बन्धित कार्यों आदि की जानकारी के साथ–साथ कृषि सांख्यिकी, संगणक अनुप्रयोग एवं कृषि जैव सूचना से सम्बन्धित विभिन्न लेखों एवं शोध–पत्रों को भी प्रस्तुत किया गया है। पाठकों के हिन्दी ज्ञानवर्धन के लिए दैनिक स्मरणीय शब्द–शतक हिन्दी व अँग्रेजी में दिया गया है।

संस्थान में 01 से 14 सितम्बर 2018 के दौरान हिन्दी पखवाड़े का आयोजन किया गया। दिनांक 01 सितम्बर 2018 को हिन्दी पखवाड़े का उद्घाटन संस्थान के निदेशक, डॉ. लाल मोहन भर द्वारा किया गया। हिन्दी पखवाड़े के उद्घाटन के तत्पश्चात काव्य–पाठ का आयोजन किया गया जिसमें संस्थान के कर्मियों द्वारा स्व–रचित तथा प्रतिष्ठित कवियों की रचना का पाठ किया गया। संस्थान में प्रत्येक वर्ष हिन्दी दिवस के अवसर पर डॉ. दरोगा सिंह स्मृति व्याख्यान का आयोजन किया जाता है। इस वर्ष इस कड़ी का सत्ताइसवाँ व्याख्यान भा.कृ.अनु. परिषद् के उप–महानिदेशक (शिक्षा), डॉ. नरेन्द्र सिंह राठौड़ जी द्वारा ''भारत में स्थायी कृषि हेतु आवश्यक आयाम'' विषय पर दिया गया। डॉ. नरेन्द्र सिंह राठौड इस समारोह के मुख्य अतिथि भी थे। भा.कृ.अनु. परिषद् के सहायक महानिदेशक (शिक्षा), डॉ. पुण्यव्रत एस. पाण्डेय जी इस समारोह के विशिष्ट अतिथि थे। संस्थान के वैज्ञानिक प्रभागों के लिए प्रभागीय चल–शील्ड प्रतियोगिता आयोजित की गयी जिसमें वैज्ञानिक प्रभागों में कार्यरत वैज्ञानिकों, तकनीकी कर्मियों, छात्रों द्वारा वित्त वर्ष 2017–18 के दौरान हिन्दी में लिखे एवं प्रस्तुत किए गए शोध–पत्रों, हिन्दी में दिए गए व्याख्यानों एवं सेमिनारों, वैज्ञानिक विषयों पर हिन्दी कार्यशालाओं के आयोजन, शोध–पत्र पोस्टर प्रस्तुति इत्यादि वैज्ञानिक एवं तकनीकी प्रकृति के कार्यों के आधार पर प्रभागीय चल–शील्ड का निर्धारण किया गया। संस्थान के वैज्ञानिकों, छात्रों, आर.ए. एवं एस.आर.एफ. के लिए डिजिटल हिन्दी शोध–पत्र प्रस्तुति प्रतियोगिता का आयोजन किया गया। इस प्रतियोगिता में प्रतिभागियों द्वारा स्वयं के मूल अनुसंधान पर आधारित शोध–पत्रों की हिन्दी में डिजिटल प्रस्तुति की गयी।

इसके अतिरिक्त, हिन्दी पखवाड़े के दौरान काव्य–पाठ, प्रश्न–मंच, अन्ताक्षरी तथा हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता का आयोजन किया गया। प्रश्न–मंच एवं अन्ताक्षरी प्रतियोगिता के संचालकों द्व ारा इन प्रतियोगिताओं को ऑडियो विजुअल रूप में प्रस्तुत किया गया जिससे ये प्रतियोगिताएँ अत्यन्त ही रोचक रहीं। सभी प्रतियोगिताओं में छात्रों सहित संस्थान के विभिन्न वर्ग के कर्मियों ने बढ़–चढ़कर हिस्सा लिया।

दिनांक 14 सितम्बर 2018 को हिन्दी दिवस के अवसर पर हिन्दी पखवाड़े का समापन हुआ तथा समापन समारोह के अवसर पर हिन्दी पखवाड़े के दौरान आयोजित विभिन्न कार्यक्रमों/प्रतियोगिताओं के प्रतिभागियों को सम्मानित करने एवं सफल प्रतियोगियों को पुरस्कृत करने के साथ–साथ वर्ष 2017–18 के दौरान ''सरकारी कामकाज मूल रूप से हिन्दी में करने के लिए प्रोत्साहन योजना'' के अन्तर्गत भी नकद पुरस्कार प्रदान किये गये। इसके अतिरिक्त, इस अवसर पर जुलाई 2017 से जुलाई 2018 तक की अवधि के दौरान संस्थान में आयोजित हिन्दी कार्यशालाओं के वक्ताओं को प्रमाण–पत्र वितरित करने के साथ–साथ संस्थान द्वारा प्रकाशित हिन्दी पत्रिका : सांख्यिकी विमर्श 2017–18 के सम्पादक मंडल के सदस्यों को भी प्रशस्ति–पत्र प्रदान किये गये।

Annexure-I

LIST OF RESEARCH PROJECTS

1st April, 2018 to 31st March, 2019

DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEMS RESEARCH

On-going

Institute Funded

1. Design involving three-way and four-way genetic crosses for agricultural and animal breeding programmes. (AGENIASRISIL201700300089) Harun (till 11.09.2018), Anindita Datta (since 12.09.2018), Cini Varghese, Seema Jaggi: 09.03.2017-08.03.2020
2. Generalized row-column designs for cop and animal experiments. (AGENIASRISIL201700400090) Anindita Datta, Harun (till 11.09.2018), Seema Jaggi, Cini Varghese: 31.03.2017-30.03.2020
3. Analytical procedure for factorial experiments with Logistic and Gompertz error distributions. (AGEDIASRISIL201701300099) Sunil Kumar Yadav: 25.05.2017-24.05.2019

Outside Funded

4. ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Under ICAR Headquarter Plan Scheme (2015-2020). (AGENIASRICOL201503100068)
   ICAR-IASRI: Rajender Parsad, AK Choubey (till 20.01.2018), Anil Kumar, Mukesh Kumar, Anshu Bharadwaj, Susheel Kumar Sarkar, Arpan Bhowmik, Raju Kumar (till 04.06.2017), Vandita Kumari Choudhary (till August 2016) and Sukanta Dash (since 03.04.2017)
   ICAR-NAARM: A Dhandapani
   ICAR-NBSS&LUP: GP Obi Reddy, Nirmal Kumar and Sudipto Chattaraj
   ICAR-IARI: Vinay Kumar Seghal and Joydeep Mukerjee
   ICAR-DKMA: Mitali Ghosh Roy
   ICAR-CMFRI: J Jayasankar
   ICAR-CRIDA: NS Raju, P Vijaya Kumar (since 17.12.2017), AVM Subba Rao (Since 17.12.2017)
   : 24.07.2015-31.03.2020
5. Incomplete split-plot designs: construction and analysis. Funded by SERB. (AGENIASRISOL201601000079) BN Mandal, Sukanta Dash, Rajender Parsad, VK Gupta (till March 16, 2016): 16.08.2016-15.08.2019
6. Planning, designing and analysis of experiments planned on stations under All India Coordinated Research Project on Integrated Farming Systems. Funded by AICRP on IFS, IIFSR, Modipuram. (AGEDIASRISOL201701900105) Anil Kumar, Md. Harun (till 11.09.2018), Susheel Kumar Sarkar and Eldho Varghese (till 22.07. 2017): 01.04.2017- 31.03.2020
7. Designing and Analysis of ON FARM Research Experiments Planned under AICRP on IFS. Funded by AICRP on IFS, ICAR-IIFSR. (AGEDIASRISOL201702000106) Cini Varghese, Sukanta Dash, Arpan Bhowmik: 01.04.2017- 31.03.2020
8. Planning, designing and analysis of data relating to experiments for AICRP on Long Term Fertilizer Experiments. Funded by AICRP on Long Term Fertilizer Experiments, ICAR-IISS. (AGEDIASRISOL201702100107) BN Mandal, Anindita Datta, Sunil Kumar Yadav: 01.04.2017-31.03.2020

Completed

Institute Funded

9. Some investigations on trend resistant row-column designs. (AGENIASRISIL201502900066) Arpan Bhowmik, Seema Jaggi, Eldho Varghese (till 06.10.2017) and Sunil Kumar Yadav: 24.09.2015-30.06.2018

10. On construction of orthogonal and nested orthogonal Latin hypercube designs. (AGENIASRISIL201503200069) Sukanta Dash, Rajender Parsad, BN Mandal and Susheel Kumar Sarkar: 16.11.2015-18.01.2019

New Initiated

Outside Funded

11. Plant source based environmentally safe crop protection and production technologies: Development and capacity building under the Niche Area of Excellence (NAE) Programme of ICAR at IARI. (AGEDIASRICOP201900600152)
    ICAR-IARI: Anupama Singh, Rajesh Kumar, Supradip Saha
    ICAR-IASRI: Sukanta Dash, Anil Kumar
    : 27.03.2019-26.03.2022
12. Application of Next-Generation Breeding, Genotyping, and Digitalization Approaches for Improving the Genetic Gain in Indian Staple Crops. Funded by ICAR and Bill and Melinda Gates Foundation (BMGF). (AGEDIASRICOP201900200148)
    ICAR-IARI : AK Singh, Ranjith Kumar Ellur, S Gopala Krishnan, C Bharadwaj, Shailesh Tripathi, Rajbir Yadav, Harikrishna, Neelu Jain, M Ganapathi, Jyoti Kaul, RS Raje, G Rama Prashat, Durgesh Kumar
    ICAR-IIMR : T Nepolean, Madusudhana, B Aruna, Sanjana Reddy
    ICAR-IIPR : Abhishek Bohra, B Mondal
    ICAR-CPRI: Vinay Bhardwaj, Vinod
    ICAR-NRRI: JN Reddy, Anandan
    ICAR-IIRR: LV Subbarao, Abdul Fiaz
    ICAR-IIWBR: Satish Kumar, Ravish Chatrath
    ICAR-Project Coordinating Unit (Pearl millet): Vikas Khandelwal
    ICAR-Project Coordinating Unit (Chickpea): AK Srivastava
    ICAR-IASRI: Shusheel Kumar Sarkar
    ICRISAT: Abhishek Rathore
    : 22.01.2019-21.01.2023

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

On-going

Institute Funded

13. Future perspective of Bt technology in Indian agriculture. (AGENIASRISIL201601700086) Mrinmoy Ray, KN Singh, Santosha Rathod (till 13.06.2018), Bishal Gurung (till 19.07.2018), Ravindra Shekhawat (since 15.12.2016) and Ramasubramanian V (since 17.07.2017): 01.12.2016-18.04.2019
14. Development of count time-series models for predicting pest dynamics using weather variables. (AGEDIASRISIL201700900095) Prawin Arya, Bishal Gurung (till 19.07.2018) and Md. Wasi Alam (since 20.07.2018): 19.04.2017-18.10.2019
15. Modelling and forecasting of drought index using machine learning techniques. (AGEDIASRISIL201701200098) Rajeev Ranjan Kumar (till 11.09.2018), KN Singh (since 12.09.2018), Ravindra Singh Shekhawat
    ICAR Headquarters, New Delhi: Sanjeev Panwar
    : 22.05.2017-21.09.2019
16. Tractorization in Semi Arid Tropic (SAT) India: Determinants and implications. (AGEDIASRISIL201701100097) Ravindra Singh Shekhawat, Rajeev Ranjan Kumar (till 11.09.2018): 01.05.2017-01.05.2019
17. Parameter estimation of time series models using Bayesian technique. (AGEDIASRISIL201702200108) Achal Lama, Bishal Gurung (till 19.07.2018), Santosha Rathod (till 13.06.2018): 01.11.2017- 31.10.2020

Outside Funded

18. Forecasting Agricultural output using Space Agrometeorology and Land based observations (FASAL). Funded by IMD, New Delhi. (AGENIASRICOP201600700076)
    IMD: KK Singh
    ICAR-IASRI: KN Singh, Bishal Gurung (till 19.07.2018) and Achal Lama (since 31.10.2018)
    : 13.04.2016-31.03.2020
19. Creation of Policy and Strategy Cell (PSC) at ICAR-NIAP for Doubling Farmers' Income in India by 2021-22: Estimating Farm Income and Facilitating the Implementation of Strategic Framework. Funded by Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture, and Farmers Welfare, Govt. of India. (AGENIASRICOP2017006 00092)
    ICAR-NIAP: Director, Raka Saxena, Naveen P Singh, Usha R Ahuja
    ICAR-IASRI: RK Paul
    : 31.03.2017-31.03.2022
20. Modeling insect pests and diseases under climate change and development of digital tools for pest management National Innovations in Climate Resilient Agriculture (NICRA). Funded by ICAR. (AGEDIASRICOP201701500101)
    ICAR-NCIPM: S Vennila, MN Bhat, Niranjan Singh
    ICAR-CRIDA: M Prabhakar, MS Rao
    ICAR-IASRI: RK Paul
    : 20.06.2017-31.03.2020
21. Efficiency of micro irrigation in economizing water use in India-learning from potential and unexplored states. Funded by NITI Ayog. (AGEDIASRICOP201702300109)
    ICAR- NIAP: Subhash Chand, Shivendra Kumar Srivastava
    BACA, Anand, Gujrat: RS Pundir
    ICAR-IASRI: Ravindra Singh Shekhawat
    : 20.12.2017-31.03.2019
22. Studying dynamics of markets integration and price transmission of agricultural commodities under ICAR's Lal Bahadur Shastri Young Scientist Award 2016. (AGEDIASRISOL201801600125) RK Paul: 02.04.2018-31.03.2021

Completed

Institute Funded

23. Development of methodology for nonparametric modelling of time-series data and its application in agriculture. (AGENIASRISIL201500800045) Himadri Ghosh and Soumen Pal (October, 2015):06.06.2015-30.10.2018

New Initiated

Institute Funded

24. Crop diversification: Pattern, determinants and its impact on nutritional security in India. (AGEDIASRISIL201802800137) Anuja AR, Rajesh T, Harish HV, Mrinmoy Ray: 05.09.2018-04.09.2021
25. Role of research and development in Indian agriculture: An economic analysis. (AGEDIASRISI L201802500134) Rajesh T, Shivaswamy GP, Anuja AR, Ravindra Singh: 03.07.2018-02.07.2021
26. Prospects of irrigation in India: Trends, determinants and impact on agricultural productivity. (AGEDIASRISIL201802600135) Shivaswamy GP, Rajesh T, Anuja AR, Harish Kumar HV and Achal Lama: 19.07.2018-18.07.2021
27. Modelling dynamics of institutional credit to agriculture in India. (AGEDIASRISIL201900400150) Harish Kumar HV, Shivaswamy GP, Anuja AR, Achal Lama: 02.02.2019-01.08.2021
28. Enhanced Classification and Regression Tree (CART) models for forecasting in Agriculture. (AGEDIASRISIL201900700153) Ramasubramanian V, Mrinmoy Ray, Md. Wasi Alam: 31.03.2019-30.09.2021

Outside Funded

29. ICT based extension strategies for nutrition sensitive agriculture in the states of UP and Odisha. Funded by NASF. (AGEDIASRICOP201803600145)
    ICAR-IARI: Premlata
    ICAR-ATARI Zone-IV, Kanpur: Shantanu Dubey
    OUAT, Bhubaneswar: PJ Mishra
    ICAR-IASRI: KN Singh, Shashi Dahiya, Mrinmoy Ray
    : 01.11.2018-31.03.2020

DEVELOPMENT OF TECHNIQUES FOR PLANNING AND EXECUTION OF SURVEYS AND STATISTICAL APPLICATIONS OF GIS AND REMOTE SENSING IN AGRICULTURAL SYSTEMS

On-going

Institute Funded

30. Assessment of post harvest losses in fruits and vegetables and strategies for their reduction in Andaman and Nicobar Islands. (AGENIASRICIP201601400083)
    ICAR-CIARI: Sachidananda Swain, SK Zamir Ahmad, LB Singh, Chandrika Ram, Manoj Kumar
    ICAR-IASRI: Prachi Misra Sahoo, Tauqueer Ahmad
    : 03.10.2016-31.07.2019 (Association of ICAR-IASRI w.e.f. 03.10.2016)
31. A study on calibration estimators under adoptive cluster sampling. (AGENIASRISIL201601500084) Raju Kumar (till 03.06.2017), Ankur Biswas (since 04.06.2017-PI & Associate till 03.06.2017), Pradeep Basak (since 26.09.2017), Deepak Singh: 25.10.2016- 15.04.2019
32. Two step calibration for estimation of finite population total under two-stage sampling design. (AGEDIASRISIL201701600102) Pradip Basak, Kaustav Aditya, Hukum Chandra, Ajit: 29.07.2017-28.01.2020

Outside Funded

33. Pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanathan Committee Report. Funded by Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi. (AGENIASRISOL201500300040) Kaustava Aditya, UC Sud (till 31.07.2017), Hukum Chandra, AK Gupta (till 31.07.2016), Ankur Biswas, Vandita Kumari (till 04.10.2017), Raju Kumar (till 03.06.2017), Anshu Bhardwaj, Anil Kumar, Ajit and Pradip Basak (since 13.09.2017): 16.02.2015- 30.06.2019
34. Investigation of Causes of Divergence between Official and Trade Estimates of Jute Production. Funded by Directorate of Economics & Statistics (DES), Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India. (AGENIASRISOL201502800065) Prachi Misra Sahoo, UC Sud (till 31.07.2017), Tauqueer Ahmad, Ajit, Kaustav Aditya and Ankur Biswas: 01.09.2015- 30.06.2019

Completed

Outside Funded

35. Study to test the developed alternative methodology for estimation of area and production of horticultural crops. IASRI component of CHAMAN program under under MIDH, Funded by Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MoA), Government of India. (AGENIASRISOL201401700036) Tauqueer Ahmad, UC Sud (till 31.07.2017), Prachi Misra Sahoo, Kaustava Aditya, AK Gupta (till 31.07.2016) Ankur Biswas and Deepak Singh (since 02.08.2016): 16.09.2014- 31.07.2018

New Initiated

Institute Funded

36. Construction of composite index under complex surveys. (AGEDIASRISIL201801800127) Deepak Singh, Pradip Basak and Raju Kumar (since 05.12.2018): 26.04.2018- 25.04.2020

Outside Funded

37. Energy Audit Survey of AICRP on Energy in Agriculture & Agro-based Industries: Sampling design and analysis. Funded by ICAR-All India Coordinated Research Project on Energy in Agriculture & Agro-based Industries (ICAR-AICRP on EAAI). (AGEDIASRICOP201802000129)
    ICAR-CIAE: KC Pandey
    ICAR-IASRI: Hukum Chandra, Susheel Kumar (till 05.07.2018), Pradip Basak (since 11.07.2018), Ajit
    : 01.06.2018-31.05.2021
38. Integrated sampling methodology for crop yield estimation using Remote Sensing, Field surveys and Weather parameters for crop insurance. Funded by Ministry of Agriculture & Farmers Welfare, Govt. of India. (AGEDIASRISOL201803300142) Tauqueer Ahmad, Prachi Misra Sahoo, Anil Rai, Hukum Chandra, Ankur Biswas: 28.09.2018-30.06.2019
39. Integrated Sample Survey Solution for major Livestock Products. Funded by Animal Husbandry Statistics Division, Department of Animal Husbandry, Dairying & Fisheries Ministry of Agriculture and Farmers Welfare, Govt. of India. (AGEDIASRISOL201900800154) Prachi Misra Sahoo, Tauqueer Ahmad, Ankur Biswas, Pradip Basak, Anil Rai, SB Lal: 28.03.2019-31.12.2019

DEVELOPMENT OF STATISTICAL TECHNIQUES FOR GENETICS/ COMPUTATIONAL BIOLOGY ANDAPPLICATIONS OF BIOINFORMATICS IN AGRICULTURAL RESEARCH

On-going

Institute Funded

40. Gene Selection for Classification of Crop Gene Expression Data. (AGENIASRISIL201503000067) Samarendra Das (till 09.08.2017), PK Meher (since 10.08.2017), RK Paul and UK Pradhan (till January 10, 2017), Prakash Kumar (from 01.04.2017 to 05.02.2018): 20.10.2015- 31.05.2019
41. Platform for integrated genomics warehouse. (AGENIASRISIL201600900078) KK Chaturvedi, MS Farooqi, SB Lal, DC Mishra, Sanjeev Kumar: 10.06.2016-09.06.2019
42. Development of an improved hybrid De-novo whole genome assembler. (AGENIASRISIL201700100087) SB Lal, Anu Sharma, Sanjeev Kumar, DC Mishra, Neeraj Budhlakoti (till 11.09.2018): 04.01.2017-03.07.2019
43. Non-linear modeling for genomic predictions based on multiple traits. (AGENIASRISIL201700500091) Neeraj Budhlakoti (till 11.09.2018), DC Mishra (since 12.09.2018), SB Lal, DC Mishra (from 31.03.2017 to 11.09.2018 as an Associate): 31.03.2017-30.03.2019
44. Study of long memory and periodicities in climate variables in different Meteorological Subdivisions of India. (AGEDIASRISIL201701000096) RK Paul, LM Bhar, AK Paul: 19.04.2017-18.04.2020
45. Estimation of breeding value using generalized estimating equation and Bayesian approach. (AGEDIASRISIL201800100110) Himadri Shekhar Roy, LM Bhar, AK Paul: 07.02.2018-06.02.2021
46. A study on detection and interpretation of expression Quantitative Trait Loci (eQTL) mapping. (AGEDIASRISIL201800200111) Himadri Shekhar Roy, LM Bhar. RK Paul, AK Paul: 03.02.2018-02.02.2021
47. Development of web server for phenotype analysis for cattle breeding management. (AGEDIASRICIP201801100120)
    ICAR-CIRC: Umesh Singh, Susheel Kumar, AK Das, TV Raja, Rani Alex
    ICAR-IASRI: UB Angadi, MA Iquebal, Sarika, Dinesh Kumar
    : 12.03.2018-31.03.2021
48. Study of robust estimation of heritability. (AGEDIASRISIL201801300122) AK Paul, Himadri Sekhar Roy, LM Bhar, RK Paul: 22.03.2018-21.03.2021

Outside Funded

49. ICAR-Network project on functional genomics and genetic modification (Earlier: ICAR Network Project on Transgenics in Crops (NPTC)). Funded by ICAR-NRCPB-Sub-Scheme. (AGENIASRICOP201500400041)
    ICAR-NRCPB: NK Singh (till 11.05.2015 and then from 10.01.2017), TR Sharma (from 12.05.2015-09-01-2017)

ICAR-IASRI: MA Iquebal, Sarika, Dinesh Kumar, Anil Rai
: 27.01.2015-31.03.2020

50. Computational and analytical solutions for high-throughput biological data. Funded by CABin. (AGENIASRISOL201502400061) Anil Rai, Dinesh Kumar, AR Rao, Monendra Grover, KK Chaturvedi, Sanjeev Kumar, DC Mishra:04.09.2015-31.03.2020
51. Creating a fully characterized genetic resource pipeline for mustard improvement programme in India. Funded by National Agricultural Science Fund (NASF). (AGENIASRICOP201700800094)
PAU: SS Banga, National Professor (ICAR)
ICAR-IARI: DK Yadav
Directorate of rapeseed-mustard research, Bharatpur: KH Singh
GBPUAT: Ram Bhajan
ICAR-IASRI: AR Rao, Cini Varghese, PK Meher
: 01.01.2017-31.12.2019
52. Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in Rice and Wheat– Phase II. Funded by National Agricultural Science Fund (NASF). (AGENIASRICOP201700700093)
ICAR-IARI: Viswanathan Chinnusamy
ICAR-IASRI: Anil Rai, AR Rao, Sudeep, Sanjeev Kumar
IIT, New Delhi: Brejesh Lall
ICAR-NRRI: Padmini Swain
: 01.01.2017-31.12.2019
53. Potential gene mining from salt tolerant grasses for improvement of salt tolerance in crops. Funded by NASF (AGEDIASRICOP201701400100)
ICAR-CSSRI: Anita Mann, Ashwani Kumar, Arvind Kumar, BL Meena
ICAR-IASRI: Monendra Grover, DC Mishra
: 01.06.2017-31.03.2020
54. Rice-metasys: understanding rice gene network for blast resistance and drought tolerance through system biology approach. Funded by CABin Scheme. (AGEDIASRICOP201800300112)
ICAR-NRCPB: Amol Kumar U Solanke, SV Amitha Charu Rama Mithra
ICAR-IASRI: DC Mishra, KK Chaturvedi: 01.03.2018- 31.03.2020
55. Computational and experimental biology approaches for delineation of selected secondary metabolite pathways and antimicrobial peptides (AMPs) in major spices. Funded by CABin Scheme (AGEDIASRICOP201800400113)
ICAR-IISR: Johnson George K, TE Sheeja, R Praveena, P Umadevi, R Sivaranjani
ICAR-IASRI: UB Angadi, Dinesh Kumar, MA Iquebal, Sarika
: 05.03.2018-31.03.2020
56. Deciphering genetic variation in the carbohydrate metabolism of farmed rohu families. Funded by CABin Scheme (AGEDIASRICOP201800500114)
ICAR-CIFA: JK Sundaray, S Nandi, PK Meher, L Sahoo, Kiran D, Khuntia Murmu, UK Udit, AR Rasal
ICAR-IASRI: Sarika, Dinesh Kumar, MA Iquebal, UB Angadi
: 05.03.2018-31.03.2020
57. Genomic data analysis to elucidate the regulatory network and candidate genes underlying cytoplasmic male sterility in pigeonpea. Funded by CABin Scheme (AGEDIASRICOP201800600115)
ICAR-IIPR: A Bohra
ICAR-IASRI: MA Iquebal, Dinesh Kumar, Sarika, UB Angadi
: 05.03.2018-31.03.2020
58. Computational approach for genomic resource improvement and precision phenotyping of less explored yield traits in Wheat. Funded by CABin Scheme (AGEDIASRICOP201800700116)
ICAR-IIWBR: Ratan Tiwari, Pradeep Sharma, Sonia Sheoran
ICAR-IASRI: Dinesh Kumar, MA Iquebal, Sarika, UB Angadi
: 05.03.2018-31.03.2020
59. Computational biology approach for deciphering stress induced transcriptomic and proteomic changes rice-microbial interaction system. Funded by CABin Scheme. (AGEDIASRICOP201800800117)

ICAR-NBAIM: DP Singh, Renu, Sunil Kumar, Pramod Sahu
ICAR-IASRI: Sanjeev Kumar, KK Chaturvedi, MS Farooqi
: 06.03.2018-31.03.2020

60. Investigations on stipe rust-defence response, identification of defence genes/QTLs associated with rust resistance in Wheat. Funded by CABin Scheme. (AGEDIASRICOP201800900118)
ICAR-NBPGR: Sundeep Kumar, Amit K Singh
ICAR-IASRI: Monendra Grover, DC Mishra, Neeraj Budhlakoti (till 11.09.2018)
: 09.03.2018-31.03.2020
61. Investigations on pathogenic microorganisms of shrimp aquaculture using metagenomic and other bioinformatic approaches. Funded by CABin Scheme. (AGEDIASRICOP201801000119)
ICAR-CIBA: Ashok Kumar Jangam, SV Alavandi, K Vinaya Kumar, R Mary Lini, Satheesha Avunje
ICAR-IASRI: Monendra Grover
: 09.03.2018-31.03.2020
62. Genomic and transcriptome sequencing of coriander (Coriandrum sativum) to reveal insight of its genomic architecture and breeding targets. (Collaboration with Junagadh Agricultural University, Junagadh). (AGEDIASRICOP201801200121)
JAU: Rukam Singh Tomar, MV Parakhia, Shradda B Bhatt
ICAR-IASRI: MA Iquebal, Sarika
: 14.03.2018-31.03.2021
63. Statistical approaches for genome-wide association studies and genomic selection for multiple traits in structured plant and animal population. Funded by DST. (AGEDIASRISOL201801400123) LM Bhar, Himadri Shekhar Roy (since 04.05.2018), PK Meher (since 04.05.2018) : 16.03.2018-15.03.2021

Completed

Institute Funded

64. A study on sequence encoding based approaches for splice site prediction in agricultural species. (AGENIASRISIL201600100070) PK Meher, UK Pradhan (till January 10, 2017), SD Wahi (till August 31, 2016) and AR Rao: 01.01.2016-27.10.2018

Outside Funded

65. Elucidating the mechanism of Pashmina fibre development: An OMICS approach. Funded by National Agricultural Science Fund (NASF) (AGENIASRICOP201501500052)
SKUAST-K: Nazir A Ganai
ICAR-IASRI: AR Rao and PK Meher
ICAR-NDRI: Jai K Kaushik
: 01.07.2015-31.12.2018
66. Stochastic differential equation models and their applications to agriculture. Funded by Science and Engineering Research Board (SERB), New Delhi. (AGENIASRICOP201600200071)
Ex. Emeritus Scientist, ICAR: Prajneshu
ICAR-IASRI: Himadri Ghosh, LM Bhar
: 06.11.2015-19.02.2019

New Initiated

Institute Funded

67. Discovery of novel genes and promoters responsible for salinity tolerance in Haloarcula spp. (AGEDIASRISIL201803400143) Monendra Grover, DC Mishra
ICAR-IARI, New Delhi: Rajeev Kaushik
: 01.11.2018-31.10.2019
68. Development of methodology for trait specific genes identification. (AGEDIASRISIL201900300149) MS Farooqi, DC Mishra, KK Chaturvedi: 02.02.2019-01.02.2021

Outside Funded

69. Studying Dynamics of market integration and price transmission of agricultural commodities. Funded by ICAR. (AGENIASRISOL201801600125) RK Paul: 02.04.2018-31.03.2021
70. Molecular Markers for Improving Reproduction of Cattle and Buffaloes. Funded by Bill & Melinda Gates Foundation. USA. (AGEDIASRICOP201803000139)
    ICAR-NDRI: TK Datta
    ICAR-CIRB: Varij Nayan
    ICAR-IASRI: Dinesh Kumar, MA Iquebal, Sarika, UB Angadi, Anil Rai
    : 19.09.2018-30.09.2023
71. Genomics assisted crop improvement and management. Funded by NAHEP (AGEDIASRICOP201803200141)
    ICAR-IARI: Viswanathan Chinnusamy
    ICAR-IASRI: AR Rao, Sudeep, Seema Jaggi, Anindita Datta, Soumen Pal, Sanjeev Kumar
    : 26.09.2018-31.03.2021
72. Transcriptome analysis to decipher mechanism related to distinctive morphological phenotypes in indigenous poultry. Funded by CABin. (AGEDIASRICOP201802900138)
    ICAR-NBAGR, Karnal: Ramesh Kumar Vijh
    ICAR-IASRI: Anil Rai, AR Rao
    : 19.09.2018- 31.03.2020
73. Structural and functional genomics of potato and its pest/pathogen using bioinformatics approaches. Funded by CABin. (AGEDIASRICOP201802400133)
    ICAR-CPRI: SK Chakrabarti, Shashi Rawat, Som Dutt, Jagesh Tiwari, Aarti Bairwa, Tanuja Buckseth
    ICAR-IASRI: Anil Rai, AR Rao, Sanjeev Kumar, DC Mishra, Neeraj Budhlakoti (till 11.09.2018)
    : 08.06.2018-31.03.2020
74. Network project on computational biology and agricultural bioinformatics under two subprojects: Funded by CABin. (AGEDIASRICOP201802300132)
    Sub-project-1: Exploring the epigenetic control of heat stress response in wheat for characterizing the regulatory networks associated with thermo tolerance.
    ICAR-IARI: C Viswanathan, RR Kumar, Suneha Goswami
    ICAR-IASRI: DC Mishra, Monendra Grover, Sanjeev Kumar, KK Chaturvedi
    Sub-Project-2: Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids.
    ICAR-IARI: Viswanathan C., Mallikarjuna, MG
    ICAR-IASRI: Anil Rai, AR Rao, PK Meher
    : 08.06.2018-31.03.2020
75. Metagenomic profiling for assessing microbial biodiversity in river Ganga for ecosystem health monitoring. Funded by CABin. (AGEDIASRICOP2018022000131)
    ICAR-CIFR: BK Behera, BK Das, PK Parida, Dhruba Jyoti Sarkar, RK Raman
    ICAR-IASRI: Anil Rai, AR Rao, PK Meher
    : 08.06.2018-31.03.2020
76. Deciphering health biomarkers and thermo-tolerant traits by computational genomics approach in goats. Funded by CABin. (AGEDIASRICOP2018021000130)
    ICAR-CIRG: Rajveer Singh Pawaiya, K Gururaj, Mahesh Dige, PK Rout
    ICAR-IASRI: Anil Rai, AR Rao
    Component 1: Host transcriptome analysis for identification of biomarkers and epitope mapping assisted diagnostics development for enterotoxaemia in goats.
    Component 2: Identification of heat stress/tolerance genes through transcriptomics approach in goats.
    : 08.06.2018-31.03.2020
77. Characterization, evaluation, genetic enhancement and generation of genomic resources for accelerated utilization and improvement of minor pulses. Funded by DBT. (AGEDIASRICOP201803500144)
    ILS, Bhubneshwar: Ajay Kumar Parida
    ICAR-NBPGR: Kuldeep Singh, DP Wankhede
    ICAR-IASRI: Sanjeev Kumar, Anu Sharma

UAS, Bangalore: Niranjana Murthy
PAU, Ludhiana: Dharminder Bhatia
CSKHPKVV, Palampur: Rajan Katoch
VNMKV, Parbhani, Maharashtra: Deepak K Patil
ICAR-CAZRI, Jodhpur: Rajwant Kaur Kalia
World Vegetable Centre, South Asia, Hyderabad: RM Nair
: 24.10.2018-23.10.2021

78. Improving the usability of buffalo spermatozoa by sperm surface remodelling and immune acceptance in female reproductive tract. Funded by NASF. (AGEDIASRICOP201802700136)
ICAR-NDRI: TK Datta, Rakesh Kumar, SM Deb, TK Mohanty, JK Kaushik
ICAR-IASRI: Sarika, Dinesh Kumar, MA Iquebal
: 12.07.2018-11.07.2021
79. Molecular characterization, development of molecular markers and metabolite analysis of tree bean (Parkia roxburghii) landraces of North-East India. [BT/PR24912/NER/95/904/2017]. Funded by DBT. (AGEDIASRICOP201803100140)
ICAR Research Complex for NEH Region (Gangtok Sikkim Centre): Sudip Kumar Dutta, Ratankumar Akoijam, Vishambhar Dayal
UBKB, West Bengal: Somnath Mandal, Nandita Sahana
ICAR-IASRI: MA Iquebal, Sarika
: 15.03.2019-14.03.2021
80. An integrative transciptomics and DNA methylomics approach to understand the dynamic features of biotic stress responses associated with mastitis in buffalos. Funded by CABin. (AGEDIASRICOP201900100147)
ICAR-CIRB: Varij Nayan, SK Phulia, Anurag Bharadwaj
ICAR-IASRI: MA Iquebal, Dinesh Kumar, Sarika
: 16.01.2019-31.03.2020

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going

Institute Funded

81. Management system for post graduate education - II. (SIX1218) Sudeep, PK Malhotra (30.09.2014), RC Goyal (till 30.06.2013), Yogesh Gautam (till 15.08.2014) and Pal Singh (w.e.f. 01.10.2013): 01.04.2012–30.06.2019
82. National Information System on Agricultural Education Network in India. (NISAGENET-IV). (SIX1217) RC Goyal (till 30.06.2013), Sudeep (since 01.07.2013), Alka Arora, Pal Singh, Shashi Dahiya (on study leave from 03.07.2014 to 02.07.2017 rejoins the project as associate from 25.10.2017), Soumen Pal (till 30.09.2012), Anshu Bhardwaj (since 01.10.2014):01.04.2012–30.06.2019
83. Implementation of ICAR-ERP, unified communication and web hosting solution. (AGENIASRISIL201500600043) AK Choubey (till 21.01.2018), Sudeep (since 22.01.2018-PI & Associate till 21.01.2018), Alka Arora (on leave from 04.07.2016 to 22.03.2017 rejoins on 23.03.2017), N Srinivasa Rao (Transferred to NAARM from 24.09.2016), Mukesh Kumar, SN Islam (Deputed to ICAR HQ from 20.08.2016 for coordinating the implementation rejoins on 16.07.2018), Anshu Bhardwaj, Sangeeta Ahuja, Shashi Dahiya (from 05.08.2017): 10.04.2015-30.09.2019
84. Development and assessment of educational mobile apps for improving livestock health and production. (AGEDIASRICIP201701700103)
ICAR-IVRI: Rupasi Tiwari, Triveni Dutt, Mahesh Chander, Sanjay Kumar, Amarpal, Putan Singh, JK Prasad, Bina Mishra, BHM Patel, Bablu Kumar, Mahendran
ICAR-IASRI: Sudeep, Mukesh Kumar, Soumen Pal
: 28.06.2017-31.03.2019
85. Development of direct benefit transfer portal for DARE schemes. (AGEDIASRISIL201801500124) Soumen Pal, Sudeep, Alka Arora: 26.03.2018-25.03.2020

Outside Funded

86. Management and impact assessment of farmer first project. Funded by ICAR farmer first programme under KVK scheme (ATARI-I) (AGENIASRICOP201700200088)
    ICAR-NIAP: Shiv Kumar, Rajni Jain, Vinayak R Nikam, Kinsly IT, Abhimanyu Jhajhria
    ICAR-NAARM: P Venkatesan, Bharat S Sontakki, N Sivaramane
    ICAR-IASRI: Mukesh Kumar, Anshu Bhardwaj, Soumen Pal
    ICAR-DKMA: Aruna T Kumar, Mitali Ghosh Rai
    : 14.02.2017-31.03.2020
87. Knowledge management system for agriculture extension services in Indian NARES. Funded by ICAR Extramural Research Projects-Agricultural Extension Division. (AGENIASRICOL201600500074)
    ICAR-IASRI: Alka Arora, AK Choubey (till 20.01.2018), NS Rao (till 24.09.2016), SN Islam, Soumen Pal, Sudeep, Ajit (since 29.08.2018), RK Paul (since 29.08.2018)
    ICAR Headquarters, New Delhi: P Adiguru
    : 04.03.2016-31.03.2020

New Initiated

Institute Funded

88. Goat production Management Information System (GMIS). (AGEDIASRICOP201803700146)
    ICAR-CIRG: PK Rout
    ICAR-IASRI: SN Islam
    : 01.04.2017 -31.03.2020 (Association of ICAR-IASRI 03.12.2018)
89. Training Management Information System for ICAR (TMIS). (AGEDIASRISIL201801900128) Sudeep, Shashi Dahiya, Sangeeta Ahuja: 01.05.2018-31.03.2020

Outside Funded

90. Investments in Indian Council of Agricultural Research leadership on Agricultural Higher Education under the National Agricultural Higher Education Project (NAHEP Comp-2 Project). (AGEDIASRISOL201900500151)
    ICAR-IASRI: Sudeep, Alka Arora, Anshu Bhardwaj, Mukesh Kumar, Shashi Dahiya, Pal Singh, SN Islam, Soumen Pal, Ajit, Ramasubramanian V, Mrinmoy Ray, Achal Lama
    ICAR-NAARM: SK Soam, D Thammi Raju, N Srinivasa Rao, Alok Kumar, VV Sumanthkumar, Sanjiv Kumar, Surya Rathore
    ICAR-NIAP: Rajni Jain
    : 28.02.2019-31.03.2021
91. Artificial intelligence based mobile app for identification and advisory of maize diseases and insect pests. Funded by NASF ICAR Hq. (AGEDIASRISOL201901000156)
    ICAR-IASRI: Sudeep, Alka Arora, Mukesh Kumar, SN Islam
    ICAR-IIMR Ludhiana: KS Hooda
    IIT, Delhi: Brejesh Lall
    : 01.01.2019-31.12.2021

Consultancy Projects

92. Customization and Implementation of Academic Management System (AMS) for PG and UG education at BAU, Sabour (Bhagalpur).
93. Sudeep, Mukesh Kumar and MM Maurya: 25.06.2018 – 24.06.2019
    Customization and Implementation of Academic Management System for Post Graduate & Under Graduate Education at Birsa Agricultural University (BAU), Kanke, Ranchi.
    Sudeep, Alka Arora, MM Maurya: 30.07.2018 – 29.07.2019
94. Knowledge management system for DUS characteristics of crops. Funded by Production of Plant Varieties & Farmers Rights Authority (PPVFRA), MoA & Farmers'Welfare.
    Sudeep, Alka Arora, Soumen Paul and LM Bhar: 05.01.2019 – 04.01.2020

95. Study on field testing of the developed guidelines on estimating post harvest losses of horticultural crops, livestock products and fish and fish products (FAO Rome).
    Tauqueer Ahmad, Anil Rai, Prachi Misra Sahoo, Ankur Biswas, Man Singh and Kaustav Aditya: 21.12.2017 – 31.10.2018
96. Customization and Implementation of Academic Management System (AMS) for Post Graduate and Under Graduate Education at UHS Bagalkot.
    Sudeep, AK Choubey (till 20.01.2018): 28.10.2017–15.02.2019
97. Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Madhya Pradesh State.
    Tauqueer Ahmad, UC Sud (till 31.07.2017), Prachi Misra Sahoo, Anil Rai, Kaustav Aditya, Raju Kumar, Man Singh and Neelam Chandra: 01.06.2015 – 31.10.2018
98. Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Haryana State.
    Tauqueer Ahmad, UC Sud (till 31.07.2017), Prachi Misra Sahoo, Anil Rai, Ankur Biswas, Vandita Kumari, Man Singh, and Neelam Chandra: 06.08.2015 – 05.09.2018

National Fellow Scheme

99. Robust and efficient small area estimation methods for agricultural and socio-economic surveys and their application in indo-gangetic plain.
    Hukum Chandra: 25.11.2014 - 24.11.2019

Annexure-II

ICAR-IASRI PERSONNEL

Dr. Lal Mohan Bhar, Director (A)

Division of Design of Experiments

Name of the Scientist	Designation
Dr. Seema Jaggi	Principal Scientist and Head (A)
Dr. Rajender Parsad	Principal Scientist
Dr. Cini Varghese	Principal Scientist
Dr. Anil Kumar	Principal Scientist
Dr. Susheel Kumar Sarkar	Scientist
Dr. B.N. Mandal	Scientist
Dr. Sukanta Dash	Scientist
Dr. Arpan Bhowmik	Scientist
Sh. Sunil Kumar Yadav	Scientist
Mohd. Harun	Scientist
Dr. Anindita Datta	Scientist

Division of Sample Surveys

Name of the Scientist	Designation
Dr.Tauqueer Ahmad	Principal Scientist and Head
Dr. (Smt.) Prachi Misra Sahoo	Principal Scientist
Dr. Kaustav Aditiya	Scientist
Sh. Deepak Singh	Scientist
Dr. Ankur Biswas	Scientist
Dr. Raju Kumar	Scientist
Smt. Vandita Kumari Choudhary	Scientist
Dr. Pradip Basak	Scientist
Sh. Sushil Kumar (till 05.07.2018)	Scientist

Division of Statistical Genetics

Name of the Scientist	Designation
Dr. Lal Mohan Bhar	Principal Scientist and Head
Dr. Amrit Kumar Paul	Principal Scientist
Dr. Himadri Ghosh	Principal Scientist
Dr. Ranjit Kumar Paul	Scientist
Dr. P.K Meher	Scientist
Sh. Samarendra Das	Scientist
Sh. Upendra Kumar Pradhan	Scientist
Sh. Prakash Kumar	Scientist
Dr. Himadri Shekhar Roy	Scientist

Division of Forecasting and Agricultural Systems Modeling

Name of the Scientist	Designation
Dr. K.N.Singh	Principal Scientist and Head (A)
Dr. Ramasubramanian V.	Principal Scientist
Dr. Prawin Arya	Principal Scientist
Dr. Wasi Alam	Senior Scientist
Dr. Bishal Gurung (on Deputation)	Scientist
Sh. Kanchan Sinha	Scientist
Dr. Santosha Rathod (till 14.06.2018)	Scientist
Dr. Mrinmoy Ray	Scientist
Dr. Ravinder Singh Shekhawat	Scientist
Sh. Rajeev Ranjan Kumar	Scientist
Dr. Achal Lama	Scientist
Sh. Rajesh T.	Scientist
Dr. Anuja A.R.	Scientist
Sh. Shivaswamy G.P.	Scientist
Dr. Harish Kumar H.V.	Scientist

Division of Computer Applications

Name of the Scientist	Designation
Dr. Sudeep Marwaha	Principal Scientist and Head (A)
Dr. Alka Arora	Principal Scientist
Dr. Anshu Bharadwaj	Principal Scientist
Dr. Mukesh Kumar	Principal Scientist
Dr. Shashi Dahiya	Senior Scientist
Sh. Pal Singh	Scientist
Sh. Shahnawazul Islam	Scientist
Dr. Sangeeta Ahuja	Scientist
Dr. Soumen Pal	Scientist

Centre for Agricultural Bioinformatics (CABin)

Name of the Scientist	Designation
Dr. Anil Rai	Principal Scientist and Head (A)
Dr. Dinesh Kumar	Principal Scientist
Dr. A.R. Rao	Principal Scientist
Dr. Monendra Grover	Principal Scientist
Dr. Ulavappa B. Angadi	Principal Scientist
Dr. S.B Lal	Senior Scientist
Dr. Krishna Kumar Chaturvedi	Senior Scientist
Dr. Sarika	Senior Scientist
Dr. Mir Asif Iquebal	Senior Scientist
Dr. Anu Sharma	Scientist
Sh. Sanjeev Kumar	Scientist
Mohd. Samir Farooqui	Scientist
Dr. Dwijesh Chandra Mishra	Scientist
Sh. Sudhir Srivastava	Scientist
Sh. Neeraj Budlakothi	Scientist

PME Cell

Dr. Ajit	Principal Scientist & Incharge, PME Cell

National Fellow

Dr. Hukum Chandra	ICAR-National Fellow

Professors

Agricultural Statistics	Dr. Seema Jaggi
Computer Applications	Dr. Sudeep Marwaha
Bioinformatics	Dr. A.R.Rao

Administration and Finance

Senior Administrative Officer & Head of Office	Sh. Suresh Kumar Gajmoti (till 20.06.2018) Sh. Vijay Kumar (from 31.10.2018)
Senior Finance and Account Officer	Sh. Arvind

Vigilance

Vigilance Officer	Dr. L.M. Bhar

Right to Information (RTI) and Liaison

Transparency Officer & Nodal Officer, RTI	Dr. Mukesh Kumar
Public Information Officer	Sh. Chander Vallabh
Liaison Officer	Sh. Anil Kumar

Annexure-III

Various ICAR-IASRI Committees

Consultancy Processing Cell (CPC)

1.	Dr. Rajender Parsad, Principal Scientist	Chairman
2.	Dr. Seema Jaggi, Principal Scientist and Head(A), Design of Experiments	Member
3.	Dr. Anil Kumar, Principal Scientist	Member
4.	Dr. Tauqueer Ahmad, Principal Scientist & Head, Division of Sample Surveys	Member
5.	Dr. Ajit, Principal Scientist	Member
6.	Senior Finance and Accounts Officer (Ex-Officio)	Member
7.	Head of Office (Ex-Officio)	Member
8.	Sh. Naresh Kumar, CTO	Member Secretary

Institute Technology Management Committee (ITMC)

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Dr. Anil Rai, Principal Scientist & Head(A), Centre for Agricultural Bioinformatics	Member
3.	Dr. K.S. Rana, Professor and Head, Division of Agronomy, ICAR-IARI, New Delhi	Member
4.	Dr. Seema Jaggi, Principal Scientist and Head(A), Design of Experiments	Member
5.	Dr. Rajender Parsad, Principal Scientist & Incharge, ITMU	Member Secretary

Institute Technology Management Unit (ITMU)

1.	Dr. Rajender Parsad, Principal Scientist	Office Incharge & Member Secretray
2.	Dr. Tauqueer Ahmad, Principal Scientist &Head, Division of Sample Surveys	Member
3.	Sh. Naresh Kumar, CTO	Member

Institute Deputation Committee

1.	Director	Chairman
2.	All Heads of Divisions	Members
3.	Senior Administrative Officer	Member
4.	Sr. Finance & Account Officer	Member
5.	Incharge, PME Cell	Member Secretary

Project Monitoring Committee (PMC)

1.	Director	Chairman
2.	All Heads of Divisions	Members
3..	Incharge, PME Cell	Member Secretary

Institute of Joint Staff Council

Official Side Members

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Sh. Yogesh Kadian, Head of Office	Member Secretary
3.	Dr. Ajit, Principal Scientist	Member
4.	Dr. Prawin Arya, Principal Scientist	Member
5.	Dr. S. B. Lal, Senior Scientist	Member
6.	Dr. Shashi Dahiya, Scientist	Member
7.	Sh. Arvind, Sr. F&AO	Member

Staff Side Members

1.	Sh. Janak Kumar, SSS	Secretary
2.	Sh. Ashok Kumar, SSS	Member (CJSC)
3.	Sh. Dharmendra, UDC	Member
4.	Sh. K.B. Sharma, Assistant	Member
5.	Sh. Harilal Rai, Driver	Member
6.	Sh. Hari Singh, Technical Assistant(Electrician)	Member

Grievance Committee

Official Side Members

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Sh. Yogesh Kadian, Head of Office	Member
3.	Sh. Arvind, Sr. F&AO	Member
4.	Assistant Administrative Officer (Admn. II)	Member Secretary

Staff Side Members

1.	Sh. Pal Singh, Scientist	Member, Scientific Group
2.	Sh. Satya Pal Singh, Assistant Chief Technical Officer	Member, Technical Group
3.	Sh. Basant Kumar, Assistant	Member, Administrative Group
4.	Sh. Vivekanand Shah, SSS	Member, Skilled Supporting Staff Group

ICAR Staff Welfare Fund Scheme

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Dr. Prawin Arya, Principal Scientist	Welfare Officer
3.	Sh. Yogesh Kadian, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Dr. Prachi Mishra Sahoo, Principal Scientist	Female Member
6.	Sh. K.B. Sharma, Secretary, IJSC(SS)	Member
7.	Sh. Shyam Swaroop, SSS	Member
8.	AAO, Admn-II	Member Secretary

Women Cell

1.	Dr. Seema Jaggi, Principal Scientist and Head(A), Design of Experiments	Chairperson
2.	Dr. Cini Varghese, Principal Scientist	Member
3.	Smt. Savita Wadhwa, CTO	Member
4.	Smt. Suman Khanna, Stenographer	Member
5.	Smt.Neelam Sethi, Assistant	Convener

International Training Hostel (ITH)

1.	Dr. Anil Kumar, Principal Scientist	Coordinator
2.	Sh. Diwan Singh, Clerk	Caretaker
3.	Sh. Dilip Ghashyam Khapekar, AAO	Incharge, Guest House

Hostel Executive Committee

1.	Warden	Dr. K.N. Singh
2.	Prefect	Sh. Nitin Varshney
3.	Mess Secretary cum Assistant Prefect	Sh. Samir Burman
4.	Cashier	Sh. Kapil Chaudhary
5.	Maintenance Secretaries	Sh. Vivek Kumar Sh. Nitesh Sharma
6.	Sport Secretaries	Sh. Mahalinga Raya Sh. Jitendra Kumar Sh. Amit Saha
7.	Cultural Secretaries	Sh. Dilip Kumar Sh. Jutan Das Ms. Debdali Chowdhury Ms. Tanima Das
8.	Gym Secretaries	Sh.Vinay Sh. Rohit Singh
9.	Health Secretary	Sh. Rahul Banerjee
10.	Magazine Secretary	Sh. Mohit
11.	Common Room Secretary	Sh. Luvkush Patel
12.	Communication Secretary	Sh. Naveen HS
13.	Auditors	Sh. Subhrajit Satpathy Sh. Sandeepan Sarkar Sh. Arpan Maji Sh. Asith Kumar Pradhan Sh. Nobin Ch. Paul
14.	Food Committee	Md. Asif Khan Sh. Pramod Kumar Maurya Sh. Tanmay Kumar Sahoo Sh. Abhishek Sh. Sumit Saurabh Sh. Srikant Bairy
15.	Panse Guest House Representative	Md. Aamir Khan
16.	Girl's Representative	Ms. Sayantani
17.	Warden's Nominee	Sh. Tanuj Misra

Institute Recreation Club

1.	Dr. L.M. Bhar, Director (A)	Chairman
2.	Dr. K.N. Singh, Principal Scientist & Head(A), Division of Forecasting and Agricultural Systems Modeling	Co-chairman
3.	Sh. Yogesh Kadian, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Sh. Raj Kumar Verma, Assistant	Member
6.	Sh. Mayank Pundir, Assistant	Secretary
7.	Sh. Dharmendra Tanwar, LDC	Treasurer
8.	Smt. Vijayalakshmi Murthy, PA	Women Member

Institute Sports Committee

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Dr. K.N. Singh, Principal Scientist & Head(A), Division of Forecasting and Agricultural Systems Modeling	Co-chairman
3.	Sh. Yogesh Kadian, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Dr. Sushil Kumar Sarkar, Scientist	Member
6.	Sh. RS Tomar, Chief Technical Officer	Convener
7.	Secretory, IJSC	Member
8.	Sh. KB Sharma, Assistant	Member
9.	Sh. Sunil Kumar	Member
10.	Sh. Krishan Kumar	Member
11.	Sh. Janak Kumar	Member
12.	Sh. Santosh Kumar	Member
13.	Sh. Naresh Kumar	Member
14.	Dr Ankur Biswas, Scientist	Member
15.	Dr. Sukanta Dash, Scientist	Member
16.	Sh. Raj Kumar Verma	Member
17.	Smt. Vijayalakshmi Murthy, PA	Women Member
18.	Assistant Administrative Officer-II	Member

IASRI Employees Co-operative Thrift and Credit Society Limited

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Patron
2.	Sh. M.M. Maurya, Sr.TO	President
3.	Sh.Virendra Kumar, Sr.TO	Vice-President
4.	Sh. Sunil Bhatia, TO	Secretary
5.	Sh. Ashok Kumar	Treasurer
6.	Dr. (Mrs.) Anshu Bharadwaj, Principal Scientist	Women MC Member
7.	Dr. (Mrs.) Sarika, Senior Scientist	Women MC Member
8.	Dr. Arpan Bhowmik, Scientist	MC Member
9.	Sh. Dharmendra Tanwar	MC Member
10.	Sh. Manoj Kumar, Sr. TO	MC Member
11.	Sh. Ashok Kumar, SSS	MC Member
12.	Sh. Janak Kumar, SSS	MC Member

Sankhyaki Vimarsh Committee

1.	Dr. Anil Kumar, Principal Scientist	Chairman
2.	Md. Samir Farooqi, Scientist	Member
3.	Dr. Susheel Kumar Sarkar, Scientist	Member
4.	Dr. Dwijesh Chandra Mishra, Scientist	Member
5.	Dr. Sukanta Dash, Scientist	Member
6.	Sh. Santosh Kumar	Member
7.	Sh. B. J. Gahlot, CTO	Member
8.	Smt. Usha Jain, ACTO	Member
9.	Smt. Savita Wadhwa, CTO	Member

Newsletter Preparation Committee

1.	Dr. L.M. Bhar, Director(A) & Head, Division of Statistical Genetics	Chairman
2.	Dr. Ajit, Principal Scientist	Member
3.	Dr. Ramasubramanian V., Principal Scientist	Member
4.	Dr. Shashi Dahiya, Scientist	Member
5.	Dr. Susheel Kumar Sarkar, Scientist	Member
6.	Dr. (Mrs.) Sarika, Senior Scientist	Member
7.	Dr. Mrinmoy Ray, Scientist	Member
8.	Dr. Anindita Dutta, Scientist	Member
9.	Dr. Himadri Shekhar Roy, Scientist	Member
10.	Sh. Sushil Kumar, Scientist	Member
11.	Sh. Brahmajeet Gahlot, CTO	Member

Institute Canteen Committee

1.	Dr. A. R. Rao, Principal Scientist	Chairman
2.	Sh. Devendra Kumar, CTO	Member
3.	Sh. K.B. Sharma, Assistant	Member
4.	Assistant Administrative Officer (Purchase)	Member

Proprietary Articles Purchase Committee

1.	Dr. Ramasubramanian V., Principal Scientist	Chairman
2.	Dr. Sudeep, Principal Scientist & Head(A), Division of Computer Applications	Member
3.	Dr. Ranjit Kumar Paul, Scientist	Member

Institute Seminar Association Committee

1.	Dr. Amrit Kumar Paul, Principal Scientist	Chairman
2.	Dr. Ranjit Kumar Paul, Scientist	Secretary
3.	Dr. (Mrs.) Shashi Dahiya, Scientist	Member
4.	Dr. Dwijesh Chandra Mishra, Scientist	Member
5.	Dr. Arpan Bhowmik, Scientist	Member
6.	Dr. Ankur Biswas, Scientist	Member
7.	Dr. Mrinmoy Ray, Scientist	Member

Institute Krishi Vigyan Mela Committee

1.	Dr. Prawin Arya, Principal Scientist	Chairman
2.	Dr. Susheel Kumar Sarkar, Scientist	Member
3.	Dr. Ranjit Kumar Paul, Scientist	Member
4.	Dr. Sukanta Dash, Scientist	Member
5.	Dr. Soumen Pal, Scientist	Member
6.	Dr. (Mrs.) Anuja A.R., Scientist	Member
7.	Dr. Ravindra Singh Shekhawat, Scientist	Member
8.	Dr. Himadri Shekhar Roy, Scientist	Member
9.	Dr. Raju Kumar, Scientist	Member
10.	Sh. Deepak Singh, Scientist	Member
11.	Sh. Raj Kumar, SSS	Member
12.	Sh. Ravidas, SSS	Member

Institute Mera Gaon Mera Gaurav Coordination Committee

1.	Dr. Amrit Kumar Paul, Principal Scientist	Chairman
2.	Dr. Krishna Kumar Chaturvedi, Senior Scientist	Member
3.	Dr. Ranjit Kumar Paul, Scientist	Member
4.	Dr. Kaustav Aditya, Scientist	Member
5.	Dr. Soumen Pal, Scientist	Member
6.	Dr. Arpan Bhowmik, Scientist	Member
7.	Dr. Mrinmoy Ray, Scientist	Member

Institute Swachhata Committee

1.	Dr. Monendra Grover, Principal Scientist	Chairman
2.	Dr. Ranjit Kumar Paul, Scientist	Secretary
3.	Dr. (Mrs.) Shashi Dahiya, Scientist	Member
4.	Dr. Dwijesh Chandra Mishra, Scientist	Member
5.	Dr. Arpan Bhowmik, Scientist	Member
6.	Dr. Ankur Biswas, Scientist	Member
7.	Dr. Mrinmoy Ray, Scientist	Member

Institute ASHOKA HPC Committee

1.	Dr. A.R. Rao, Principal Scientist	Chairman
2.	Sh. Goldi Mishra, Chief Technological Officer(A), IISER, Homi Bhabha Road, Pashan, Pune	Member
3.	Dr. Sudeep, Principal Scientist & Head(A), Division of Computer Applications	Member
4.	Dr. Krishna Kumar Chaturvedi, Senior Scientist	Member
5.	Dr. Shashi Bhushan Lal, Senior Scientist	Member
6.	Sh. Yogesh Kadian, Head of Office	Member
7.	Sh. Arvind, Sr. F&AO	Member
8.	Sh. Subhash Chand, Incharge EMU	Member Secretary

Institute HPC (NABG) Committee

1.	Dr. U. B. Angadi, Principal Scientist	Chairman
2.	Dr. Krishna Kumar Chaturvedi, Senior Scientist	Member
3.	Dr. Shashi Bhushan Lal, Senior Scientist	Member
4.	Dr. (Mrs.) Anu Sharma, Scientist	Member
5.	Sh. Jai Bhagwan, Sr. TO	Member Secretary

Institute Data Book Committee

1.	Dr. Tauqueer Ahmad, Principal Scientist & Head, Division of Sample Surveys	Chairman
2.	Dr. Prachi Mishra Sahoo, Principal Scientist	Member
3.	Dr. Ankur Biswas, Scientist	Member
4.	Sh. Deepak Singh, Scientist	Member
5.	Dr. Pradip Basak, Scientist	Member
6.	Sh. Sheoraj Singh,	Member
7.	Smt. Neelam Chandra	Member

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1	डॉ॰ लाल मोहन भर, निदेशक	अध्यक्ष
2	डॉ॰ तौकीर अहमद, अध्यक्ष, प्रतिदर्श सर्वेक्षण प्रभाग	सदस्य
3	डॉ॰ अनिल राय, अध्यक्ष, कृषि जैव सूचना केंद्र	सदस्य
4	डॉ॰ सीमा जग्गी, अध्यक्ष, परीक्षण अभिकल्पना प्रभाग	सदस्य
5	डॉ॰ कमलेश नारायण सिंह, अध्यक्ष, पूर्वानुमान कृषि प्रणाली मॉडलिंग प्रभाग	सदस्य
6	डॉ॰ सुदीप मारवाह, अध्यक्ष, संगणक अनुप्रयोग प्रभाग	सदस्य
7	डॉ॰ रामासुब्रमनियन वी॰, प्रभारी, पी॰एम॰ई॰ प्रकोष्ठ	सदस्य
8	श्री योगेश कादियान, प्रशासनिक अधिकारी	सदस्य
9	श्री अरविंद, वरिष्ठ वित्त एवं लेखा अधिकारी	सदस्य
10	श्री चंद्रवल्लभ, सहायक प्रशासनिक अधिकारी	सदस्य
11	श्री दिलीप खापेकर, सहायक प्रशासनिक अधिकारी	सदस्य
12	श्री मानस चौधरी, सहायक प्रशासनिक अधिकारी	सदस्य
13	श्री विशाल लखनपाल, सहायक प्रशासनिक अधिकारी	सदस्य
14	श्री रोहित रस्तोगी, सहायक प्रशासनिक अधिकारी	सदस्य
15	श्री प्रभु दयाल, सहायक प्रशासनिक अधिकारी	सदस्य
16	श्री राजेंद्र कुमार कोली, सहायक प्रशासनिक अधिकारी	सदस्य
17	श्री अमित कुमार मारवाड़ी, सहायक वित्त एवं लेखाधिकारी	सदस्य
18	डॉ॰ सिनी वरगीस, प्रमुख वैज्ञानिक	हिंदीतर प्रतिनिधि
19	डॉ॰ सौमेन पाल, वैज्ञानिक	हिंदीतर प्रतिनिधि
20	डॉ॰ अनिल कुमार, प्रमुख वैज्ञानिक एवं अध्यक्ष,	संपादक मण्डल
21	पुस्तकालयाध्यक्ष	सदस्य
22	सुश्री ऊषा जैन, सहायक मुख्य तकनीकी अधिकारी एवं प्रभारी, हिन्दी एकक	सदस्य–सचिव

Annexure-IV

ICAR-NATIONAL AGRICULTURAL SCIENCE MUSEUM

ICAR-National Agricultural Science Museum (NASM) was conceived by the ICAR and executed by the National Council of Science Museum (NCSM), Ministry of Culture, Government of India during 2004. This museum is the only one of its kind in the country and is located in a sprawling two-storey building spread over 2000 sq. m. In this museum, the development of civilizations and Indian Agriculture since pre-historic age to the present time is displayed in a vibrant and vivid detail. Global issues pertaining to agriculture have also been presented. All this knowledge has been made available using computers, posters, models, audios as well as visuals. The responsibility of up-keep and maintenance of NASM rests with our institute. NASM is situated at NASC Complex, New Delhi. The major sections of the museum are:

1. Six Pillars of Agriculture
2. Agriculture in Pre-historic Period
3. Agriculture during Indus-valley Civilization
4. Agriculture during Vedic and Post Vedic Period
5. Agriculture during Sultanate and Mogul Period
6. Agriculture during British Period
7. Agricultural Science in Independent India
8. Global Issues Related to Agriculture
9. Golden Future of Indian Agriculture
10. Children Section

Under the guidance of the management committee of museum, the activities of the museum relating to up-keep and maintenance are looked after. The fully air-conditioned Museum remains open to visitors on all days from 10:30 hrs to 16:30 hrs except Monday (weekly holiday). There is a nominal fee of Rs. 10/- per head, but the groups of farmers, children from school/ college are exempted from entrance fee. During the period under report, a total of 1,31,812 visitors visited the NASM. 2650 tickets were sold, 1,24,258 students from Schools/College/Ag. University of Delhi/NCR & different states of India, 1127 farmers from different States of India (Fig.), 166 Trainees from different training programmes conducted by ICAR Institutes and other Govt. Departments, 3222 ICAR staff visitors, 07 media publication visitors and 98 Foreign delegates of various countries also visited the NASM. The staff of our institute who were and are presently In-charge of the museum are given below:

SN	Name	Designation	From	To
1.	Sh. S.K. Sablania	Chief Technical Officer	03.11.2004	31.05.2005
2.	Sh. RP Jain	Scientist	01.06.2005	30.03.2010
3.	Dr. Sushila Kaul	Scientist	30.03.2010	31.03.2014
4.	Sh. Pal Singh	Scientist	13.05.2014	31.10.2017
5.	Sh. Arbind Kumar	Chief Technical Officer	01.11.2017	31.01.2019
6.	Sh. Rajendra Singh	Chief Technical Officer	01.02.2019	Till date

Fig.: Visit by farmers from different states of India to National Agricultural Science Museum

Participation in Pusa Unnati Krishi Mela

Our institute participated in Pusa Unnati Krishi Mela, 2019 held at IARI mela ground, New Delhi during 05-07 March, 2019. Our institute presented some attractive posters of NASM exhibits to the general visitors, researchers, students and farmers to give them adequate knowledge about NASM (Fig.). There was 221 visitors including students, farmers, Government and non govt. agencies visited also distributed NASM booklet & Pamphlets to the visitors.

Fig.: Our institute staff at Pusa Unnati Krishi Mela 2019

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch