ICAR-IASRI

Annual Report
2016-17

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Improved Prediction of Antimicrobial Peptides

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The Onion Genomic Resource

Website for ICT Impact Assessment and analysis(ICTIAA)

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Annual Conference of Vice Chancellors of
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DATA ENTRY SOFTWARE

he developed alternative methodology for estimation
cultural crops: IASRI Component of CHAMAN Progr

ICAR - Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi - 110012
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ISO 9001:2008 Certified Institute
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भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
INDIAN AGRICULTURAL STATISTICS
RESEARCH INSTITUTE

ANNUAL REPORT
2016-17

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Ajit

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 onwards

Vision

Statistics and Informatics for enriching the quality of Agricultural Research

Mission

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

Mandate

- Research, education and training in agricultural statistics, computer applications in agriculture and agricultural bioinformatics
- 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 2016-17 of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), an ISO 9001:2008 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, significant advisory and consultancy services provided, dissemination of knowledge acquired and human resource development. The scientists, technical personnel, administrative, finance and other staff of the Institute have put in their best efforts in fulfilling the mandate of the Institute. During the year, research was carried out under 86 research projects (36 Institute funded, 6 Collaborative, 40 Externally funded, 1 National Fellow Scheme and 3 Consultancy Projects) in various thrust areas.

A landmark for the Institute this year is that under the FAO sponsored project, 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. The developed sampling methodology is likely to be adopted globally specially in developing countries in future. The methodology is accepted and is published by the FAO as a Technical Report of Global Office.

An online portal named 'Krishi Vigyan Kendra Knowledge Network' (http://kvk.icar.gov.in/) has been developed to disseminate knowledge and information from KVKs to farmers. A KVK Mobile App for the farmers has been developed in the Android platform and is available at Google Play Store. Personnel Management System for managing the cadre strength and transfer of the scientific staff has been developed and implemented in ICAR. KRISHI Portal (http://krishi.icar.gov.in) has been enriched by providing links of several online resources available/developed at different ICAR institutes (269 under 15 broad headings) and an Interportal Harvester (http://krishi.icar.gov.in/ohs-2.3.1/).

An algorithm using R language has been developed for constructing A-optimal balanced bipartite (BBPB) designs and weighted A-optimal block designs. Developed various R package like WaveLetLongMemory , dhga (https://CRAN.R-project.org/package=dhga); BootMRMR (https://CRAN.R-project.org/package=BootMRMR), GSAQ (https://CRAN.R-project.org/package=GSAQ).

DIRProt, A web server for discriminating the insecticide resistance proteins from non-resistant proteins (http://cabgrid.res.in:8080/dirprot/);GinMicrosatDb-Genome-Wide Microsatellite Markers Database for Sesame (http:/backwin.cabgrid.res.in:8080/Gingelly7); Onion Genomic Resource http://webtom.cabgrid.res.in/ogr/) hosting comprehensive information of assembly of available onion ESTs; web server iAMPpred (http://cabgrid.res.in:8080/amppred/) for predicting the propensity of a candidate peptide and a computational tool DCDNC (http://cabgrid.res.in:8080/DCDNC/) for discrimination of CDS sequence from intronic sequence have been developed.

During the year, 20 training programmes (Six under Centre of Advanced Faculty Training, Two Winter Schools, Eight training programmes for Technical Personnels and Four other training programmes) were organized in which 376 participants were imparted training. During the year, a total of 33 students {7 Ph.D. (Agricultural Statistics), 7 M.Sc. (Agricultural Statistics), 3 Ph.D. (Computer Application), 6 M.Sc. (Computer Application), 5 Ph.D. (Bioinformatics) and 5 M.Sc. (Bioinformatics)} were admitted. A Senior Certificate Course in Agricultural Statistics and Computing was also organized.

The Institute has published 173 research papers in National and International refereed Journals along with 18 articles in Hindi-Sankhiki-Vimarsh, 25 Reference Manuals, 40 popular articles/short communications, 7 Project Reports,1 book, 12 book chapters and 5 Technical Reports and Bulletins.

I am extremely happy to share that some of our colleagues received academic distinctions during the year. Dr. Rajendra Parsad recieved NAAS Recognition Award 2015-16 for significant contributions to Social Sciences in XIII Agricultural Science Congress 2017; Dr. A.R. Rao was conferred as Fellow, National Academy of Agricultural Sciences (NAAS) under section Social Sciences and awarded as Fellow, Indian Society of Genetics and Plant Breeding. Dr. A.R. Rao was also awarded Prof. P.V. Sukhatme Gold Medal by the Indian Society of Agricultural Statistics. Dr. Hukum Chandra was conferred as Fellow of the National Academy of Agricultural Sciences (NAAS). Dr. R.K. Paul received Young Scientist Award in Social Sciences for the biennium 2015-16 from National Academy of Agricultural Sciences (NAAS). Dr. Sukanta Dash received the MN Das Memorial Young Scientist Award from Society of Statistics, Computer and Application. Dr. P.K. Meher received Dr. G.R. Seth Memorial Young Scientist Award from Indian Society of Agricultural Statistics. Mr. Samredra Das received Netaji Subhas-ICAR International Fellowship for pursuing Ph.D. in Foreign University. Dr. M.A. Iquebal received SESR Computational Biologist 2016 award from Society for Educational and Scientific Research.

During the period under report scientists were deputed on different assignments to Rome, Italy; Chiba, Japan; Thimpu, Bhutan; Addis Ababa, Ethiopia;Kigali, Rwanda; Kingston, Jamaica and Sri Lanka.

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 (Education), ICAR; Dr. K. Algusundaram, DDG (Engg.), ICAR; Dr. G. Venkateshwarlu, ADG (EQA&R), ICAR and Dr. Kanchan K. Singh, ADG (FE), ICAR, for their constant direction, inspiration and backing. My sincere appreciation are to all Heads of Division, 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 the In-charge, Dr. Ajit for all the efforts and coordinating various activities.

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.
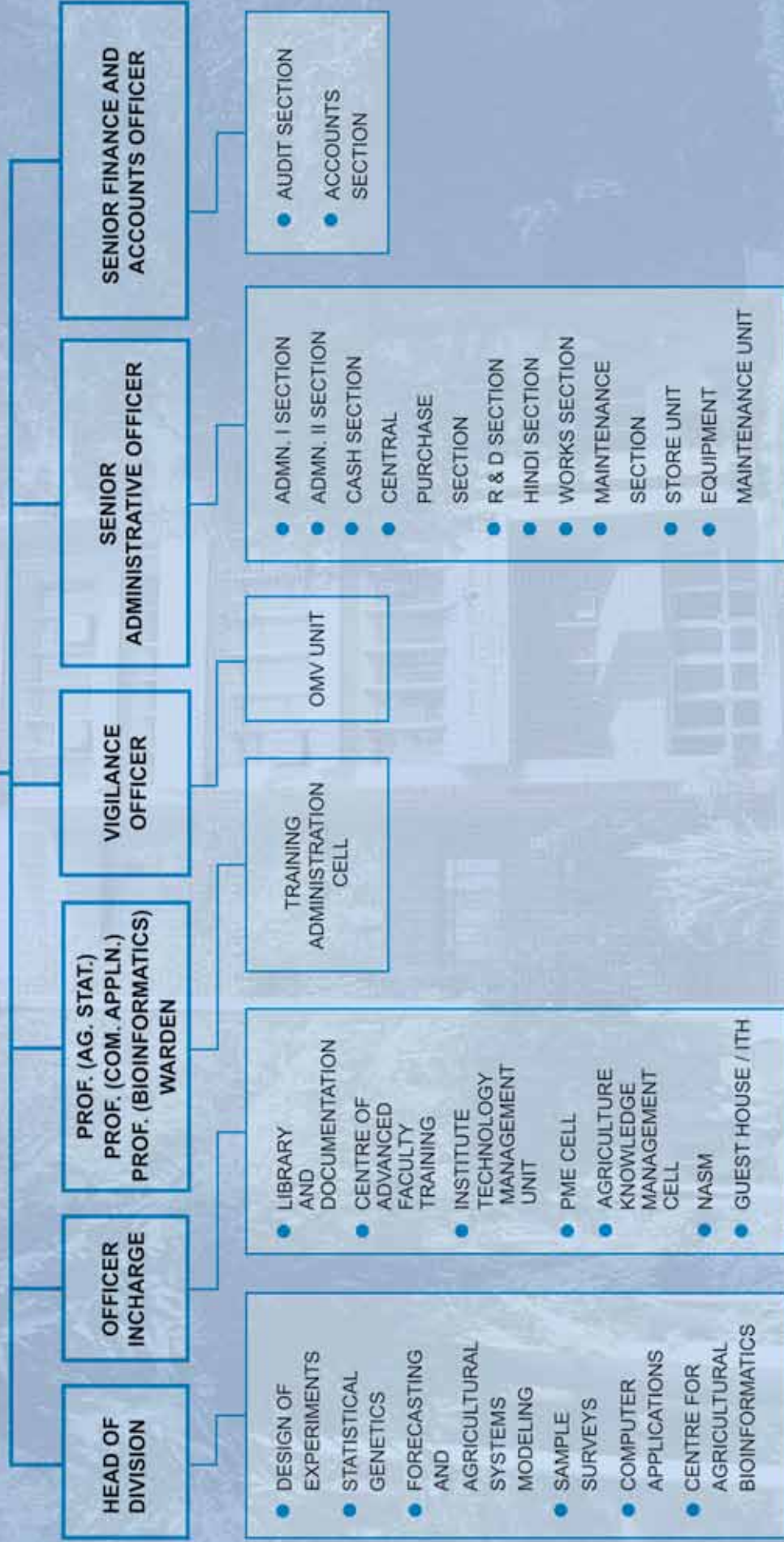
(UC Sud)
Director

Milestones

Year	Milestone
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

Year	
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 System 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.

ORGANOGRAM

RESEARCH ADVISORY COMMITTEE

DIRECTOR

INSTITUTE MANAGEMENT COMMITTEE

HEAD OF DIVISION

- DESIGN OF EXPERIMENTS
- STATISTICAL GENETICS
- FORECASTING AND AGRICULTURAL SYSTEMS MODELING
- SAMPLE SURVEYS
- COMPUTER APPLICATIONS
- CENTRE FOR AGRICULTURAL BIOINFORMATICS

OFFICER INCHARGE

- LIBRARY AND DOCUMENTATION
- CENTRE OF ADVANCED FACULTY TRAINING
- INSTITUTE TECHNOLOGY MANAGEMENT UNIT
- PME CELL
- AGRICULTURE KNOWLEDGE MANAGEMENT CELL
- NASM
- GUEST HOUSE / ITH

PROF. (AG. STAT.)
PROF. (COM. APPLN.)
PROF. (BIOINFORMATICS)
WARDEN

TRAINING ADMINISTRATION CELL

VIGILANCE OFFICER

OMV UNIT

SENIOR ADMINISTRATIVE OFFICER

- ADMN. I SECTION
- ADMN. II SECTION
- CASH SECTION
- CENTRAL PURCHASE SECTION
- R & D SECTION
- HINDI SECTION
- WORKS SECTION
- MAINTENANCE SECTION
- STORE UNIT
- EQUIPMENT MAINTENANCE UNIT

SENIOR FINANCE AND ACCOUNTS OFFICER

- AUDIT SECTION
- ACCOUNTS SECTION

1

Executive Summary

It is often desirable to execute trials in response surface design such that the number of input factor level changes is kept small to make the experiment cost-effective. A general expression for the total number of changes in the run sequences of Plackett-Burman designs has been obtained and using a SAS macro Plackett-Burman designs have been generated. Developed an R-software package, termed as *minimalRSD*, for the generation of minimally changed run sequence for Response Surface Designs (RSDs) and hosted at https://cran.r-project.org/web/packages/minimalRSD/index.html. This package consists of three series of designs viz., central composite designs (CCD) with full as well as fractional factorial points (half replicate) and Box Behnken designs (BBD) with minimally changed run sequences.

KRISHI Portal (http://krishi.icar.gov.in) has been enriched through providing links of several online resources available/developed at different ICAR institutes. Total number of links from ICAR and other sources on the KRISHI Portal are 269 under 15 broad headings. In order to bring various agricultural research publications collected by various organizations within as well as outside ICAR, an Interportal Harvester (http://krishi.icar.gov.in/ohs-2.3.1/) has been strengthened. Meta Data has been harvested from 17 Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) protocol enabled web applications viz. KRISHIKOSH, CMFRI Eprints, NAARM Eprints, DSpice at IISR, Indian Agricultural Research Journals, OAR@ICRISAT, ICRISAT Dataverse, DSpace at IIT, Bombay; CSIR-NISCAIR; CSIR-Madras Complex; NISCAIR Online Periodical Repository; Shodhganga (a platform for research

students to deposit their Ph.D. theses), DSpace at CIFT; ePrints at CFTRI; ICAR KRISHI Publication and Data Inventory Repository, Electronic theses of Indian Institute of Science; Open Access Repository of Indian Theses: CSIR etc. Unified search is ready for 17 repositories for 1,84,466 records. ICAR-geoportal ver 2 has been developed by integrating all spatial layers in a single view for easy understanding of user and implemented spatial layer level "query" for displaying user queried features only. KRISHI Portal has attracted more than 38,000 page views across 1500 cities of 125 countries (as per Google Analytics).

An algorithm using R language has been developed for constructing A-optimal balanced bipartite (BBPB) designs and weighted A-optimal block designs for comparing a set of test treatments with a set of control treatments and has been utilized to construct a list of A-optimal BBPB designs and weighted A-optimal block designs in the parametric range $v_1 \leq 30, v_2 \leq 3, b < 50, k < 10$ where v_1 denotes number of test treatments, v_2 denotes number of control treatments, b denotes the number of blocks and k denotes the block size.

Latin hypercube designs have proved to be a popular choice for experiments run on computer simulators and in global sensitivity analysis. Construction methods have been developed for providing a complete solution to construction of Orthogonal Latin hypercube designs for 2, 3, 4, 5, and 6 factors with any permissible runs*.

Keeping in view the importance of teaching and e-learning process in agricultural education system and to visualize its impact on ICT tools in agricultural

education, a Web based application and a website has been developed and named as ICTIAA (http://ictiaa.icar.gov.in). This website provides both the services of MOOC (Massive Open Online Courses) as well as impact analysis of ICT Tools.

A method of construction for obtaining incomplete split plot designs with complete main plots and incomplete subplots has been developed.

Under the study to empirically examine whether future markets help in discovering the better price to achieve market efficiency and transparency in trading of agricultural commodities, it was inferred that price discovery takes place only in future market and not in spot market. In other words we can say future market leads the spot market price in price formation. This study indicates that time varying parameter model is superior to the constant parameter hedge ratio model in calculating optimal hedge ratio. This fact has been confirmed in graphical presentation of two hedge ratio models. The study further indicate that optimal hedge ratio as calculated in Time Varying model facilitates large investment in the future instruments.

The STARMA model has been implemented in seasonally adjusted monthly maximum temperature in nine districts of Karnataka. The results of Univariate ARIMA and STARMA model have been compared in terms of Mean Absolute Percentage Error (MAPE) and it was found that STRAMA model performed better as compare to univariate ARIMA model in each location. Machine learning optimization techniques like Genetic algorithm (GA) and Particle Swarm Optimization (PSO) were used to optimize the parameters of STARMA model. The GA and PSO optimized parameters STARMA model were incorporated in STARMA model and model fitting was done. It was found that proposed approach performed better as compared to existing STARMA model.

Sieve bootstrap approach for constructing prediction interval in VAR model has been developed. The proposed approach was implemented in real as well as simulated datasets. Empirical results showed that proposed approach was better than the conventional approach in terms of length of confidence interval. Sieve bootstrap approach for constructing prediction interval in neural network has been developed. The proposed approach was implemented in a simulated data sets generated from Mackey glass equation.

A new Delphi methodology has been developed using GOS tree approach. A new time series

intervention model Trend Impact Analysis (TIA) has been developed to generate scenarios. Delphi and Trend Impact Analysis has been combined to generate scenarios. SAS Macro was developed to implement proposed TIA.

Under two stage sampling design, methodology for estimation of population parameters using calibration approach has been developed, under the assumption that the auxiliary variable is inversely related to study variable. Three different product type calibration estimators for population total along with their approximate variance have been developed. A simulation study was carried out to empirically evaluate the statistical performance of developed product type calibration estimators. Proposed product type calibration estimator of the population total provided best performance when population level complete auxiliary information is available at the SSU level for all the PSUs in the population.

To improve the data collection work under large scale surveys, an Andorid application named Mobile Assisted Personal Interview (MAPI) has been developed and deployed for data collection in the state of Uttar Pradesh for two districts and in Gujarat for one district using android tablets. The MAPI was found to be very advantageous over the existing paper based survey method with respect to timeliness, accuracy and reliability of data. MAPI software was developed with questions regarding the location of survey which records the GPS location of the survey along with pictures of the location making the data more reliable than the existing survey method. The offline version of the MAPI software is available online at sample survey resource server (http://sample.iasri.res.in/ssrs/android.html). For other customized surveys, the developed software can be modified based on the request of the registered user. The online version of the MAPI software was also developed which is ready for use.

Under the FAO (Food and Agricultural Organization of United Nations) sponsored project, 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. Primary data collection was made in one district of Indonesia and Jamaica using Computer Assisted Personal Interviewing (CAPI) and in all the three countries in second district

using Paper Assisted Personal Interviewing (PAPI) methods. The developed sampling methodology is likely to be adopted globally specially in developing countries in future by Food and Agriculture Organization of United Nations. The methodology is accepted by the FAO of United Nations and is published by the FAO as a Technical Report of Global Office. The report is available at FAO of the United Nations Global Strategy's website.

A new sampling methodology for estimation of area and production of horticultural crops which is efficient, simple, less time consuming and cost effective is being validated in six states of the country namely, Maharashtra, Tamil Nadu, Andhra Pradesh, Himachal Pradesh, Haryana and Madhya Pradesh. After validation of the developed methodology, the developed methodology will be implemented in all the states of the country from 2018-2019 by Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture and Farmers Welfare, Govt. of India.

Performance of various procedures of estimating optimal unobserved bandwidth has been studied for modeling foodgrain production time-series data. Epanechnikov kernel is best in case of kernel smoothing approach of modeling compound growth rate and actual foodgrain production. Computer program has been written to generate long memory error processes using uncorrelated wavelet transform to simulate time-series data of compound growth rate.

Market integration of different pulses in different zones of India was studied. The results show that there is a strong cointegration among the wholesale as well as retail prices of the major pulses, although the cointegration varies, some pulses have strong cointegration while others have poor. In addition to the horizontal cointegration, the vertical cointegration between the wholesale and retail prices of different pulses were also investigated. It is concluded that price signals are transmitted across regions indicating that price changes in one zone are consistently related to price changes in other zones and are able to influence the prices in other zones. However, the direction and intensity of price changes may be affected by the dynamic linkages between the demand and supply of pulses.

Impact assessment of crop insurance has been estimated in Andhra Pradesh & Telangana States. The analysis shows that at all India level, only 4% of

total farm households have insured their crop but in the selected states the percentage of crop insured farming households is 16.74%. Majority of insured farming households (98%) availing crop insurance were among the borrowers. Majority (55.2%) of farmers mentioned lack of awareness as the major reason for not availing insurance. Out of the total insured farmers only 9.23% females insured their crop. Overall, non-insured sampled household farmers had a lower education attendance rate compared with insured farmers. Propensity score Matching (PSM) method and Instrumental Variable (IV) method has been employed to estimate the impact of crop insurance on farm output. Both the method show that crop insurance has a positive and significant effect on farm output.

Stochastic differential equation (SDE) has been solved and used to obtain optimal forecast of untransformed data along with conditional forecast error variance.

Gene Regulatory Networks (GRNs) have become one of the most important approaches for modelling gene-gene relationships in system biology studies. These networks allow us to carry out studies of different biological processes in a visual way. The noise and high dimensionality in the Gene Expression (GE) data have limited the applicability of certain statistical techniques to model the underlying gene regulatory interactions. Statistical approaches have been developed to model and construct the GRNs under sparse biological conditions. Estimator for obtaining the true GE values of genes from noisy microarray data was obtained using particle filtering approach under a state space framework. Using the true GE values, an approach to model and construction of GRNs under sparsity condition was developed. For identification of hub genes (highly interacting genes) in the gene network, a resampling based approach, hub gene detection technique, was developed. An R package, DHGA (Differential Hub Gene Analysis) was also developed to identify the hub genes and unique hub genes in the GRNs constructed for a case vs. control study. To identify the informative genes from the big crop GE data, an improved gene selection technique was proposed by improving existing SVM-RFE procedure.

Methodology has been developed for finding associations among positions in position-wise aligned sequence datasets.

From the farmers/ growers point of view, selection of genotypes which are stable over the locations/

environments as well as high yielding are desirable. Two simultaneous selection indices have been developed to select stable genotypes with better performance and composite stability measure based on existing measures, by using Multiple Criteria Decision-Making (MCDM) technique, for selection of stable genotype along with high yield.

Statistical approaches have been developed to select biologically relevant genes from the high dimensional GE data. An improved gene selection technique, Boot-MRMR was developed to select biologically relevant genes by maximizing the relevancy and minimizing the redundancy. To validate the chosen genes obtained by using a gene selection technique, a gene set enrichment test (GSET) with QTLs was proposed. To remove the noise from the microarray data, an estimator for obtaining the true GE values based on wavelets analysis has been developed.

Database for drought and salt inducible genes in rice has been developed. An information management system has been developed on SNPs associated with economically important traits in Indian goats.

A web based software for NGS analysis and annotation entitled "High Performer Computation for Differential expression, Annotation & Transcriptome Assembly" (hpcDATA) has been deployed on Institute server, available over LAN, for testing (URL: http://192.168.7.45:8084/hpcDATA). The developed software is capable of De-Novo assembly of transcriptome sequence data. The workflow includes SRA toolkit, FastQC, Trimometic, trinity and Rsem tools. Altogether across above tools, approximately 100 parameters have been customized tested and included in this pipeline. It can be also used for reference based analysis (workflow) of transcriptome data, which includes: SRA toolkit, FastQC, Trimmomatic, Bowtie, Tophat, Cufflink and Cuffdiff tools in the pipeline. It also include modules on "Differential gene identification module", "Annotation Module" and "Project monitoring module".

Onion Genomic Resource (http://webtom.cabgrid. res.in/ogr/) has been developed as the open web resource freely accessible and hosts comprehensive information of assembly of available onion ESTs from public domain as well as the transcriptome data from Allium cepa with their annotations and functional significance.

DIRProt: A web server for discriminating the insecticide resistance proteins from non-resistant proteins (http://cabgrid.res.in:8080/dirprot/) has

been developed and can be used for discriminating the insecticide resistance proteins from non-resistant proteins. Here, four types of resistance proteins encoded by four categories of insecticide resistance genes viz., Cytochrome P450, Acetylcholinesterase (AChE), Knock down resistance (KDR), resistance to dialdrin (RDL) have been considered. The server has been trained with DPC features i.e., di-peptide composition (DPC). Moreover, the SVM machine learning technique with the RBF kernel is used in the background for prediction purpose.

Developed R package WaveLetLongMemory and successfully uploaded in CRAN.

Developed a computational method for species identification using DNA barcode. Based on this approach, a web server SPIDBAR (http://cabgrid. res.in:8080/spidbar/) has also been developed for easy identification of species by the taxonomist.

Developed a computational tool DCDNC (http:// cabgrid.res.in:8080/DCDNC/) for discrimination of CDS sequence from intronic sequence, based on the sequence features derived with regard to methylation mediated substitution and spontaneous deamination. This tool has been validated in Cattle and Rice dataset. By using this server, user will get the output in terms of probability with which the submitted test sequence is predicted as coding sequence.

Developed a web server iAMPpred (http://cabgrid. res.in:8080/amppred/) for predicting the propensity of a candidate peptide as antibacterial, antiviral or antifungal with certain probability. The performance of this server was found comparable with the existing tools (AntiBP, CAMP2, AntiBP23, AVPpred4, iAMP-2L, ClassAMP6 and EFCFCBF7) meant for prediction of anti-microbial peptides. The antimicrobial peptides predicted by this server will help enable the designing of peptide based antibiotics.

An R package, dhga was developed and available at https://CRAN.R-project.org/package=dhga for the users.

An R package, BootMRMR was developed and available at https://CRAN.R-project.org/ package=BootMRMR for the users.

An R package, GSAQ was developed and available at https://CRAN.R-project.org/package=GSAQ for the users.

GinMicrosatDb: A Genome-Wide Microsatellite Markers Database for Sesame (Sesamum Indicum L.) has been developed (http:/backwin.cabgrid.res.

in: 8080/Gingelly7). Whole genome sequencing of sesame variety 'Swetha' was used for development of microsatellite markers so as to ensure availability of substantial number of polymorphic markers for use in marker assisted breeding programs.

An online portal named 'Krishi Vigyan Kendra Knowledge Network' has been developed to disseminate knowledge and information from KVKs to farmers. It has been hosted at ICAR – IASRI data center and available at URL (http://kvk.icar.gov. in/). It is a single window platform which provides information about KVK, package of practices related to agriculture and allied sector, facilities at KVKs, details of events organized by KVKs and agricultural contingency plan for most of the districts of India. The portal has an integrated query module including simple and advance search facilities. Monitoring facility has been developed in the portal for ATARIs and ICAR Extension division. State wise and ATARI wise monitoring reports have been developed for KVK Profile, Events, Facilities and Package of Practices. KVKs can upload, view and update Monthly Progress Report (MPR) and Agriculture Extension MPR (AE-MPR) reports through the portal. ATARIs can view the consolidated reports of MPR and AE-MPR of the KVKs under their office. A live cluster map has been incorporated into the portal to keep track of the users. More than 6 lakh of users have already visited this portal. A Dashboard monitoring system for various components of portal has been developed.

A KVK Mobile App for the farmers has been developed in the Android platform. The app is available at Google Play Store and consists of the following functionalities: KVK, Facilities, Package of Practices, Send Query, Upcoming Event, Past Event, Weather Advisory, Market, Change KVK and KVK Portal. Farmers can ask any farm related query to the experts in KVK and get solution for that through this app. ICAR Email Ids for all KVK Heads have been created. A separate mailbox has been created for providing support to the portal users.

ICAR-ERP has been implemented in 111 Institutes of ICAR including ICAR Headquarters and Agricultural Scientist Recruitment Board. For the effective implementation of ICAR-ERP, six knowledge enhancement trainings on HRMS & Payroll and SCM modules have been organized at five different locations. Institute specific training on ICAR-ERP have been organized at IASRI. The Payroll Module

was successfully customized as per the 7th CPC and salary through ERP system has been disbursed by 47 Institutes. The Expenditure report on cash basis has been customized, tested and demonstrated to Finance Division of ICAR Headquarters.

Online Application System for Ph.D. entrance examination of IARI has been developed as a module of the MS-PGE system. About 3300 students registered with the system since its launching in 2017. Multiple reports as per the requirements of the PG School, IARI for allocating the examination center and for validating the participants have been generated. Support has been provided to solve the queries of the various users' w.r.t. application filling to candidates as well as for other modules such as student registration and result uploading.

Academic Management System has been developed for CIFE, Mumbai. Production instance of the system (NDRI Academic Management System) is installed and development of master database has been started. Production instance of the system (IVRI Academic Management System) is installed and development of master database has been started.

Personnel Management System for managing the cadre strength and transfer of the scientific staff has been developed and implemented in ICAR. Design and development of web based application on Results framework document management system in ICAR has been completed.

All the existing solutions developed by IASRI for the Education Division of ICAR have been merged under the umbrella of Agriculture Education Portal of ICAR. Additional new initiatives like development of student portal has been started. A web responsive homepage has been developed and made available on Internet at http://education.icar.gov.in. The new additional functionalities added to the portal includes: Statement of Expenditure (SoE) sub module under Budget Module for uploading SoE of each component; Demand of funds and guidelines sub module for uploading demand under each component is developed to facilitate filling of funds under different heads by the University Nodal Officer and multiple new reports to track the demand of funds for each module and release of funds by the Education Division. All the reports have been made browser compatible and can be viewed in Internet Explorer, Google Chrome and Mozilla Firefox. A number of reports have also been made web responsive for viewing on mobile phones/tablets.

KVK MOBILE APP

Register with your details

After registration, Login

After first login, select your primary KVK

Get details of all facilities provided by KVK

Get details of information about KVK by selecting state and district

Know Package of Practices for crops, fisheries, horticulture and livestock

Ask your farm related queries to Experts and get solution

Get details of events like Field Day, Kisan Mela, Method Demonstration etc. already organized by KVK

Download AgroMeteorological Advisory in English/Local language

Get prior information about events to be organized at KVK

Visit KVK portal

Access Agro-commodity prices from eNAM Portal

Change your primary KVK

Introduction

ICAR-Indian Agricultural Statistics Research Institute (IASRI) is a pioneer 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 9001:2008 certificate in the year 2013. 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 and useful contributions to research in Agricultural Statistics in the fields like Design of Experiments, Statistical Genetics, Forecasting Techniques, Statistical Modelling, Sample Surveys, Econometrics, Computer Applications in Agriculture, Software Development, 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 Corelation (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.

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 with192 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 Agriculture & Farmers Welfares Minister at IASRI on 21st December, 2016. About 40 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 Agriculture & Farmers Welfare Minister.

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 both under plan and non-plan is furnished as:

Budget Allocation vis-à-vis Utilization (2016-17) Institute Plan & Non-Plan

Head of Account	Allocation		Expenditure	
	Non-Plan	Plan	Non-Plan	Plan
Pay & Allowances+Pension & other retirement benefits	2894.75000	0.00000	2887.06181	0.00000
TA	6.00000	13.47000	4.23000	12.73625
OTA	0.05000	0.00000	0.05000	0.00000
HRD	3.00000	10.77000	2.98911	8.22155
Fellowship	68.00000	0.00000	66.84967	0.00000
Research & Operational	7.19000	29.22000	6.12543	27.31735
Equipments	7.00000	13.94000	2.59761	11.99408
Information Tech	0.00000	0.00000	0.00000	0.00000
Furniture	1.00000	0.00000	0.98559	0.00000
Works	0.00000	0.00000	0.00000	0.00000
Library	0.00000	35.91000	0.00000	0.20336
Loan & Advances	11.00000	0.00000	2.19000	0.00000
Administrative Exp.	580.95000	153.51000	567.17123	149.13117
Guest House Maintenance	2.25000	0.00000	1.34059	0.00000
Other Miscellaneous	0.00000	852.84000	0.00000	852.80781
Total	3581.19000	1109.66000	3541.59104	1062.41157

Staff Position (as on 31 March 2017)

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	1
Scientific	130	67
Technical	215	57
Administrative	84	61
Canteen	14	8
Skilled Supporting Staff	78	36
Total	**522**	**230**

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Research Achievements

The set research targets of the Institute are being implemented by six divisions, viz. Design of Experiments, Sample Surveys, Statistical Genetics, Forecasting and Agricultural System Modelling, Computer Applications and Centre for Agricultural Bioinformatics. The basic, applied, adaptive and strategic research in Agricultural Statistics and Informatics is carried out under following six broad programmes that cut across the boundaries of the divisions and encourage interdisciplinary research:

1. Development and Analysis of Experimental Designs for Agricultural System Research
2. Forecasting, Modelling and Simulation Techniques in Biological and Economic Phenomena
3. Development of Techniques for Planning and Execution of Surveys and Statistical Applications of GIS and Remote Sensing in Agricultural Systems
4. Development of Statistical Techniques for Genetics/Computational Biology and Applications of Bioinformatics in Agricultural Research
5. Development of Informatics in Agricultural Research
6. Teaching and Training in Agricultural Statistics and Informatics

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

ICAR Research Data Repository for Knowledge Management as KRISHI-Knowledge Based Resources Information Systems Hub for Innovations in Agriculture

Strengthening and Maintenance of KRISHI Page

- Strengthened and maintained KRISHI Portal (http://krishi.icar.gov.in)-Knowledge based Resources Information Systems Hub for Innovations in Agriculture consisting of six repositories namely (i) Technology Repository (ii) Publication Repository (iii) Experimental Data Repository (iv) Observational Data Repository (v) Survey Data Repository and (vi) Geo-portal.

- KRISHI Portal has been enriched through providing links of several online resources available/developed at different ICAR institutes. Total number of links from ICAR and other sources on the KRISHI Portal are 269 (as against 134 reported last year) under 15 broad headings.

- An application for identifying the inactive links on

KRISHI Portal has been developed and is being used to notify to the respective Institutes. This is a stand alone application and generates List of "Inactive Links" in MS-Word file on Computer Desktop. This can be used for other applications as well. Some screen shots are given in the sequel.
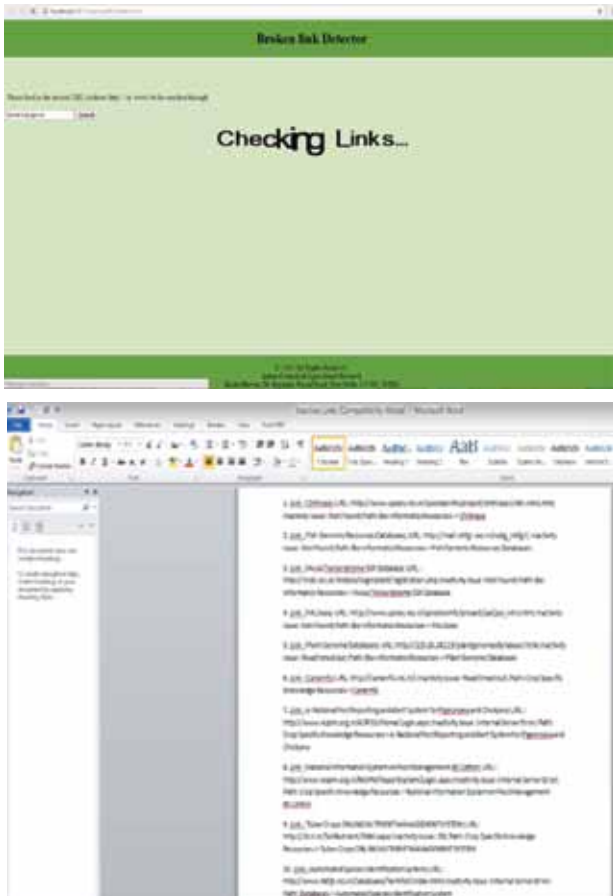
ICAR-Publication and Data Inventory Repository

Prepared formats for meta data related to Data Inventory and Publication Repository at ICAR Institutes. Online module of Institutional Publication and Data Inventory Repository has been prepared in DSpace 5.5 in JSPUI user interface and

PostgrSQL Database. In authorization set up, nodal officers from all 108 ICAR Institutes have been included through MS Directory Server (by LDAP: Light Directory Access Protocol) for submitting and reviewing the information being uploaded. Here the User ID and Password would be same as in ICAR.GOV.IN domain. Other researchers from NARES can be added using DSpace database authentication once they register through browser. While authenticating through database, it will not be possible to have same user ID and password as in ICAR.GOV.IN domain. These repositories are being enriched through populating data by Nodal Officers and other researchers. As of now, 2503 publications and 117 datasets have been submitted from 76 Institutes. 124 researchers other than Nodal Officers have registered themselves as submitters.

Report Applications module was enriched through provision of generating Institute wise and collection wise list of submitters and list of embargo items (all, current and expired) prepared and made available under administration and nodal officer authentications.

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Interportal Harvester: In order to bring various agricultural research publications collected by various organizations within and as well as outside of ICAR, an Interportal Harvester (http://krishi.icar.gov.in/ohs-2.3.1/) has been strengthened. Meta Data has been harvested from 17 Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) protocol enabled web applications viz. KRISHIKOSH, CMFRI Eprints, NAARM Eprints, DSpice at IISR, Indian Agricultural Research Journals, OAR@ICRISAT, ICRISAT Dataverse, DSpace at IIT, Bombay; CSIR-NISCAIR; CSIR-Madras Complex; NISCAIR Online Periodical Repository; Shodhganga (a platform for research students to deposit their Ph.D. theses), DSpace at CIFT; ePrints at CFTRI; ICAR KRISHI Publication and Data Inventory Repository, Electronic theses of Indian Institute of Science; Open Access Repository of Indian Theses: CSIR etc. Unified search is ready for 17 repositories for 1,84,466 records (earlier 80847 reported last year).

Unit Level Data Repository

- **Experimental Data Repository:** (a) Efforts were to made to digitize 45 Compendia Volumes consisting of 23254 pages pertaining to National Index of Agricultural Experiments 1948-1965 as searchable PDF files and uplaoded at http://krishi.icar.gov.in/Compendia.jsp; (b) The Information System developed for All-India Coordianted Sorghum Improvement Programme (available at http://www.aicsip.naarm.org.in) was used for creating Kharif and Rabi Trials for the year 2015-16. The number of trials for the current year using the system is 13 and total number of locations under which the trials are to be conducted would

be 180 and total number of traits to be recorded during the year in all the locations in these 13 trials is 2230. Layouts of all 180 trials are available through on-line and the field preparations could be taken up at individual locations even before the seeds were received. The data recorded on 2230 traits would be received on-line, processed and statistically analyzed using the same system and (c) the experimental data for AICRP on Long Term Fertilizer Experiments for the following 16 centres has been entered in the database: (i) PDKV, Akola(2012-13 to 2014-15); (ii) GKVK UAS, Bangalore (2012-13 and 2013-14); (iii) CRIJAF, Barrackpore (2010-11 to 2013-14); (iv) OUAT, Bhubaneswar (2012-13 to 2013-14); (v) TNAU, Coimbatore (2010-11 to 2014-15); (vi) ICAR-IARI, New Delhi (2013-14 to 2015-16); (vii) JNKVV, Jabalpur (2012-13 to 2014-15); (viii) RRS, ANGRAU, Jagatial (2011-12 to 2015-16); (ix) Junagarh (2010-11 to 2014-15); (x) KAU, Pattambi (2011-12 to 2014-15); (xi) CSKHPKV, Palampur (2012-13 to 2013-14); (xii) GNPUA&T, Pantnagar (2011-12 to 2013-14); (xiii) MPKV, Prabhani (2013-14 to 2014-15); (xiv) IGKV, Raipur (2010-11 to 2014-15); (xv) BAU, Ranchi (2013-14 to 2014-15) and MPUA&T, Udaipur (2011-12).

- Based on the information received from different AICRPs following websites have been made functional: (i) AICRP on Farm Implements and Machinery (http://aicrp.icar.gov.in/fim); (ii) AICRP on Post Harvest Engineering and Technology (http://aicrp.icar.gov.in/phet/); (iii) AICRP on Long Term Fertilizer Experiments (http://aicrp.icar.gov.in/ltfe/);

(iv) AICRP on Sorghum (http://aicrp.icar.gov.in/sorghum/); (v) AICRP on Irrigation Water Management (http://aicrp.icar.gov.in/iwm/).

Observational Repository

Developed an application to harvest meteorological data from http://www.aicrpam-nicra-aws.in/. Anomalies in data harvested were reported to ICAR-CRIDA, Hyderabad. ICAR-CRIDA, Hyderabad after looking into the anomalies had informed that the anomalies are due to the fact that most of the AWS stations are under maintenance and confirmed that following 10 AWS are functional : Andhra Pradesh (Kurnool); Bihar (Nawada); Chattisgarh (Mahasamund); Gujarat (Rajkot); Himachal Pradesh (Kullu, Sirmaur); Maharashtra (Nandurbar); Nagaland (Phek); Rajasthan (Jodhpur); Tamil Nadu (Namakkal). Data from these 10 AWS has been made available under Observational repository at http://krishi.icar.gov.in/ObservationData/ on the following parameters: Temperature (oC); Relative Humidity (%); Wind Speed (km/h); Wind Direction (degrees); Rainfall (mm); Solar Radiation (MJ/m2): March 31, 2017 onwards (two times a day).

ICAR Geo-Portal

- **ICAR-geoportal Ver 2** has been developed by integrating all spatial layers in a single view for easy understanding of user and implemented Spatial layer level "query" for displaying user queried features only. Updated the spatial layers of "Vulnerability to Climate Change" and "Standardized Precipitation Index" on the Geo-portal. (i) Spatial layers of "Weekly Standardized Precipitation Index" and "Seasonal Standardized Precipitation Index" for 22 meteorological weeks (28 May - 28 October 2016) have been added on ICAR-Geo-portal; (ii) Land Use and land cover based on ISRO data; (iii) Soil: (iiia) Major Soil types: Mountaineous Soils, Red Soils; Black soils, Alluvial Soils; (iiib) Salt Affected Soils; (iiic) Flood Affected Soils (Data received from ICAR-NBSSLUP, Nagpur); (iv) Net Irrigated Area (000 ha) based on data from Statistical Year Book 2013, CSO; (v) Active fires due to residue burning between October 10 - November 20, 2016 detected using satellite data and added Weekly Fire maps (for each week 31.10.2016-3.12.2016); (vi) Rice and Wheat Yields in t/ha (2008-09 to 2013-14); (vii) Livestock Census 2012 state wise for livestock population (Total livestock, cattle, buffalo, goat, sheep and pig in millions) and Equine (including Mule, Horse and Donkey) Population in thousands; (vii) Wheat weeds infestation: Anagallis Arvensis; Chenopodium Album; Cyperus Rotundus and Phalaris Minor (Data received from ICAR-DWR, Jabalpur); (viii) 13 Livestock Diseases outbreaks during 2015 viz. Anthrax, Babesiosis, Black Quarter, Blue Tonguer, Enterotoxaemia, Fascioliasis, Foot and Mouth

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Disease, Haemorrhagic Septicemia, Peste Des Petits Ruminants, Sheep and Goat Pox, Swine Fever outbreaks, Theileriosis, Trypansomiasis and Livestock census 2012 state wise (data received from ICAR-NIVEDI, Bengaluru); (ix) Buffalo Breed Habitat (data received from ICAR-NBAGR, Karnal) and (x) Real time Satellite Images: Terra-1 (RGB); Aqua-1 (RGB); Metop-2 (FCC) and Noaa (FCC) (Data received from ICAR-IARI, New Delhi) upload on Geo-Portal.

Soil Depth
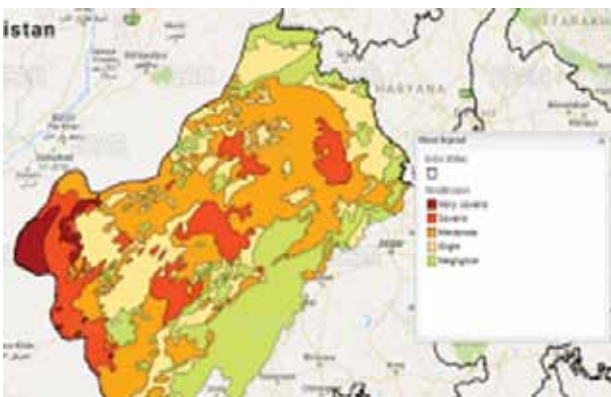
Wind Erosion
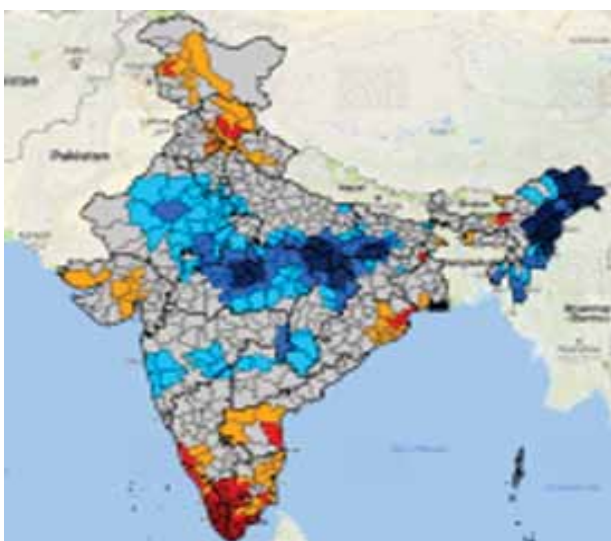
Seasonal Precipitation Index

Capacity Building and Sensitization

- To sensitize the nodal officers about the ICAR Research Data Management Policy and to discuss the future course of action for implementation, second Workshop of Nodal officers/Officer Incharge, Data Management was organized at NASC Complex, New Delhi during January 24-25, 2017. Following seven technical sessions were organized during the workshop: (i) Data Inventory Repository; (ii) Publication Repository and Interportal Harvester; (iii) ICAR Geo-Portal; (iv) Technology Repository; (v) Unit Level Data Repository; (vi) Workflows and IT Infrastructure and (vii) Hands on Training on Institutional Publication Repository; Data Inventory Repository and ICAR Geo-Portal.

- For sensitizing the researchers about the guidelines for Data Management in ICAR Institutes and spreading awareness about the importance of digitisation of research data, Sensitisation seminars have been organized in 20 more ICAR Institutes making it a total of 104.

- Sensitisation Programmes were organized by respective Officer Incharge Data Management at 104 ICAR institutes.

Policy Initiative

- As a policy initiative, the Council issued an office order regarding inclusion of details of the information regarding the data available with the person and to whom it has been handed over in "No Dues Proforma" on superannuation or transfer of scientists/technical officers;

Visibility

- KRISHI-ICAR Research Data Portal has been listed in the advertisement issued by Indian Council of Agricultural Research on the occasion of 88th Annual General Meeting of the ICAR Society (February 16, 2017).

- Implemented customized search on Portal. KRISHI Portal has attracted more than 38,000 page views across 1500 cities of 125 countries (as per Google Analytics).

Minimal Response Surface Designs (RSD) for Resource Optimization in Agricultural Experiments

The procedure of randomization of the run sequences is a technique commonly employed while implementing RSD to avoid bias which may lead to misinterpretation of the result. But this can induce a

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large number of changes in factor levels and thus make experimentation expensive, time-consuming and difficult. Hence, it is often desirable to execute trials in response surface design such that the number of input factor level changes is kept small to make the experiment cost-effective. Plackett-Burman designs have been explored to obtain minimally changed run sequence and it has been indeed possible to obtain minimum level changes for some of the factors, keeping the total number of changes fixed as the least. A general expression for the total number of changes in the run sequences of Plackett-Burman designs has been obtained. Using a SAS macro, Plackett-Burman designs have been generated. Minimally changed run sequences for fitting response models incorporating indirect effects have been investigated and it has been found that minimally changed run sequences of 2k factorial is ensuring the constancy of variance of the predicted response.

Developed an R-software package, termed as *minimalRSD,* for the generation of minimally changed run sequence for Response Surface Designs (RSDs) and hosted at https://cran.r-project.org/web/packages/minimalRSD/ index.html.

This package consists of three series of designs viz., central composite designs (CCD)with full as well as fractional factorial points (half replicate) and Box Behnken designs (BBD) with minimally changed run sequences.

Designing and Analysis of On-Farm Research Experiments Planned under AICRP on IFS (Integrated Farming Systems)

Agricultural research has traditionally been undertaken at research stations where facilities of experimentation are excellent and accessibility to researchers is favourable. Any conclusions based on the results of a group of experiments at research

stations cannot be immediately recommended for general adoption under actual farming conditions. This may primarily be due to (i) The number of experimental stations are small (ii) The fertility of soil and the level of management at research stations are superior to those in cultivator's field. Thus, before giving the promising results from agricultural research stations to extension workers for adoption by the farming community, it is necessary to test these results under farming conditions. On-farm research provides the key to the generation of location and situation specific technologies for achieving sustained productivity in agriculture. It takes into account the biological, socio-economic and technological constraints operating at farmer's level and is thus a first-hand source for feedback.

A fairly extensive programme on farmers' field is in operation in India under the aegis of All India Coordinated Research Project on Integrated Farming System (AICRP on IFS) located at ICAR-Indian Institute of Farming System Research (ICAR-IIFSR), Modipuram. On-Farm Research (OFR) component of AICRP on Integrated Farming Systems was working with large number of marginal and small farmers from 2011 in 31 districts covering 20 states to systematically characterize the existing farming systems, identify the constraints, make collective, compatible and convenient farm interventions and study the changes. Collaboration of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI) with ICAR-IIFSR exists since 1960s in terms of statistical support. Recently, ICAR-IASRI became a voluntary centre in this programme.

Integrated Farming System (IFS) is considered to be a powerful tool and holds the key for ensuring income, employment, livelihood and nutritional security in a sustainable mode for small and marginal farmers. At the same time, it is one of the most complex systems in terms of huge number of parameters to be observed that too in different modes and scales of measurements. Some variables are quantitative in nature while others are qualitative. The measurements are difficult as one need to consider various systems, seasons, crops, livestock, impact of training, soil and water parameters, approach to market, etc. But, the most difficult task lies in tabulating the data and drawing valuable information from the data. Comparison of existing and diversified data (with respect to production, marketable surplus, cost, return and profit) under different farming systems and also identification of best suitable farming system for each centre are of prime interest in the study.

- There are three types of experiments being conducted under On-Farm Research viz., OFR 1: *On-farm crop response to application of major plant nutrients in pre-dominant cropping system,* OFR 2: *Diversification of existing farming systems under marginal household conditions and* OFR 3: *On-Farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers.*

OFR 1 data entry and analysis is being carried out online using a software developed for the said purpose. Under OFR 2 experiments alone, from each centre, every year, data is received in 16 excel worksheets, broadly grouped into 9 classes viz., PART A (Identification, Farming history, Water), PART B (Benchmark), PART C (Systems, Interventions, Results), PART D (Species, Interventions, Results), PART E (Product Results), PART F (Trainings, Results), PART G (Natural resources improvement), PART H (Abnormal weather), PART I (ITK). Also, data is received with respect to existing and diversified farming conditions from the same 24 households for each of the centres. Similarly, huge amount of data is received for OFR 3 experiments too.

Due to such vast amount of data, often the data is received after a period of 6 months. It is a herculean task to process the data and bring it into a suitable format for analysis. To shorten this delay in deriving results and to make data entry more user-friendly, a "web based software for online data entry and analysis of data pertaining to OFR 2 and OFR 3 experiments" has been designed using ASP.NET/C# as front end and SQL Server as back end. Some snapshots of the software are given below:

Planning, designing and analysis of data relating to experiments for AICRP on Long Term Fertilizer Experiments

Data analysis has been done for the centres named Akola (2013-14, 14-15), Bhubaneswar (2014-15), Coimbatore (2010-11,11-12,12-13,13-4,14-15), Delhi (2013-14,14-15,15-16), Jabalpur (2014-15) and Parbhani (2013-14, 2014-15) for Kharif and Rabi season and Barrackpore (2010-11,11-12,13-14) for Kharif season and report has been sent to the Centre in-charges. Data was uploaded to Information System on Long Term Fertilizer Experiments (ISLTFE) for various centres. Combined analysis has been performed for Delhi centre for Rabi crop wheat grain yield data for the period 1993 to 2011. It was found that the treatment, year and treatment-year interaction effects were significant at less than 1% level. Least square mean was maximum for T8: 100% NPK+FYM (least square mean 49.87 q/ha) and T3: 150% NPK (least square mean 49.66 q/ha). Combined analysis of Delhi centre for the Rabi crop wheat showed that the treatments T8: 100% NPK+FYM (least square mean 49.87 q/ha) and T3: 150% NPK (least square mean 49.66 q/ha) gave maximum yield.

Planning, designing and analysis of experiments planned on stations under All India Coordinated Research Project on Integrated Farming Systems

The experiments on stations under All India Coordinated Research Project on Integrated Farming Systems are 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, 32×2 balanced confounded factorial design and split-split plot design. Data received from the experiments conducted for the year 2014- 15 have been analysed, and the results tabulated in the form of summary tables and sent to the respective scientist-in-charge of the cooperating centres. The table below provides the distribution of Coefficient of Variation (CV) for the experiments analysed:

CV	0-3	3-5	5-10	10-15	15-20	≥20
Number of Experiments	11	56	89	47	13	7

Developed a software module for data entry of Expt. 1a (Intensification / diversification of cropping sequence based on high value crops) and also developed analysis module.

A-optimal block designs for comparing test treatments with control treatment(s) - an algorithmic approach

An algorithm using R language has been developed for constructing A-optimal balanced bipartite (BBPB) designs and weighted A-optimal block designs for comparing a set of test treatments with a set of control treatments and has been utilized to construct a list of A-optimal BBPB designs and weighted A-optimal block designs. A total of 460 designs are obtained in the parametric range.

Some Investigations on Trend Resistant Row-Column Designs

In agricultural and allied experiments, situations are quite common where there may be evidences of two sources of variability apart from the treatment applied to the experimental material. Row-Column designs are useful for this situation. In agricultural experiments, response may be affected by systematic trend. Thus, trend component should be incorporated into the row-column model. Further, apart from the trend effect, it may be the situation that the response of a particular experimental unit may also be affected by the neighbour effects from its adjacent unit. Under this situation, it is important to study row-column model incorporating trend component with neighbour effects. Trend resistant row-column designs with neighbour effects should be obtained for this situation. Further, it may be the case that the observations may be correlated. Thus, this should also be taken into account for row-column designs incorporating trend component. Considering this, the information matrix for estimating contrast pertaining to direct effect of treatment under row-column designs with one directional trend component in the presence of non-directional neighbour effects has been obtained after eliminating all the effects.

On construction of orthogonal and nested orthogonal Latin hypercube designs

Latin hypercube designs have proved to be a popular choice for experiments run on computer simulators and in global sensitivity analysis. The columns of a Latin hypercube design (LHD) represent the input factors and, the rows, the experimental runs. Different approaches have been suggested and developed in the literature for constructing Latin hypercube and orthogonal Latin hypercube with desirable properties. One such approach consists of finding Latin hypercube with zero correlations between pairs of input factors (or, columns). In terms

of Latin hypercube designs, this requirement is equivalent to the condition that (a) the columns of the design are mutually orthogonal. Designs satisfying condition (a) are called orthogonal Latin hypercube designs (OLHD) and named as 1st order OLH(n, m). First order OLH(n, m) designs ensure independence of estimates of linear effects when a first order model is fitted. However, if a second-order model is needed, then it is desirable that the Latin hypercube design satisfies condition (a) and additionally, the following condition: (b) the element-wise square of each column and the element-wise product of every two columns are orthogonal to all columns in the design. A Latin hypercube design with n rows and m columns satisfying both (a) and (b) are denoted by second order OLH (n, m) design. A 2nd order OLH (n, m) design ensures that not only the estimates of linear effects are mutually uncorrelated but they are also uncorrelated with the estimates of quadratic and interaction effects in a second order model. Developed construction methods for providing a complete solution to construction of Orthogonal Latin hypercube designs for 2, 3, 4, 5, and 6 factors with any permissible runs.

Creating Awareness for Efficient Use of ICT and MOOCs in Agriculture Education

Agriculture is the backbone of the Indian economy which plays the most decisive role in the socioeconomic development of the country. Information and Communication Technologies (ICTs) are referred to as the varied collection of technological gear and resources which are made use of to communicate. They are also made use of to generate, distribute, collect and administer information. The use of Information and Communication Technology (ICT) in education is lagging behind expectation and desire. It is difficult and may be even impossible to imagine future learning environments that are not supported, in one way or another, by Information and Communication Technologies (ICT). When looking at the current widespread diffusion and use of ICT in modern societies, especially by the young – the so-called digital generation – then it should be clear that ICT will affect the complete learning process today and in the future. There is, in other words, a widespread belief that ICTs have an important role to play in changing and modernizing educational systems and ways of learning. There is, however, little scientific evidence of the concrete contributions of ICTs to the learning domain, despite the efforts of the last decades. Hence, there is a need to bring evidence together on the impact of ICT on education and training in India.

Keeping in view of importance of teaching and e-learning process in agricultural education system for the researchers and to visualize its impact on ICT tools in agricultural education system, there is a need to develop online tools in agriculture education and to assess the impact of online tools in agriculture education.

A Web based application has been prepared using JAVA (7.0), JSP/ Servlet, Apache Tomcat 7, HTML, CSS and JAVASCRIPT in Front-End and SQL Server in Back-End with features such as View, Upload , Download E-Books and E-Media. It also does State wise, University Wise and Overall Impact analysis of ICT tools with features like view and download datasheet stored in database and results file with proper interpretation for all State Agricultural Universities in text and graphical view.

A website has been developed and named as ICTIAA (http://ictiaa.icar.gov.in). This website provides both the services of MOOC as well as impact analysis of ICT Tools. Some snapshots are shown below:

Home page

Login Page: Enter Credentials

E-Learning ->Click E-Book

E-Learning ->Click E-Media

Incomplete split plot designs: construction and analysis

A method of construction for obtaining incomplete split plot designs with complete main plots and incomplete subplots has been developed. Suppose there are v1 levels of the main plot treatments and v2 levels of the subplot treatment and further the experimenter can afford b blocks. Then the main plot treatments are first arranged in a randomized complete block design with b blocks. Now, we take a connected and highly A-efficient incomplete block design with parameters v2, number of blocks b and block size k < v2. This block design is associated with each level of the main plot treatment. The obtained design is an incomplete split plot design with complete main plots and incomplete sub-plots. The method has been used to construct incomplete split plot designs of such nature and a total of 391 incomplete split plot designs have been obtained in the restricted parametric range of v1,v2 . Similarly, a method of constructing incomplete split plot designs which are incomplete at main plot level and complete at subplot level has been developed and a number of incomplete split plot designs are obtained..

Development of Varietal and Hybrid Technologies of Pearl millet [Pennisetum glaucum (L). R. Br.] for Higher Yield and Nutritional Improvement

Pearl millet is grown in harsh environments where other crops fail to grow and is affected by many biotic (downy mildew, blast, rust, ergot and white grub in specific areas of Rajasthan) and abiotic (heat, drought and salinity) stresses leading to fluctuation in annual area and production. Developing resistant/ tolerant genotypes to these stresses can address these issues to a great extent. High yielding hybrids/ varieties suitable for different agronomic conditions possessing climate resilience would help in improving productivity and sustainability of this crop in India.

For the experiment conducted at IARI, the data generated was analyzed on various traits (Days to 50% flowering, Plant height, Number of tillers, Panicle length, Panicle girth, Days to maturity, Yield, etc. and some bio-chemical traits). Correlations among morphological traits were also worked out. The combined analysis of data over three years viz., 2014, 2015 and 2016 was done for the New Delhi centre.

Central Composite Design (CCD) was suggested for an experiment on development of Pearl Millet based expanded product. Input factors were Temperature (100-140$\square$C), Screw Speed (300-500 rpm), Moisture Content (14-24 %) and Feeder Speed (12-16 rpm). Responses measured were Expansion ratio, Bulk Density, WAI, WSF, Capacity etc. + Anti-oxidants (FRAP, CUPRAC, DPPH, TEAC etc.) + Phenols. For another experiment on product based on Pearl Millet + Soy, a CCD with different input combinations has been provided. From both the experiments data on physical properties as well as nutritional properties was generated and analyzed.

Standardization and validation of scales for measuring socio-psychological constructs related to risk adjustment and entrepreneurship behaviours of farmers

Risk adjustment and agriprenurship are important dimensions of Indian Farming and the same are desirable behaviors of the farmers. However, the prevailing trends of using nearly the same set of variables by researchers, academicians and scholars in extension discipline to analyze any behavioral phenomenon in individual, has failed to capture novel constructs like risk adjustment and entrepreneurship holistically. The scales often being used to measure the associated socio-psychological variables are not only quite old, which have lost relevance in the present socio-economic conditions, but also suffer from lack of construct validity. Considerations of ecological and variable representativeness in research are important ingredients and there is a need to broaden and deepen the pool of socio-psychological variables with search of new constructs in changing agrarian context with extensive surveys and case analyses.

Development of new scales with application of advanced psychometrics and software is required to provide precise measurement for generalization.

The framework for identification of entrepreneurs has been developed. The questionnaire for collecting information has been prepared. A list of entrepreneurs recognized by different organizations of repute (IARI, KVKs, SAU's Ministry, etc) have been prepared. Data has been collected by personal visits from farmers in Shyahadava, Payal, Talwandi Rana, Juglan, Gurana villages of Hissar district. Data has also been collected through personal visits from the villages of three districts of Kerala viz., Ernakulam, Idukki and Thrissur and interacted with various agri-entrepreneurs mainly fish farmers, strawberry growers, piggery farmers, dairy farmers, other multi crop growers and agri-nursery owners to measure the entrepreneurial behavior of famers. An Agri-entrepreneurs workshop was organized in collaboration with IARI and KVK, Sikohpur.

Information System for Planning and Analysis of Experiments on All-India Coordinated Research Project on Vegetable Crops

Existing observation tables for all types of experiments viz. varietal trials, resistant varietal trials, hybrid trials, vegetable production, seed production, etc. have been modified as per changes in the new technical programme for 2016-17. Following crops have been added in crops table: Carrot, Watermelon, Yard long bean, Bathua and Okra. Information System has been reallocated to new server with URL www.iasri.res.in/aicrpvc in ICAR Data Centre to http://aicrp.icar.gov.in/vc/.

Strengthening Statistical Computing for NARS

Installation, License Files and Technical support

- License files for 2016-17 have been received from SAS. SAS Licenses files for 2016-17 have been uploaded on Resources Page of the Indian NARS Statistical Computing Portal for the exiting users in NARES. Indian NARS Statistical Computing Portal (http://stat.iasri.res.in/sscnarsportal/public) under the link SAS License 2016-17.

- Received JMP 12.1 version download link from SAS and accordingly it was downloaded.

- A document on guidelines for downloading and installation of Free SAS-University Edition

using Oracle VM VirtualBox was prepared and circulated to Nodal Officers.

Indian NARS Statistical Computing Portal

- The 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, 2016- March 31, 2017 are 1,08,904 which is on an average more than 295 logged in per day.
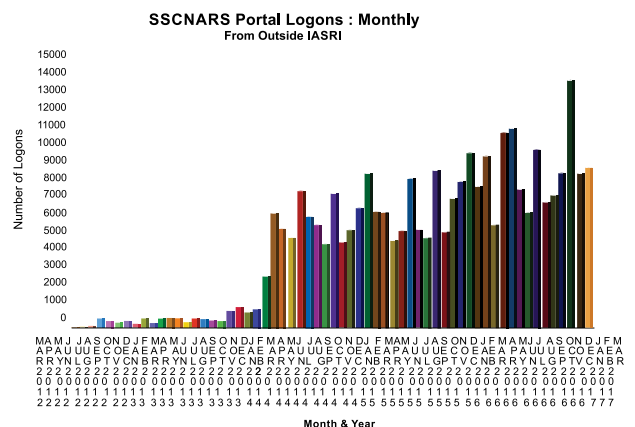
- Website of the project is being maintained and updated regularly. The website has been updated by including (i) Updated Reference Manual on Data Analysis Using SAS by updating two Chapters on (a) SAS for Statistical Procedures and (b) Design Resources Server and (iii) updated list of Nodal Officers.

- Website is registered under google analytics on November 15, 2010. Till March 31, 2017, there were 97,589 page views across 536 cities of 78 countries. Average time on each page was 2.56 minutes. During April 01, 2016 to March 31, 2017, there were 17,702 page views across 424 cities of 72 countries.

Information System for Designed Experiments

In On-farm Experiment-1 (Response of Nutrients) and For LTFE (Long Term Fertilizer Experiments)

Online data entry for the year 2016-17 is in progress. For On-station Experiment-1A (Intensification / Diversification of cropping sequence based on high value crops): Validation of on-line data for on-station experiment–1 for the year 2016-17 is in progress. Databases are being maintained for Agricultural Field Experiments Information System, Farm Experiment-1 (Response of Nutrients), On-Station Experiment–1A (Intensification/Diversification of cropping sequence based on high value crops) and LTFE -Long Term Fertilizer Experiments.

Strengthening Design Resources Server

For dissemination of research in Design of Experiments, Design Resources Server (www.iasri.res.in/design) was further strengthened by adding the links on

(i) Balanced Incomplete Latin square Designs: Strengthened the link of online generation of Balanced Incomplete Latin square Designs for all values of (v, r) except for v = 4n+2, where n is any positive integer at www.iasri.res.in/design/BILS_ Design/Default.aspx. by For this the earlier module for online generation of BILS for all values of 3 < v < 21 (expect v = 6, 10, 14, 18) has been generalized. Some screen shots for balanced incomplete Latin Squares are given in the sequel.

Usage of the Server

The server has a facility of "Ask a Question" through which a lot of questions are being received and answered. More than 50 questions asked during this period through link 'Ask a Question' were answered for providing e-advisory services. During April 01, 2016 to March 31, 2017, Google Analytics gave 11,855 page views across 704 cities of 85 countries. Average time taken on page is 3.13 minutes

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

A Study on Price Efficiency in Agricultural Commodity Market

The purpose of this study was to empirically examine

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whether futures markets help in discovering the better price to achieve market efficiency and transparency in trading of agricultural commodities. Future trading in Chana (Gram), Cumin (Jeera), Soybean and Castor Seeds was examined using secondary data on price of respective commodities in major spot markets and price in commodity exchange (NCDEX).

The Cointegration analysis between spot price and future price of selected commodities was carried out to know if the two price series are cointegrated in the long run or not because for market efficiency it is desirable that two price series should be cointegrated in the long run. The spot price of Chana (Gram) taken from Bikaner, Delhi and Indore market; Cumin (Jeera) Unjha market; Soybean Indore, Kota and Nagpur markets and Castor seeds of Deesa (Gujarat) market and the future price of NCDEX were considered for the analysis.

The results indicates that there is at most one co-integrating equation and one co-integrating vector between the bivariate price series or these series are co-integrated with each other.

The results of error correction model suggest that Indore spot market of Soybean is not strongly linked to the Future (NCDEX) market or there is gap in the flow of information from future to spot market. The results of error correction model suggest that Kota spot market of Soybean is strongly linked to the Future (NCDEX) market and there is flow of information from future to spot market. The future prices also act as price setter for spot market Kota in case of Soybean prices. The results confirm that the Castor Seed futures price leads the price behavioral pattern of the spot price.

The results of Causality of Relationship in the three spot price of Chana revealed that there is a significant long run relationship between the two price series. This relationship is unidirectional runs from future to spot market and not vice versa. The study also observed some short run relationship between the two price series and this relationship is also unidirectional which runs from spot to future market and not vice versa.

The study of hedge ratio test revealed that in case of Cumin (Unjha) market the time varying hedge model performed better than constant hedge model in estimating optimal hedge ratio. This study indicates that Time Varying Hedge model perform better or superior over the Constant Hedge ratio model. It implied that Time Varying Hedge model

efficiently calculate optimal hedge ratio and the future instrument can attract large returns on the investment. This study indicates that time varying parameter model is superior to the constant parameter hedge ratio model in calculating optimal hedge ratio. The fact has been confirmed in graphical presentation of two hedge ratio models. The study further indicated that optimal hedge ratio as calculated in Time Varying model facilitates large investment in the future instruments

Study on volatility spillover of agricultural commodity prices

Price volatility in commodity prices can create uncertainty thereby threaten agricultural performance which has a negative impact on the welfare of farmers. In this study, an attempt has been made to examine the pattern of volatility spillover under VEC-MGARCH model for onion markets of Mumbai, Nashik, Bangalore and Delhi. The time varying nature of dynamic conditional correlation has been evaluated under DCC model set up indicating the evidence about how shocks and volatility are transmitted from market to market. The study also focused on semi-parametric multivariate GARCH modeling for capturing volatility of the markets under consideration which was able to identify the volatility interaction among the markets of Mumbai, Nashik and Bangalore. Finally, the study evaluated the modelling capability of RBF neural networks engineered by Genetic Algorithm (GA) approach to understand the volatility interaction among the markets.

Development of Hybrid Time Series Models using Machine Learning Techniques for Forecasting Crop Yield with Covariates

BDS test of residuals obtained through ARIMA (2,1,0), supports that residuals are not identically independently distributed, hence support vector machine and artificial neural network approach was used for modeling and forecasting of residuals. ANN approach was applied on the residuals obtained by ARIMA (2,1,0). Different models were used with the combinations of different time delays and hidden nodes using logistic function as activation function. On the basis of in-sample residual forecast, estimated MAPE under ARIMA (2,1,0) and Hybrid approach were found to be 8.77% and 6.95% , respectively. Performance of hybrid approach was found to be better than that of ARIMA (2,1,0) alone. On the basis of forecasted residuals, the forecast of yield using hybrid approach was computed. Considering

these forecast values of yield by 2020 as a base data obtained through hybrid linear time series approach, linear time series approach was applied to obtain the forecasted yield by 2025. Residuals obtained through ARIMA(2,1,0) were further applied on support vector machine (SVM) with dimension 3 and fitted values of residuals were obtained. Forecasted yield values were corrected by using fitted residuals and eventually estimated MAPE for hybrid model using support vector machine. MAPE for hybrid model under SVM was found to be 14.77% as compare to 17.677% of ARIMA (2,1,0) alone. Work on support vector machine and transfer function model is in progress for long term forecast.

Forecasting of spatio-temporal time series data using Space Time Autoregressive Moving Average (STARMA) model

The STARMA model has been implemented in seasonally adjusted monthly maximum temperature in nine districts of north Karnataka. Univariate ARIMA modeling for seasonally adjusted monthly maximum temperature of north Karnataka has been carried out for each location separately. The results of Univariate ARIMA and STARMA model has been compared in terms of Mean Absolute Percentage Error (MAPE) and it was found that STRAMA model performed better as compared to univariate ARIMA model in each location. Further, machine learning optimization techniques like Genetic algorithm (GA) and Particle Swarm Optimization (PSO) has been used to optimize the parameters of STARMA model. Objective function for GA and PSO in terms of Mean Squared Error (MSE) has been defined and MATLAB code for the same is also developed. The PSO code for STARMA parameter optimization has been developed in MATLAB. Further, the GA and PSO optimized parameters of STARMA model are then incorporated in STARMA model and model fitting has been carried out. Modeling performance of proposed method with existing STARMA model has been compared in terms of MAPE and it was found that proposed approach performed better as compared to existing STARMA model. Estimation of STARMA model under spatial heterogeneous covariance structure is under progress.

Non-parametric bootstrap approach for constructing prediction intervals for non-linear and bivariate time series models

Sieve bootstrap approach for constructing prediction interval in VAR model was developed. The proposed approach was implemented in real as well as simulated datasets. Empirical results showed that proposed approach is better than the conventional approach in terms of length of confidence interval. Sieve bootstrap approach for constructing prediction interval in neural network was developed. The proposed approach was implemented in a simulated data set generated from Mackey glass equation. Derivation of rescaling factor of a bivariate process is in progress

Future perspective of Bt technology in Indian agriculture

New Delphi methodology has been developed using GOS tree approach. A new time series intervention model Trend Impact Analysis has been developed to generate scenarios. Delphi and Trend Impact Analysis has been combined to generate scenarios. SAS Macro was developed to implement proposed TIA

Forecasting Agricultural Output using Space Agrometeorology and Land based Observations (FASAL)

Forecasts were carried out for yield data of wheat of Arrah district in Bihar. Data were obtained from IMD. LASSO technique has been employed for variable selection. The residuals obtained by fitting the model were tested and found to have presence of volatility. To this end, GARCH was employed to properly fit the data.

Smallholders' Productivity and Agricultural Growth through Technology, Sustainable Intensification and Ecosystem Services

Crop diversification was studied using Simpson Crop Diversification Index in eastern part of Indo-Gangetic plain. It has been observed that diversity is increasing in this area. Logit model was used to identify the determinants of groundwater buying or selling and installation of tube wells. Garrett ranking technique was used to quantify the relative significance of various factors influencing the installation of electric and diesel operated tube wells, groundwater purchasing and selling decisions of farmers

Network Project on Market Intelligence

Examined the forecast procedure as adopted by different centres in their respective presentation. Forecasts on different commodity prices by collaborating centres have been validated time to time. The validation of price forecast has been done for the following collaborating centres: PJTSAU,

BHU, GBPUAT, IABM, IIHR, ICAR-NEH, JAU, JNKVV, KAU, OUAT, PDKV, SKUAST-K, UASB and Visva Bharati University.

Under this project, the first study was undertaken to compare the status of market infrastructure across the selected regulated markets of Uttarakhand by market infrastructure development index computed for three categories viz., trade infrastructure, storage infrastructure and support infrastructure. Haldwani emerges as the best-equipped market as per the combined index (score of 0.62) and also outscores highest among the trade, storage and support infrastructural categories. Kashipur stands next in the category due to its better positioning in trade infrastructure while Dehradun scores low in the combined index due to poor trade and storage infrastructure despite standing second in the infrastructure support category. A positive and significant association was noticed between the commodity arrivals (potato and tomato) and market infrastructure categories. A panel regression analysis between potato arrivals, price, and market Dummies reveals that price has no time varying effect on the arrival of potato, but showed a significant and positive relationship between the markets and arrival reflecting the dependence of arrivals on market attribute.

The second study has been carried out to examine the market integration of different pulses in different zones of India. The study discusses the applications of time series model to investigate the wholesale and retail price market integration of major pulses in India. The study selected five major pulses (Tur, Gram, Moong, Urad, Masoor) and five major regions namely north zone (NZ), south zone (SZ), east zone (EZ), west zone (WZ) and north east zone (NEZ) in the country based on their volume of production. The results show that there is a strong cointegration among the wholesale as well as retail prices of these major pulses, although the cointegration varies, some pulses have strong cointegration while others have poor. In addition to the horizontal cointegration, the vertical cointegration between the wholesale and retail prices of different pulses are also investigated. Different causal relationships have been found between wholesale and retail prices in these five zones. Applications of vector error correction model (VECM) indicates that all the error correction terms (ECTs) are negative and most of these terms are statistically significant implying that the system once in disequilibrium tries to come back to the equilibrium situation. The study further uses Impulse response analysis which shows that change in wholesale prices of these five pulses in one zone will cause change in wholesale prices in other zones. It is concluded that price signals are transmitted across regions indicating that price changes in one zone are consistently related to price changes in other zones and are able to influence the prices in other zones. However, the direction and intensity of price changes may be affected by the dynamic linkages between the demand and supply of pulses.

The third study was carried out on monthly wholesale price of onion data series obtained from AGMARKNET website from January, 2005 to February, 2016 considering six markets, namely, Delhi, Bangalore, Hubli, Lasalgaon, Pune and Solapur. Here last 12 observations i.e. from March, 2015 to February, 2016 constitute the validation set in each case. Here two wavelet based neural network approaches have been applied. The improvement upon time-delay neural network (TDNN) also is obtained up to a great extent through using wavelet based approaches as exhibited through proper empirical evidence.

The results of these studies establishes the potential performance of wavelet based combinatory model as a proficient alternative to the traditional statistical approaches. Wavelet-GARCH model offers a unique strategy for volatility forecasting through transformation and representation of original series at various scales. Decomposition makes it possible to describe the useful pattern of the series from both global and local aspects and subsequently minimizes the signal noise level making the transformed series amenable to easy analysis and evaluation. The combinatory of Wavelet-GARCH hybrid model has been found to outperform the individual ARIMA and GARCH model. The R software package has been used for data analysis.

Network Project on Impact Assessment of Agricultural Research and Development

Impact assessment of crop insurance has been estimated in Andhra Pradesh & Telangana States. The analysis shows that at all India level only 4% of total farm households have insured their crop but in the selected states the percentage of crop insured farming households is 16.74%. Majority of insured farming households (98%) availing crop insurance were among the borrowers. Majority (55.2%) of farmers mentioned lack of awareness as the major reason for not availing insurance. The average frequency of crop loss was observed to be 67.1 percent and the claimes received are about only 1.5 percent. The majority 68.7 % of the farmer responds that the major reason for the crop loss found to be

inadequate rainfall/drought followed by other natural cause. The output is measured in terms of rupees per hectare. The difference in socio-economic variables like household size, education and age of the household head is not much different between the two groups. The number of female respondents was only 7.15% and 92.85% respondents were males. Out of the total insured farmers only 9.23% females insured their crop. The descriptive analysis showed that 31.15% of the Insured farmers reported that they have attended at least one extension training programme whereas only 2.55% of the non-insured farmers reported that they had attended one extension training programme. About 71.23% of non-insured farming household heads had no education (illiterate) at all and only 7.35% attended primary school where as 56.92% of insured farming household heads had no education (illiterate). Overall, non-insured sampled household farmers had a lower education attendance rate compared with insured farmers.

Propensity Score Matching (PSM) method and Instrumental Variable (IV) method has been employed to estimate the Impact of crop insurance on farm output. Both the method shows that crop insurance has a positive and significant effect on farm output. The results from PSM shows that average effect of crop insurance on farm income in NNM, RM(0.01), RM(0.001) and KM is 0.1564, 0.1679, 0.1133 and 0.097 respectively. So the real income on an average would be 13 percent higher because of the participation in the crop insurance. The results from IV method show that crop insurance has a positive impact on farm income.

Total factor productivity has been estimated at district level of five agro climatic regions in India. This study is limited to the models that take district level heterogeneity into account to the extent that district level production is characterized by heterogeneous production conditions. The sources of total factor productivity growth are decomposed into technical progress, the changes in technical efficiency and the scale effects by using the estimated parameters including labour, annual rainfall, irrigated area, total cropped area, animal power, fertilizer, tractor etc.

Development of methodology for nonparametric modelling of time-series data and its application in Agriculture.

Performance of various procedures of estimating optimal unobserved bandwidth has been studied for modeling food grain production time-series data. Epanechnikov kernel is best in case of kernel smoothing approach of modeling compound growth rate and actual food grain production. In this case, cross-validated bandwidth outperforms initial bandwidth in terms of mean square error. In case of local linear smoothing approach of modeling compound growth rate, both Epanechnikov kernel of order 1 and Gaussian kernel perform satisfactorily. In this case, optimal plug-in bandwidth performs better than cross-validated bandwidth. But, it is alarming to note that in case of modeling actual foodgrain production using local linear smoothing approach, optimal bandwidth does not perform better than cross-validated bandwidth. This has been studied by computing efficiencies of various estimated bandwidth. Computer program has been written to generate long memory error processes using uncorrelated wavelet transform to simulate time-series data of compound growth rate.

Stochastic differential equation models and their applications to agriculture.

This study is funded by Science and Engineering Research Board, Department of Science and Technology, Government of India.

The data that do exist in studies with missing data or data at unequal time-intervals are potentially informative, and precluding such data from analysis could affect conclusions adversely. It may also be pointed out that errors in relative growth rate are closer to have constant variance than those in growth rates where relative growth rate satisfies the SDE with constant diffusion coefficient. Using calculus, SDE has been solved which is used to obtain optimal forecast of untransformed data along with conditional forecast error variance. The methodology has been applied to pig growth data, collected at the piggery farm of ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly. To test the suitability of Transformed Richards Nonlinear Statistical (TRNS) model, comparative study of "pure error" vis-a-vis "lack of fit" has been be carried out by F-test, which is significant at 5% level of significance, implying thereby that there is a need to employ SDE approach. Finally, the forecast formulae has been used to compute four-step ahead forecast of pig weight. It has been found that the root-mean square value for forecast is smaller in case of Richards SDE compared to TRNS modelling.

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

Improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping

This project was awarded to ICAR-IASRI by Food and Agriculture Organization of the United Nations (FAO) under the "Global Strategy to Improve Agricultural and Rural Statistics" of FAO with an approved budget of US Dollar 4,18,163 (Four lakh eighteen thousand one hundred sixty three). It was initiated on December 18, 2014 and was of one year and six months duration. This project is under Institutional Consultancy mode and ICAR-IASRI was selected for undertaking this study through competitive process of International bidding.

Under this project, sampling methodologies for estimation of crop area and yield under mixed and continuous cropping was developed for different situations prevailing in different countries. Three different approaches namely, (i) Cadastral map based approach, (ii) Area Frame approach and (iii) Household approach have been proposed under this study.

The developed methodology was 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. Primary data collection was completed in one district of Indonesia and Jamaica using Computer Assisted Personal Interviewing (CAPI) and in another district in the three countries using Paper Assisted Personal Interviewing (PAPI) methods.

Keeping in view the administrative delay which delayed the start of data collection work by the 3 countries, FAO proposed to extend the project period by four months. The revised period was included in the revised LoA. The revised LoA was approved by the FAO and after its approval by the Council and signing by the Director, ICAR-IASRI, the project period was extended by four months i.e. up to 17th October 2016.

Technical Report-4 and Technical Report-5 were prepared. Presentations on Technical

Report-4 and Technical Report-5 were made in the Validation Meeting at FAO Headquarter, Rome during September 07-08, 2016. Technical Report-6 i.e. Methodological report was submitted to the FAO after incorporating the comments and has been cleared by the FAO. Editorial comments have also incorporated for its publication by the FAO.

The Technical Report-6 entitled "Methodology for Estimation of Crop Area and Crop Yield under Mixed

Supervision of field work (area enumeration and detailed survey) in Jamaica during June 2016

Supervision of field work (area enumeration and detailed survey) in Rwanda during April 2016.

and Continuous Cropping" has been published by the FAO as Technical Report of the Global Office. Technical Report-7 was prepared in the form of a Chapter of a Hand Book to be published by the FAO. The Technical Report-7 was submitted to the FAO before date of completion of the project.

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

This project is funded by Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW), Ministry of Agriculture and Farmers Welfare (MoA&FW), Govt. of India with an approved budget of Rs. 5.4938 Crore (Five crore forty nine lakh thirty eight thousand). The project is approved under Coordinated Programme on Horticulture Assessment and Management using Geoinformatics (CHAMAN) Project of DAC under Mission for Integrated Development of Horticulture (MIDH) and is of two years and nine months duration. The ICAR-IASRI has been declared as National Level Agency (NLA) under MIDH for taking up this study.

Under this project, testing and validation of methodology for estimation of area and production of horticultural crops developed by ICAR-IASRI is being carried out in four states of the country namely, Tamil Nadu, Andhra Pradesh, Maharashtra and Himachal Pradesh. The proposed sampling design adopted for the survey is stratified multistage random sampling.

Primary data collection is in progress in Andhra Pradesh, Maharashtra and Tamil Nadu and Himachal Pradesh states. Guidance is being provided to the Field Investigators (FIs) in field data collection as and when required in all the four states. Phase-I of data collection work i.e. complete enumeration of selected villages was completed in all the four states. Phase-II of data collection work i.e. detailed survey for yield data collection is at final stage in Maharashtra and Himachal Pradesh and is in progress in Andhra Pradesh and Tamil Nadu and will continue till June 2017.

Supervision of field work (area enumeration and detailed survey) was carried out in all the four states at regular interval. Progress of the field work was reviewed, filled-in schedules were scrutinized and field visits were made to monitor the field work in Himachal Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu states. The ICAR-IASRI Scientists, Field Officer and Technical officers carried out supervision of data collection in all the selected districts in all the four states.

Development of data entry software has been completed and data analysis software is at final stage. Training for entering the data using the developed data entry software was imparted to

Review Meeting for area enumeration and detailed survey and Data entry software for primary data collection & CAPI (data collection using tablets) training in Maharashtra, Tamil Nadu, Andhra Pradesh and Himachal Pradesh districts during Nov 2016 to Jan 2017.

Supervision of field work (area enumeration and detailed survey) by ICAR-IASRI officials in Maharashtra, Tamil Nadu, Andhra Pradesh and Himachal Pradesh districts during August and September 2016
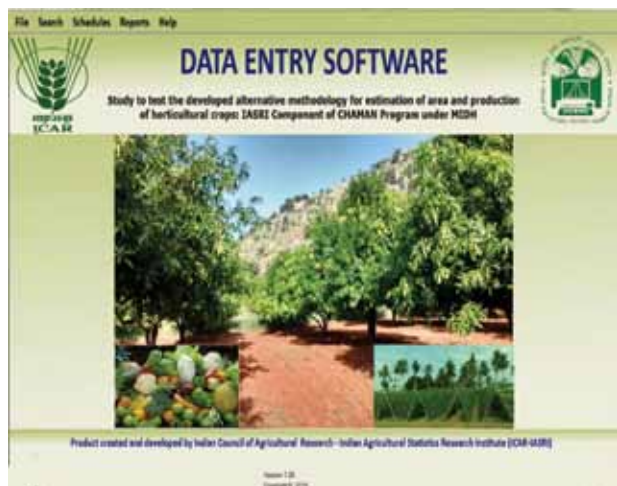
Data Entry Software for Primary Data Collection developed by ICAR-IASRI

all the four states under study. Data entry is in in progress. The schedules developed for primary data collection have been designed using CAPI (Computer Assisted Personal Interviewing) designer. Testing of these schedules was carried out. Training on (i) Data collection using tablets (CAPI) and (ii) Filling up of schedule for area enumeration (in 10 villages of an identified district in each of the four states) was imparted in all the four states.

The progress of the project was reviewed by Union Minister for Agriculture and Farmers Welfare and the desired that the methodology being tested and validated under CHAMAN project may be implemented at national level.

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 Ministry of Agriculture,

Government of India with the total sanctioned budget of Rs. 9.29 crores out of which an amount of Rs. 5.57 crores has been released as first installment. A pilot sample survey was organized in five States namely Assam, Gujarat, Karnataka, Orissa, and Uttar Pradesh. The data collection work for the state of Assam, Odisha, Uttar Pradesh and Karnataka was completed for AY 2015-16 and the data entry work in these 4 states is going on and the implementation of the MAPI (Mobile Assisted Personal Interview) software for the data collection work in the state of Uttar Pradesh has been completed. The data collection work in the state of Gujarat has started in the agriculture year 2016-17. MAPI software was successfully implemented in the state of Gujarat in one complete district. Partial data was received from three states namely Uttar Pradesh, Assam and Karnataka. The estimation procedure has been finalized. All the data received is under scrutiny and after cleaning, data analysis work will be initiated.

Calibration Estimators under Two Stage Sampling Design when Study Variable is Inversely Related to Auxiliary Variable

As per availability of complex auxiliary information under two stage sampling design the following three cases were considered: Case A- Population level complete auxiliary information is available at the primary stage unit (PSU) level, Case B- Population level complete auxiliary information is available at the SSU level for all the PSUs in the population and Case C- Population level auxiliary information is available only for the selected PSUs. Under the three scenarios in two stage sampling design when the auxiliary variable is inversely related to study variable, three different product type calibration estimators of population total along with their approximate variance and the Yates-Grundy form of estimate of variance have been developed. Usual product estimators for estimation of population total under all cases in two stage sampling design were compared with the proposed product type calibration estimators. On the basis of the correlation coefficient between study and auxiliary variable, criterion of superiority of the proposed calibration based product type estimators with respect to usual product estimators of population total have been obtained.

Two different product type calibration estimators have been developed on the basis of two phase sampling for the situation when there was unavailability of inexpensive auxiliary information under two stage sampling design. Two different cases of unavailability of auxiliary information have been considered, viz.

Case 1. The population level auxiliary information is unavailable at the PSU level. Case 2. The population level complete auxiliary information is unavailable at the SSU level. In addition, the variance and estimate of variance of the product type calibration estimators have been developed considering equal probability without replacement design (SRSWOR) at different stages and phases of sampling.

A simulation study has been carried out, in order to empirically evaluate the statistical performance of proposed product type calibration estimators. In the simulation study, it was observed that, with respect to percent Relative Bias (%RB) the proposed product type calibration estimators of the population total for the situations of availability of auxiliary information at both PSU as well as SSU level were performing better than their usual product and Horvitz-Thompson (HT) estimators under two stage sampling design when available auxiliary variable is inversely related with the study variable. The proposed product type calibration estimator of the population total under Case B was giving consistent least %RB. The product type calibration estimators of the population total developed under all cases of two stage sampling design were always
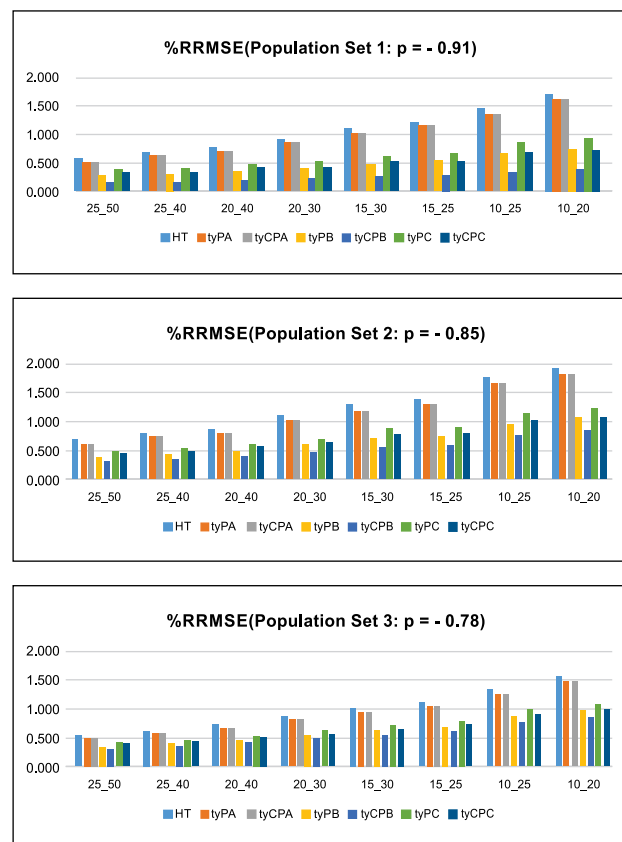
Figure 1: Comparison of all estimators under Case A, B and C w.r.t. %RRMSE of when available auxiliary variable is inversely related with the study variable under three sets of population.

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more efficient than the usual Horvitz-Thompson (HT) estimators and the product estimators as per as percent Relative Root Mean Square Error (%RRMSE) is concerned (Figure 1). The proposed product type calibration estimators of the population total developed under Case B of two stage sampling design was producing least %RRMSE. Further, developed product type calibration estimators of the population total under two phase two stage sampling design were performing better than usual HT and product estimators.

Development of Innovative Approaches for Small Area Estimation of Crop Yield, Socio-economic and Food Insecurity Parameters

The small area estimation under an area (or aggregated) level version of small area model is one of the most popular methods used by private and public agencies because of its flexibility in combining different sources of information and explaining different sources of errors. The area level models are used for small area estimation when covariates are available only at area level. These models relate

Figure. Home page and upload data page.

Figure Display of file.

Figure Download Result Page

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small area direct survey estimates to area-specific covariates, often obtained from various administrative and census records. A web based software for small area estimation under an area level model has been developed. The software is available at: http://sample.iasri.res.in/ssrs/index_sae.jsp. This software provides small area estimates for both sampled as well as non-sampled areas along with standard error and percentage coefficient of variation. The software also provides the user manual to describe the step by step procedure for using this software.

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

This project is funded by Madhya Pradesh State Govt. with an approved budget of Rs. 84,12,077. This is consultancy project under Institutional Project mode. Primary data collection is in progress in the State. Guidance is being provided to the Field Investigators (FIs) in field data collection as and when required by them. Phase-I of data collection work i.e. complete enumeration of selected villages was completed. Phase-II of data collection work i.e. detailed survey for yield data collection is in progress and will continue till June, 2017. Supervision of field work (area enumeration and detailed survey) was carried out in the State at regular interval. Progress of the field work was reviewed, filled-in schedules were scrutinized and field visits were made to monitor the field work. Data entry is in progress.

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

This project is funded by Haryana State Govt. with the total approved budget of Rs. 76, 25,557. Primary data collection is in progress in the State. Guidance is being provided to the Field Investigators (FIs) in field data collection as and when required by them. Phase-I of data collection work i.e. complete enumeration of selected villages was completed. Phase-II of data collection work i.e. detailed survey for yield data collection is in progress and will continue till June, 2017. Supervision of field work (area enumeration and detailed survey) was carried out in the State at regular interval. Progress of the field work was reviewed, filled-in schedules were scrutinized and field visits were made to monitor the field work. Data entry is in progress.

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

The three districts in which the study is going on are North and Middle Andaman, South Andaman and Nicobar. The tehsil and village lists were obtained from two sources. There were lot of discrepancies in the two lists. The final list was prepared and selection of villages was carried out. The sampling design and sample size have been finalized. The designing of schedules for primary data collection is in progress. Data will be collected by ICAR-Central Islands Agricultural Research Institute, Port Blair. In each of the selected villages, complete enumeration will be carried out. It is proposed to select 10 farmers from each of the selected villages for data collection by inquiry and out of 10 farmers, 2 farmers will be selected for data collection by observation.

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

The data on area and production under jute crop for all the 3 states under study, namely, West Bengal, Assam and Bihar was acquired. The CCE data on jute crop variety-wise as well as irrigation status-wise (irrigated/un-irrigated) for all 3 states through funding agency was also acquired from the states. Re-analysis of data following the estimation procedure for estimation of average yield of Jute has been done. Schedules have been designed for primary data collection and are being finalized. Planning and collection of primary data in all the 3 states is in progress.

A study on Calibration Estimators under Adaptive Cluster Sampling

An estimator of population mean under adaptive cluster sampling has been obtained when the final sample consists of k distinct cluster. Development of the approximate variance and the estimate of variance of the proposed calibration estimator is under progress.

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

The All-India Debt and Investment Survey (AIDIS) is one of the important survey conducted by the National Sample Survey Office (NSSO) in India at decennial intervals through household interviews

from a random, nationally representative sample of households. The recent AIDIS survey conducted during January–December 2013 (AIDIS 2013) was aimed at generating average value of assets, average value of outstanding debt per household and incidence of indebtedness, separately for the rural and urban sectors of the country, for States and Union Territories, and for different socio-economic groups. Existing data based on AIDIS 2013 survey provides reliable and representative state and national level estimates but it cannot be used directly to produce reliable estimates at the small area level due to small sample sizes which lead to high levels of sampling variability. Our knowledge and understanding of geospatial inequalities and equity in this regard is severely hampered by the lack of local level statistics in resource poor settings. The lack of robust and reliable outcome measures at the local level also put constraints for designing targeted interventions and policy development. More importantly,

states/national estimates do not adequately capture the extent of geographical inequalities which restricts the scope for evaluating progress locally within and between administrative units. State level and National goals often lead to sub-optimal interventions which are focused on groups or areas that require minimum effort to achieve set thresholds, neglecting critical areas where interventions are most needed and hence increasing inequity. Nonetheless, local goals cannot be set and monitored where baseline information is non-existent as is the case in many low and middle income regions. At the same time it is also true that conducting a new survey aimed at this level is going to be very trivial and costly as well as time consuming job. The reduction in sample size is more alarming when AIDIS 2013 was used for producing estimates at district by household

category wise (e.g. district by cultivator or district by non-cultivator household category). This small sample size problem can be easily resolved using small area estimation (SAE) provided auxiliary information is available to strengthen the already existing limited sample survey data from the district.

SAE techniques were applied to generate reliable disaggregate level estimates and spatial mapping of incidence of indebtedness for agricultural households in the State of Uttar Pradesh was done. The SAE method uses the AIDIS 2013 data which was linked with the Population Census 2011 data to produce reliable estimates of incidence of indebtedness (i.e. proportion of indebted household) at the district (All) and district by social group category (ST, SC, OBC, Others) level for rural areas of State of Uttar Pradesh. In Census 2011, looking at the status of ST population, it appeared that in most of the districts ST population is not prevalent. Therefore, small area estimates are not generated for the ST category. The diagnostic measures used for examining the validity and reliability of the generated small area estimates confirm that generated estimates have reasonably good precision. The results clearly indicate that the district-wise (All) and district by social group category wise (SC, OBC, Others) estimates generated by using SAE method are precise and representative. In contrast, the direct survey estimates are very unstable. In many districts due to small sample sizes, it is not possible to produce reliable and valid estimates using sample data alone. The estimates generated using SAE method are still reliable and reasonable for such areas. These micro estimates as well as spatial maps of incidence of indebtedness are expected to provide invaluable information to policy-analysts and decision-makers for identifying the regions and social groups requiring more attention.

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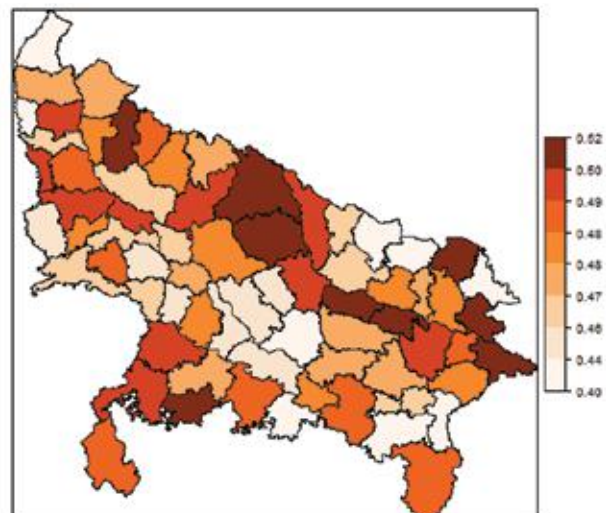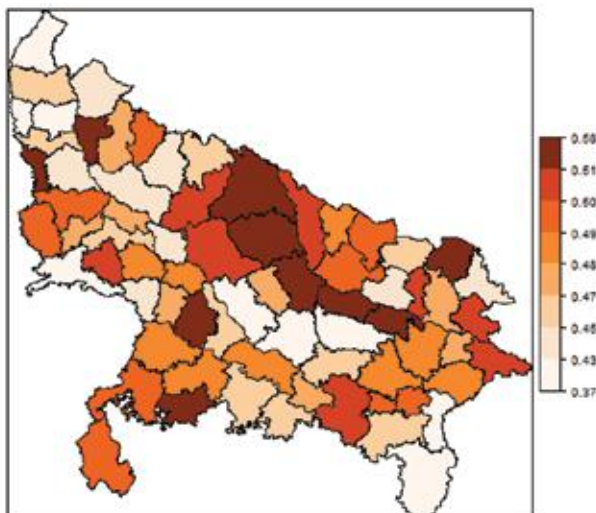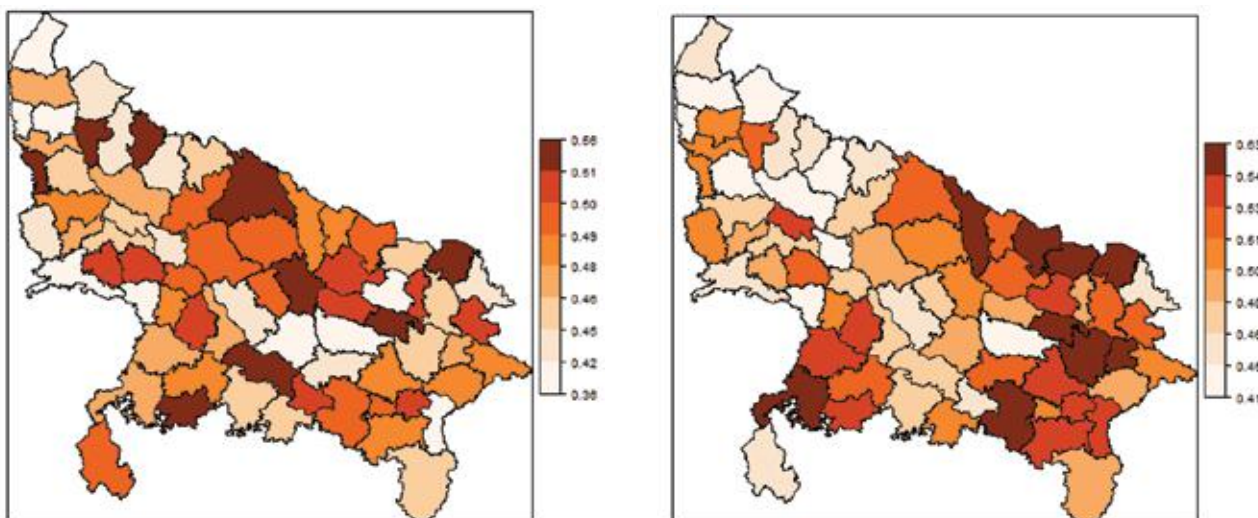
Figure. District and district by social group category wise incidence of indebtedness in agricultural households for the state of Uttar Pradesh, 2012-13.

Programme 4: DEVELOPMENT OF STATISTICAL TECHNIQUES FOR GENETICS/COMPUTATIONAL BIOLOGY AND APPLICATIONS OF BIOINFORMATICS IN AGRICULTURAL RESEARCH

Modeling and construction of transcriptional regulatory networks using time-series gene expression data

Gene Regulatory Networks (GRNs) have become one of the most important approaches for modelling gene-gene relationships in system biology studies. These networks allow us to carry out studies of different biological processes in a visual way. The noise and high dimensionality in the Gene Expression (GE) data have limited the applicability of the certain statistical techniques to model the underlying gene regulatory interactions. In this study some statistical approaches to model and construct the GRNs under sparse biological conditions has been developed. Estimator for obtaining the true GE values of genes from noisy microarray data were obtained using Particle filtering approach under a State Space framework. An approach to model and construction of GRNs under sparsity condition has been developed. For identification of hub genes (highly interacting genes) in the gene network, a resampling based approach, hub gene detection technique, was developed. An R package, DHGA (Differential Hub Gene Analysis) has been developed to identify the hub genes and unique hub genes in the GRNs constructed for a case vs. control study. To identify the informative genes from the big crop GE data, an improved gene selection technique

has been proposed by improving existing SVM-RFE procedure.

Estimation of Breeding Value Using Longitudinal Data

In sheep rearing, there is always a need of selective breeding to improve economically important traits, such as growth rate and wool quality. Sheep producers can only maintain their businesses by rearing lambs that meet market specifications, in terms of carcass weight, fat class and conformation. Allied to this, there is a need to monitor production costs to ensure efficient production of lambs and generation of a positive financial return. In the present commercial environment, the need for selective breeding is as important as ever. Selection of desirable genetics to match with a sheep herder is a challenging task.

In longitudinal study, linear models are used to fit a regression model using phenotypic value (weight) as dependent variable and age as independent variable. This is often a fixed regression, indicating that for each animal, that is certain amount of time younger or older than an average age, there will be a phenotypic correction. This correction, is same for all animals, hence a fixed regression. Random Regression Models (RRM) estimates a different regression coefficient for each animal. Hence, each animal has its own slope (some grow faster than others) and the variance of all parameters can be estimated. In longitudinal study, the within subjects measurements are correlated, accordingly a methodology has been developed using the random regression model for breeding value estimation by taking into account the correlated errors. For estimation purpose in

LMMs, Maximum Likelihood Estimation (MLE) and Restricted Maximum Likelihood Estimation (REML) are generally adopted. It is well known in the LMM literature that variance components based on the MLE are negatively biased. REML was proposed to minimize the bias. The basic idea behind the REML is to remove the fixed-effects parameters before estimating the variance components. REML estimates of variance and covariance components can be obtained by direct maximization of the associated likelihood by taking the first and second derivatives of the likelihood or by using an average information matrix. In this approach we have used the AI-REML for variance component estimation.

Though the estimation procedures are available, it is difficult to implement them. Hence, it is always advantageous to develop a user-friendly Web-Interface to analyze the data of such kind. As the stake holders are plant and animal breeders, a user-friendly Web-Interface has been developed to analyze such type of data for breeding value estimation.

Development of Rank Based Stability Measures for Selecting Genotypes

From the farmers/ growers point of view, selection of genotypes which are stable over the locations/ environments as well as high yielding is more desirable. For this purpose, two simultaneous indices for selection of stable genotypes with better yield have been developed. The first of these indices is as follows: Ii= w1(r) + w2(rRSIi) ; where, r represents the rank of mean yield of ith genotype over the environments and rRSIi represents the rank of the ith genotype based on the developed stability index. The weights (w1 and w2) are decided on the basis of tradeoff between the farmers and breeders choices. For instance, the different combinations of w1 and w2 i.e. (0.5, 0.5), (0.6, 0.4), (0.7, 0.3) and (0.8, 0.2) are taken with due consultations with plant breeders.

Five parametric Stability measures were used to develop composite index by using Multiple Criteria Decision-Making (MCDM) technique. The weights are then incorporated into the TOPSIS MCDM technique to calculate an overall score for each genotype. The TOPSIS technique has been used because of its high speed, accuracy, and compatibility. Finally, two simultaneous selection indices have been developed to select stable genotypes with better performance and Composite stability measure based on existing measures by using Multiple Criteria Decision-Making (MCDM) technique.

Gene selection for classification of crop gene expression data

Recent advances in genomic technologies enable the measurement of the activity levels of several thousands of genes or transcripts in a single experiment. DNA microarrays, with their ability to capture a substantial fraction of a cell state, are one of such powerful tools in genomics. Among these thousands of genes whose expression levels are measured, not all are required for classification, gene regulation modeling, modules detection, etc. The need is to select some genes or set of genes those are highly relevant with particular class, which is called informative genes. Attempts have been made in this study to develop some statistical approaches to select biologically relevant genes from the high dimensional GE data. An improved gene selection technique, Boot-MRMR was developed to select biologically relevant genes by maximizing the relevancy and minimizing redundancy. To validate the chosen genes obtained by using a gene selection technique, a gene set enrichment test with QTLs (GSEQ) has been proposed. To remove the noise from the microarray data, an estimator for obtaining the true GE values based on Wavelets analysis is being developed. Further, a systematic comparative analysis of the developed and 12 existing gene selection methods was performed by using 16 diversified criteria under a Multiple Criteria Decision Making Set up.

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

The True and false splice sites sequence datasets of the six different eukaryotic species viz., Oryza sativa, Bos taurus, Danio rareo, A. thaliana, D. melangster and C. elegans were extracted from the public domain i.e., UCSC genome browser (https://genome.ucsc.edu/). As most of the existing splice site prediction methods are based on the association among positions surrounding the splicing junction, a novel methodology has been developed for finding associations among positions surrounding splicing junctions. The proposed method is more statistically sound as compared to the existing empirical based approaches. The method for finding association is based on the concept of latent normal variate, where the occurrence of nucleotides at each position was described by latent multivariate normal variable. The proposed approach is applied to the cattle dataset, and the heat maps for the obtained association matrices for true and false splice sites are shown in

the figure below. It can be seen that the associations among positions surrounding true splice junctions are captured by the proposed approach, whereas no such associations are found to be present in the
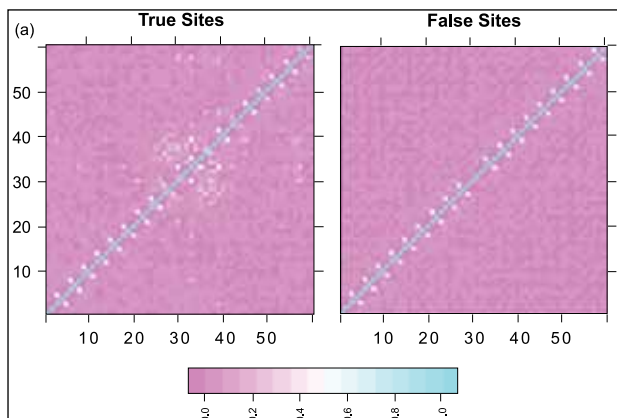
false splice junctions.

RiceMetaSys: Understanding Rice Gene Network for Blast Resistance and Drought Tolerance through System Biology Approach

Quality check followed by preprocessing of the generated raw reads of transcriptome data of eight samples from M. oryzae infected panicles in Tetep and HP2216 has been carried out. The high quality reads of eight samples HP2216 Control, Hp2216 48phi, HP2216 72phi, HP2216 96phi, Tetep Control, Tetep 48phi, Tetep 72phi and Tetep 96phi has been assembled. Differentially expressed genes under rice blast disease have been identified. Database for drought and salt inducible genes in rice has been developed

Computational Identification and Modelling of Genetic Variation in Relation to Performance Traits in Buffaloes

The prediction of SNPs related to miRNAs or their targets has been done. Assembly of ddRAD sequences has been done. Prediction of SNPs related to four important traits in buffalo using ddRAD sequences has been done.

Gene Regulatory Networks Modeling For Heat Stress Responses of Source and Sink for Development of Climate Smart Wheat

Identification of differentially expressed genes between control and heat stress conditions from wheat cv.HD2985 and HD2329 has been carried out. Novel heat stress responsive short sequence repeats (SSRs) has been identified from wheat cv.HD2985 and HD2329. Stress associated genic SNPs are

identified from the sequences of differentially expressed genes. Stress associated proteins in wheat under heat stress has been identified using fourth generation proteomic tool (iTRAQ).

Identification of Genetic Polymorphisms for Pathogenicity in Vibrio sp.

Four hundred eighty seven putative pathogenic genes were obtained from the pathogenicity islands through integrated method by island viewer. Whole genomes of three isolates causing AHPND and four other isolates (including one Indian isolate) were screened for pathogenic genes. Similarity search was done using blastx between pathogenic genes as query and whole genomes of seven isolates as database by setting maximum e-value, 10-5. Blast results were parsed with in-house python scripts to generate qualitative data for the presence or absence of genes in pathogenicity island regions in all the seven isolates.

Bioinformatics Analysis of Sequence Data of Brinjal and Bitter Gourd for Identification of Functional and Regulatory Genes for Traits of Economic Importance

Classification and comparative sequence analysis of stress tolerance genes of Viridiplantae was done. Besides, analysis of sequence data of bitter gourd for identification of genes and their regulatory apparatus involved in biotic stress and pharmaceutical traits was performed. Novel functional and regulatory genes involved in stress tolerance and pharmaceutical traits were also mined. Analysis of sequence data of brinjal for identification of stress tolerance genes and their regulatory apparatus was also done.

Computational approach for harnessing genome information and its integration with wheat phenome for efficient varietal development.

The 35K data of 375 genotype representing corset of Indian wheat were subjected to structure analysis using the STRUCTURE tool version 2.3.4 to determine the population structure among the varieties. The data consists of SNPs of 375 varieties and 35K locus. The structure was run using the modified version of structure called parastructure available at github which consists of a modified perl script which can distribute the jobs across multiple nodes on a server. Using this modified pipeline each run of K (the number of populations) is executed separately on each CPU of the cluster trough queue system based on PBS. The structure tool was run

using the above mentioned perl script with 100000 MCMC runs and 100000 BURNIN time. The results of the structure tool were then used to determine the exact K which divides the population of the entire dataset into 3 distinct populations. This tool gave the K value of 3 which divides the 375 varieties into 3 distinct populations.

The genotypes got classified into three clear cut groups. The first group representing tetraploids (durum and dicoccums), the second major group encompassing post green revolution (semi-dwarf) wheat genotypes and the third group predominantly representing traditionally tall Indian native germplasm (local land races, indigenous collections etc.). The profile generated is being subjected to studies towards developing signature profiles.

Transcriptome from root tissues of two contrasting genotypes of wheat, i.e., NI5439 (drought tolerant) and WL711 (drought sensitive) collected at booting

Figure 1: Bar plot of the 375 varieties produced by structure tool at K=3.
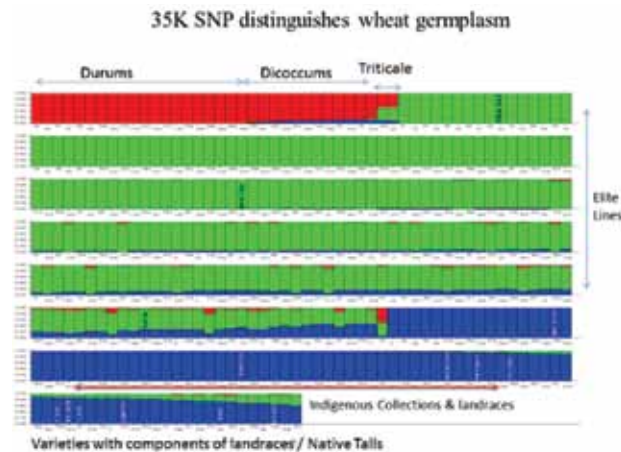
S.N.	Sample name	Total input reads	Both surviving	Forward only surviving	Reverse only surviving	Dropped
1.	PSTNWR-1 Genotype: NI5439 Control	39647672	34536938 (87.11%)	4526892 (11.42%)	311268 (0.79%)	272574 (0.69%)
2.	PSTDSWR-2 Genotype: NI5439 Stress	39895553	34125931 (85.54%)	5144784 (12.90%)	304747 (0.76%)	320091 (0.80%)
3.	PSTNWR-3 Genotype: WL711 Control	46124178	40482741 (87.77%)	5110202 (11.08%)	283280 (0.61%)	247955 (0.54%)
4.	PSTNWR-4 Genotype: WL711 Stress	37378332	32806787 (87.77%)	4099023 (10.97%)	239181 (0.64%)	233341 (0.62%)

stage was taken under study. For sequencing, Illumina platform was used. A total of approximately 40 GB (bases) data was generated. Pre-processing of wheat raw reads was performed using Trimmomatics and FASTQC tool.

De novo transcriptome assembly was done using trinity assembler. Then cap3 assembler was run on *trinity* assembly results and redundant sequences were removed. A total of 631309 transcripts and 446649 genes were achieved. The GC% was found to be 49.42 and N50 was 851. After removal of redundant sequences using cap3 assembler, a total of 365752 final sequences with improved N50 value of 1092 bp and GC content 49.46% was used for further analysis. Differentially expressed genes in following combinations were explored using RSEM and edgeR.

Venn diagram was made of all the four sets of

differential expressed genes and 1052 genes were found common in all the stages. While 11061, 2880,

Table: Stage wise listing of upregulated and downregulated differential expressed genes in four stages viz. control-1-tolerant vs. stress-2-tolerant, stress-4- sensitive vs. stress-2- tolerant, control-3-sensitive vs. stress-4-sensitive and control-3-sensitive vs. control-1-tolerant.

Data set	Upregu-lated	Downregu-lated	Total
control-1-tolerant vs. stress-2-tolerant	33021	18254	51275
stress-2-tolerant vs. stress-4_sensitive	11915	7183	19098
control-3-sensitive vs. stress-4-sensitive	11454	21018	32472
control-1-tolerant vs. control-3-sensitive	10019	29154	39173

8650, 7049 DEGs were unique in control 1 tolerant vs. stress 2 tolerant, stress 4 sensitive vs. stress 2 tolerant, control 3 sensitive vs. stress 4 sensitive and control 3 sensitive vs. control 1 tolerant respectively.
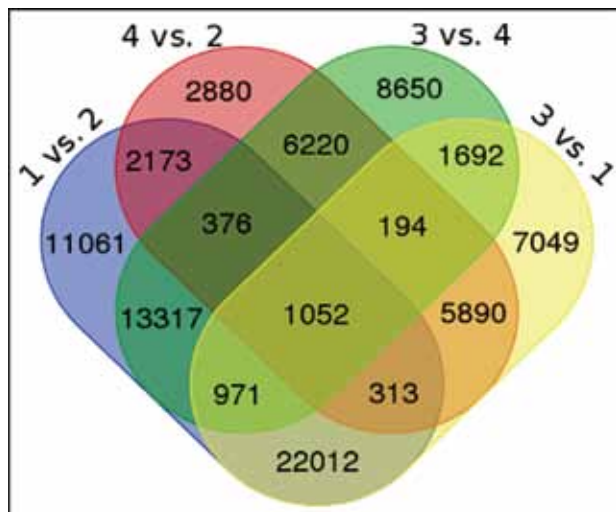
Figure: Venn diagram of differential expressed genes. Code 1 vs. 2, 4 vs. 2, 3 vs. 4 and 3 vs. 1 represents the control-1-tolerant vs. stress-2-tolerant, stress-4- sensitive vs. stress-2- tolerant, control-3-sensitive vs. stress-4-sensitive and control-3-sensitive vs. control-1-tolerant.

Molecular and computational approach to delineate metabolic pathways for better carbohydrate utilization in Labeo spp.

Data points for transcriptome were based on four iso-nitrogenous (CP-20) feed type and five tissues. In feed type, they were with 20%, 40% and 60% carbohydrate level with two group*viz*. with starch and with glucose. The tissues covered were *viz.*, brain, liver, intestine, kidney and muscles in both species of Rohu fish *Labeobata*and *L. rohita*.

Quality check and pre-processing were done for all 40 sets of transcriptomic data. Approximate 230 GB and 208 GB of *Labeobata* and *Labeorohita*, respectively paired end data was used for *de novo* assembly. *De novo* assembly was performed by using three assemblers such as Trinity, CD-hit and cap3.

Assembly Statistics

Statistics	*Labeobata*	*Labeorohita.*
Total contigs generated	332641	359317
N50	1447bp	1323
GC%	41.8	41.3
Minimum length	300	300
Maximum length	40143	27164

Within species comparison: Bioconductor package EdgeR was used to identify the differentially expressed gene (DEGs).

Differential expressed genes for *Labeobata* in Brain

Stage	Total DEG's	Up-regulated	Down-regulated
b20*-b40	6486	3575	2911
b20*-b60A	8095	4188	3907
b20*-b60B	6200	3537	2663
b40*-b60A	7230	3615	3615
b40*-b60B	7621	3921	3700
b60A*-b60B	7703	4344	3359

Differential expressed genes for Labeorohita in Brain

Stage	Total DEG's	Up-regulated	Downregulated
b20*-b40	3319	2044	1275
b20*-b60A	2865	1477	1388
b20*-b60B	2451	1056	1396
b40*-b60A	2456	1267	1189
b40*-b60B	2945	1045	1900
b60A*-b60B	2757	1527	1230

Genomic data analysis for identification of economically important markers and viral diagnostics in pulses

For computational identification of signature regions of viruses needed for early and rapid diagnosis, whole genome sequencing of viruses were done. Since legume has both DNA and RNA viruses, thus two different strategy were followed.

Crinkle disease In blackgram/urdbean (Vigna mungo) is caused by urdbean leaf crinkle virus (ULCV), which is RNA virus. RNAseq data was generated by extracting RNA from field infected, sap inoculated and healthy samples for sequencing. In order to deduce viral RNAseq and plant RNA seq, deduction was done by assembly and mapping with control having no virus. 1161 and 1865 contigs were obtained from sap inoculated and field infected sample, respectively. Cap3 was used to assemble the small contigs into complete sequence. Genome Annotation Transfer Utility (GATU) was used for annotation of viral genomes by using a closely related genome as a reference. BLAST analysis revealed that most of the sequences were obtained from Retrovirus-related Pol poly from transposon followed by Cowpea mild mottle virus (CpMMV), Tobamovirus multiplication, Mungbean yellow mosaic India virus (MYMIV) and Peanut bud necrosis virus

(PBNV). Three viruses (CpMMV, MYMIV and PBNV) have already been reported infecting many legume crops including urdbean, however, the sequences of retrovirus-related Pol poly transposon and Tobamovirus multiplication are being reported for the first time.

For DNA viruses or geminivirome study of legume crop, five crops viz chickpea (Cicer arietinum), lentil (Lens culinaris), French bean (Phaseolus vulgaris), Pigeonpea (Cajanus cajun) and Dolichos (Lablab purpureus) were selected. A total of 83 samples of different crops viz., chickpea (n=15), lentil (n=12), French bean (n=15), Pigeon pea (n=9) and dolichos (n=12) showing viral symptoms were collected from fields. After total DNA extraction, viral DNA was enriched by rolling circle amplification (RCA). RCA products for the presence of geminivirome were screened by restriction digestion. The products of the samples gave ~2.7kb and/or 1.2-1.4 kb DNA or multiple fragments totalling of 5.4-6.6kb fragments were further purified and pooled crop wise. Total of 18 library were prepared and subjected to illumina-next generation sequencing (NGS). Assembly was done using CLC genomics workbench ver 9.0. BLAST analysis revealed the presence of Mungbean yellow mosaic India virus, Tobacco curly shoot virus, Indian cassava mosaic virus and Ageratum yellow vein virus in chickpea. In lentil sample, presence of Mungbean yellow mosaic India virus, Tobacco curly shoot virus, Mungbean yellow mosaic India virus, Ageratum yellow vein virus, Cotton leaf curl virus, Tobacco leaf curl Yunnan virus were found. All these viruses have been reported to infect large number of crops, however, it is interesting that these viruses are being reported to be found associated with chickpea and lentil for the first time.

Mining and validation of candidate gene markers and screening on antimicrobial peptides of black pepper and small cardamom

For computational prediction of AMP from Black

pepper, transcriptomic approach was followed. In response to biotic stress by Trichoderma challenge, RNAseq data was generated using Illumina chemistry. After QC and pre-processing, tool trinity was used for de novo assembly to generate the transcripts.

Functional annotation was done by BLAST2GO Pro Version 4.0. All transcripts that were longer than 200 bp were aligned to three public databases (NR, Swiss-Prot and KEGG).The search for potential AMPs was performed by 6-reading frame translation of the transcripts along with cysteine motifs of AMP families. Filtering was done by (1) One ORF from six frame, (2) methionine at the beginning of peptide (3) signal peptide checked by SignalP program and (4) length ≤150 amino. Everything was done by in house script.

Similarity search using BLAST, conducted with 273 AMP sequences in the AMP data base, revealed 273 AMP sequences similar in P. colubrinum and 111 sequences similar in P. nigrum the transcriptome. Motif search for identification of cysteine rich AMPs was done. Secondary structures of these peptides were also predicted.

Transcriptome of leaf tissues associated with biotic stress, i.e., mosaic disease caused by Cardamom mosaic virus (CdMV) was generated using Illumina HiSeq™ 2000 platform as per the manufacturer's instructions (Illumina, San Diego, CA). The paired end transcriptome data was analysed for quality using FastQC tool and bad quality reads were trimmed using Trimmomatic tool. These filtered reads of control and infected data were further pooled followed by de novo assembly using trinity assembler. The resultant assembly was used for abundance estimation and analysis of differential expressed genes using RNA-Seq by Expectation-Maximization (RSEM) and edgeR of Bioconductor at stringent parameters of fold change value four and FDR <0.05.

Total trinity transcripts	166301
Percent GC	40.08
Contig N50	1997
Median contig length	559
Average contig	1073.56
Total assembled bases	178533626

A total of 5106 genes were found significant to be expressed differentially. Out of these, 3054 genes were unregulated and 2052 genes down regulated in infected sample. Figures show the graphical

representation of up and down-regulation of genes in the form of heat map along with the MA plot and volcano plot.
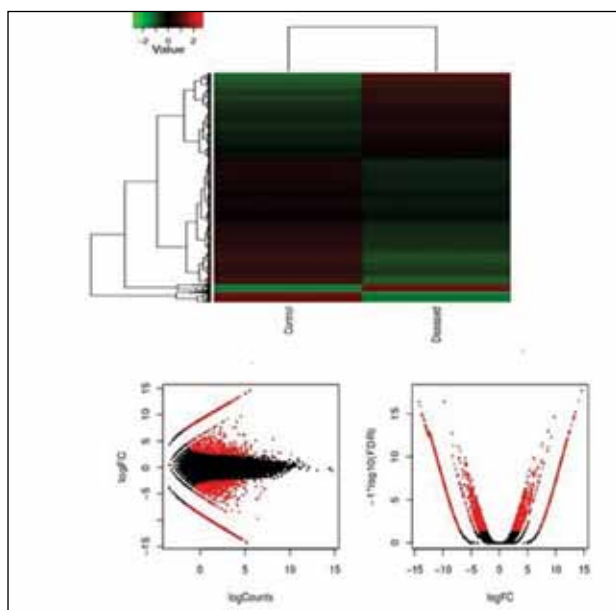
Figure: Heat map, MA plot and Volcano plot showing the differential expression of genes

Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids

This is collaborative study with IARI, New Delhi. A set of 15 drought-responsive transcription-factor (TF) families encoded by a total of 1436 genes was structurally and functionally analysed which revealed that maximum number of genes was on chromosome 1 whereas few chromosomes were completely devoid of the genes for specific TF families. Most proteins of the TF families showed negative GRAVY (grand average of hydropathy) values – the proteins were predominantly soluble or non-polar and 49.3% were confined only to the periplasm. The major drought-related functions of the identified genes were ABA signalling, ROS scavenging, photosynthesis, and stomatal development. Phylogenetic analysis grouped the TF family of genes into TF-specific and mixed groups; in the latter, the genes were present with their homologs outside the TF-specific clusters. Duplication events in the genome revealed 295 genes to be with tandem duplication, 688 genes with block duplications, and 981 paralogs. Promoter analysis confirmed a number of drought-response-related cis-regulatory elements in their promoters. The nucleotide and protein motif pattern showed that each motif was highly family specific. The structural

pattern of the important TF families revealed by the study will be useful in understanding the functional relationships among the genes. An association mapping panel has been developed and maintained for validating drought genes. Genome-wide SNPs from the HKI1105 was identified by whole genome re-sequencing approach. Transcription factors from a drought tolerant genotype HKI1105 was identified by whole genome RNA-Seq approach.

Development of Database on SNPs Associated with Economically Important Traits in Indian Goats

This is a collaborative study with CIRG, Makhdoom. A total of 300 Jamunapari and Barbari goats were selected based on the production and reproduction records for polymorphism analysis. Data was collected for various traits like, Growth Production: Weight at birth, 3 month, 6 month, 9 month and 12 month, Reproduction: data on the parity of the doe, number of kiddings, type of kidding from Barbari and Jamunapari goats. Blood samples were collected from the identified goats. Trait responsive probable genes' sequences were generated and compared with that of sequences from cattle, buffalo and sheep by nucleotide sequence alignment. SNPs were identified and an information management system has been developed.

Development of database repertoire for Clostridium perfringens strains prevalent in causing Enterotoxaemia in goats

This is a collaborative study with CIRG, Makhdoom. Experimental Enterotoxaemia was simulated in 1-3 month kids and adult goats. By such experimental ET infection, similar lesions were observed as in clinical ET, based on gross lesions and histopathological changes. Indirect hemagglutination inhibition test was also developed to detect epsilon toxin in intestinal contents of animals succumbed to ET. Preliminary screening of toxinotypes involved in goats was also carried out. Mutations in cpa gene of goat isolates were found, whereas cpa gene of Sheep C.perfringens type D was conserved compared to reference strains. G7F strain showed mutation in CDS of Cpa gene at 4 positions, and 11015 at 7 positions, while Sheep strain 11815 was conserved. Based on sequence analysis, CIRG strain type D 11015 showed valine→Leucine mutation in the epsilon toxin gene. Gene expression in various treatments of experimental ET infection has been carried out for the genes viz., IL1β, IFNγ, IFNβ, and TGFβ.

Metagenomic Applications and Transcriptome Profiling for Inland Aquatic Environmental Health Surveillance

The present study has been taken up with CIFRI, Barrackpore. Under the study, sediment samples were collected from nine sites of polluted and non-polluted stretches of river Ganga and Yamuna. A total of 84 GB metagenomic sequence data has been generated from these sediment samples. The biodiversity of bacteriophages and taxonomical diversity of viruses and bacteria were assessed from the metagenomic sequence data of the sediment samples. The sediments of polluted stretch of river Ganga had significantly higher proportion of Microviridae phage family, ssDNA viruses, and Mimiviridae virus family compared to the sediment samples of the non-polluted stretches of river Ganga near Farakka. A significantly higher percentage of Myoviridae, unclassified phage family and Retroviridae virus family were found in sediment samples taken from Farakka as compared to Kanpur. Also, the diversity in phages in the sediments of polluted stretches of river Ganga and their relationship with microbial host were discovered. Here, the taxonomic diversity, species of different bacteriophages in pathogenic host systems were explored using metagenomic approaches to provide the insight into these small virus particles in inland aquatic ecosystem.

In silico analysis of data for identification of functional alleles for stress tolerance and quality traits using Bioinformatics in potato

Under this inter-institutional study with CPRI, Shimla, the assembly and annotation of PVA, PVY, PVX and Potato Aucuba Mosaic viruses was performed and two important genes capsid genes and replicase genes were identified and their diversity analysis was also done. Genome data on Streptomyces strain 64 was analysed. A total of 21,976 genes were identified and functional annotation of 6500 sequences present in Streptomyces scabies was done. KEGG pathways analysis was also done. Assembly and functional annotation of whole genome sequence data of Phytophothora infestans 1a haplotype was done. KEGG Pathway analysis and Interproscan also done. Raw data on Fusarium sambucinum and Rhizactonia solani was received from Crop Improvement Division. Assembly and functional annotation was done. Homology Modeling and docking studies with different sugar moieties was done for three SWEET genes. Transcriptomics data on drought stress from kufri Badshah was collected on root and leaf and submitted to IASRI for analysis. NUE data is ready for analysis. Whole transcriptomics RNA sequencing nearly 150 GB is generated. Data will soon be sent to IASRI. Di –haploid potato C-13 data is generated and data sent to IASRI for further analysis. Data on Aphid Aulacorthum solani was generated de novo assembly is completed and annotation is remaining. Data was submitted to IASRI for analysis.

Whole genome sequencing and development of allied genomics resources in two commercially important fish-Labeo rohita and Clarias batrachus

This project is funded by DBT, New Delhi. Three sets of assemblies were carried out using MaSurca assembler: 1) Assembly without Scaffolding and gap closing, 2) Assembly with Scaffolding and gap closing, 3) Assembly: scaffolding with BAC end. The best assembly was observed with scaffolding with BAC end Summary statistic is depicted in Table. Further, refinement of the assembly is under progress

Table: Assembly statistics of C. batrachus data using MaSurca

Parameters	Without Scaffolding and gap closing	Scaffolding and Gap closing	Scaffolding with BAC end
Scaffolds generated	1,82,594	1,64,087	1,63,643
Maximum scaffold length	37,36,085	39,39,243	52,16,833
Minimum scaffold length	500	405	405
Average scaffold length	41,371.7	60,169.5	64,022
Total scaffolds length	1,06,32,04,338	1,09,65,41,240	1,09,65,41,684
% of Non ATGC	13.184	6.363	6.364
Scaffolds ≥500 bp	1,82,594	1,64,085	1,63,641
Scaffolds ≥1 Kbp	49,323	35,689	35,313
Scaffolds ≥10 Kbp	16,136	8,318	8,001
Scaffolds ≥1 Mbp	75	136	139
N50 value (base)	67,197	2,38,923	2,74,198
Genome coverage (mb) 0.95±0.08 pg (929.1Mb)	1,063	1,096	1,096

Assembly statistics of *C. batrachus* scaffolds >1 Kb & 10 Kb Gene prediction of the assembled contigs was carried out using Augustus gene prediction software (version 3.1). The total number of predicted genes was found to be 73,837.

Parameters	>1 KB	>10 KB
Scaffolds generated	35,313	8,001
Maximum scaffold length	52,16,833	52,16,833
Minimum scaffold length	1,000	10,001
Average scaffold length	1,35,582	2,65,649.2
Total scaffold length	1,01,03,09,606	95,19,24,381
% of Non ATGC	6.906	6.675
Scaffolds ≥ 10 Kbp	8,001	8,001
Scaffolds ≥ 1 Mbp	139	139
N50 value	3,32,510	3,64,495
Genome coverage (Mb) 0.95±0.08 (929.1Mb)	1,010(94% Approx.)	951(89% Approx.)

The predicted genes were further annotated using Blast2GO. A total of 44,505 putative genes were annotated at an identity greater than 50%. Gene ontology analysis of the annotated genes was done in order to infer its functional aspects. Most of the predicted genes were found to be involved in cellular processes, metabolic processes, biological regulation, developmental processes, growth, and many more diverse processes.

An attempt was made to get insight into the genes involved in sex determination. DMRT gene was found to have good identity and high query coverage. From our data, we could infer only four DMRT genes viz. DMRT1, DMRT2, DMRT3 and DMRT5. In order to characterize and validate the DMRT genes, primers were designed using primer 3 software. The wet lab validation of the DMRT genes is under progress. The functional annotation summary of entire putative genes of magur genome in terms of gene ontology is depicted in figure below.
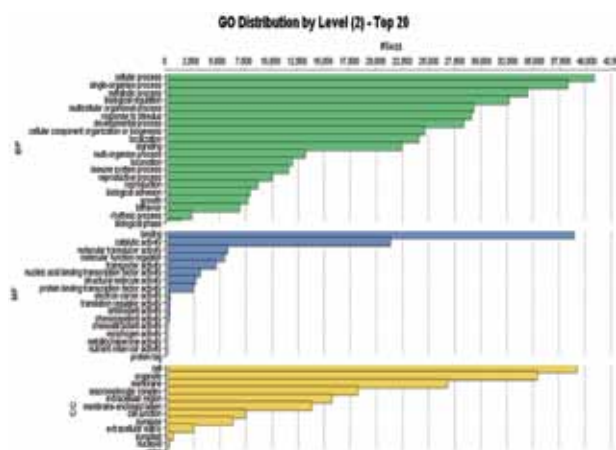
Fig. Top hits of gene ontology distribution

Primers were synthesized for a total of 30 SSRs and checked for polymorphism in wet lab. PCR amplification was carried out for all 30 loci, but only 14 loci showed amplification. These 14 amplified loci were further tested for polymorphism, of which nine were monomorphic and five were polymorphic as shown in table. For polymorphic loci, the number of alleles observed ranged from three to five with observed heterozygosity ranged from 0.038 to 0.526 and the expected heterozygosity ranged from 0.434 to 0.784.

Primer sequence, repeat type, annealing temperature of amplified microsatellite loci

Locus	Primer sequence (5'–3')	Repeat sequence	Annealing temperature
CB02	F: GCCATTCTCCGCTTAGTCAA R: TTCTCCAAACATCTACTGATCTGA	(ATT)5	59
CB03	F: CATGCAGAACTTGTGACAGTGA R: TGCGATTCTGGGTTAGCTCT	(TTA)5	59
CB05	F: GAGAGCCAGAGCGAGAGAAA R: GACGACCTGATACTGGCACA	(CAT)5	58.5
CB06	F: CTCTGTCCAGCTCTTCCACC R: ATGGACAAACCCTCCAACTG	(ATG)5	58.5
CB08	F: TCACTGTTCTCATGGCTCAGA R: CGCACGGACACACATTTTAT	(GTGC)5	59
CB13	F: ATAATCATGCAGGTGGCACA R: CTGCGGACACATTAGCACAA	(ATT)6	57
CB14	F: TCCCAGTTTGACTTGAACACC R: GAGCCGCATGTTATAGCTCC	(ATA)6	59
CB16	F: CAAACAGTCCGATCATTCCC R: ACGGACACAATGTTCACGTC	(TCCA)5	58
CB17	F: GCTTGCTTTTCCTTCACCAG R: ATGTGTCGCTTGTCGTTCAG	(TTTA)5	58
CB21	F: CAAGTCCTACCTGGCTGCTC R: AATGGCTCATTGTGTGAACG	(AAAT)6	58
CB22	F: GAGGTAGGACGGCAAGTTCA R: CGGTTCCTTTCATTGCAGTT	(ATT)5	58
CB23	F: GGTTTGGATGCATCTTGGAT R: GGACTTGGCAATGACCATCT	(TTA)5	59
CB25	F: GTGTCATTAGGGTTGCCAGG R: TTGCACAGAGGCAAGTGAAG	(TCAT)5	57
CB30	F: ATTTTGCCAGCCATTGAAAG R: TGCACCTCTAGGCAGACCTT	(AAT)6	57

Assembled scaffolds were used for repeat masking using homology and *de novo* method. For homology based method, current release of *D. rerio*RepBase database was used as repeat library in RepeatMasker and for *de novo* method repeat library was constructed using RepeatModeler and repeats were masked using this library using RepeatMasker. On totalling both de novo and homology based methods, 36.48 % of genome of Magur contained repeat sequences.

Table: Repeat sequence content in and *C. batrachus*

Repeat element	C. batrachus		
	No. of elements	Length occupied (bp)	% of sequence
SINEs	79155	10172283	1.34
LINEs	120546	27558167	3.64
LTR elements	103982	29074733	3.84
DNA elements	505873	95424882	12.61
Unclassified	596240	80232145	10.60
Small RNA	385	72498	0.01
Satellites	5638	1555931	0.21
Simple repeats	572488	23456970	3.10
Low complexity	50542	2654874	0.35

Assembled scaffolds were used for repeat masking using homology and de novo method. For homology based method, current release of D. rerio RepBase database was used as repeat library in RepeatMasker and for de novo method repeat library was constructed using RepeatModeler and repeats were masked using this library using RepeatMasker. On totaling both de novo and homology based methods, 41.62 % genome of Rohu contained repeat sequences.

Identification of repeats is a crucial step in genome annotation, we also compared repeats in these two genome with other teleost genomes like *D. rerio* (59.78%), *C. caprio* (Common carp) (37%), *C. idellus* (Grass Carp) (38%).

Table: Repeat sequence content in *L. rohita* and *C. batrachus*

Repeat element	L. rohita			C. batrachus		
	No. of elements	Length occupied (bp)	% of sequence	No. of elements	Length occupied (bp)	% of sequence
SINEs	19065	2804621	0.33	79155	10172283	1.34
LINEs	32341	6958808	0.82	120546	27558167	3.64
LTR elements	42582	14340072	1.69	103982	29074733	3.84
DNA elements	830909	157469575	18.60	505873	95424882	12.61
Unclassified	691139	107269537	12.67	596240	80232145	10.60
Small RNA	7250	1368038	0.16	385	72498	0.01
Satellites	137098	33124580	3.91	5638	1555931	0.21
Simple repeats	412879	19648413	2.32	572488	23456970	3.10
Low complexity	57959	3564659	0.42	50542	2654874	0.35

Table: Comparison of repeat content with other teleost genome

	Grass Carp		Magur		Rohu		Zebrafish		Common Carp	
	Length Occupied (bp)	%	Length Occupied (bp)	%	Length Occupied (bp)	%	Length Occupied (bp)	%	Length Occupied (bp)	%
SINEs	2352194	0.26	10172283	1.34	2804621	0.33	31330142	2.21	9314658	0.55
LINEs	14422092	1.6	27558167	3.64	6958808	0.82	37050077	2.58	60640105	3.58
LTR elements	25680184	2.85	29074733	3.84	14340072	1.69	50079393	3.31	38668676	2.28
DNA elements	193418832	21.48	95424882	12.61	157469575	18.6	546740746	38.51	232389411	13.71
Unclassified	112688266	12.51	80232145	10.6	107269537	12.67	677694	0.05	188341161	11.11

Whole genome based SNP mining and development of breed signatures for dairy and dual-purpose indigenous cattle (DBT-Funded)

This study is funded from DBT, New Delhi. Data generated from 777k Bovine HD SNP chip was subjected to structure analysis using the STRUCTURE tool version 2.3.4 to determine the population structure among the four indigenous cattle breeds. The data consisted SNPs of 72 samples and 777962 locus. The structure was run using the modified version of structure called parastructure available at github which consists of a modified perl script that can distribute the jobs across multiple nodes on a server. Using this modified pipeline, each run of K (the number of populations) is executed separately on each CPU of the cluster through queue system based on PBS.

The structure tool was run using with 100,000 BURNIN time and 100,000 MCMC replicates derived for each K, setting the admixture model as the ancestry model and allele frequency correlated as the allele frequency model.

The results of the structure tool were then used to determine the exact K which divides the population of the entire dataset into distinct populations. We used the Structure pipeline available on Github for this purpose which consists of python and R scripts which can predict the K vs Delta K values for the structure results. This tool gave the K value of 3 which divides the 72 samples into 3 distinct populations. The Bar plots of the results drawn using Structure tool are shown in Figure below.
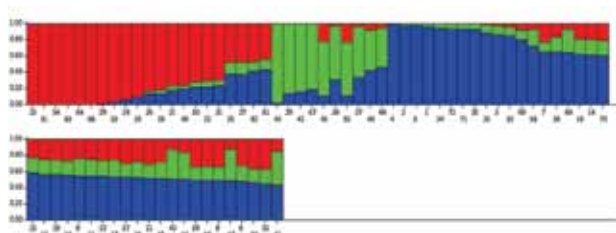
Figure. Bar plot of 72 sample of cattle produced by structure tool at K=3.

Bovine HD SNP chip 777K generated data were further analysed to obtain Runs of Homozygosity (ROH), genomic F (inbreeding coefficient) derived from ROH (F_{ROH}), F_{GRM}, F_{HOL}, F_{MOLi} and F_{MOLij} in four breeds of indigenous cattle *viz.* Gir, Sahiwal, Tharparkar and Vechur cattle. Each breed was represented by a panel of 18 samples (total 72 samples).

All SNPs not assigned to a *Bos taurus* chromosome

(BTA) or assigned to chromosomes X and Y were excluded. Markers were filtered according to quality criteria that included: (i) call frequency (≥0.95), (ii) minor allele frequency (MAF≥0.01) and (iii) Hardy-Weinberg equilibrium (P-value = 0.001). SNPs that did not satisfy these quality criteria were excluded. Therefore, unlinked SNPs were selected using -indep option of PLINK with the following parameters: 50 SNPs/window, a shift of five SNPs between windows and r^2 threshold of 0.5. A total of 625081 SNPs in Gir, 589412 SNPs in Sahiwal, 462962 SNPs in Tharparkar and 326688 SNPs in Vechur cattle breeds were retained after quality control and were used to estimate F_{ROH}.

Run of homozygosity: F_{ROH} were calculated as the proportion of genome in ROH over the overall length of the genome covered by the involved SNPs using the PLINK whole-genome association analysis toolset. The following criteria were used to define the ROH: (i) the minimum number of SNPs included in the ROH was fixed at 40; (ii) the minimum length that constituted the ROH was set to 4 Mb; (iii) two missing SNPs were allowed in the ROH; (iv) minimum density of one SNP every 100 kb; (v) maximum gap between consecutive SNPs of 1 Mb.

Moreover, the number of allowed heterozygous SNPs was set to different values: from one to three. Mean F_{ROH} values obtained allowing different numbers of heterozygous SNPs were compared within the same breed using paired t-tests. The mean number of ROH per individual per breed (MN_{ROH}), the average length of ROH (L_{ROH}) and the sum of all ROH segments per animal (S_{ROH}) were estimated.

Table 1: Descriptive statistics for runs of homozygosity (ROH) for each cattle breed

Breed	MN_{ROH}	$F_{ROH>4Mb}$	L_{ROH}	SNPs
Sahiwal	6.38	0.0520.035	8.52	149 to 21881
Vechur	15.03	0.0870.037	16.21	145 to 21132
Tharparkar	10.42	0.0630.029	10.17	148 to 16846
Gir	5.15	0.0350.019	6.11	144 to 19852

Genomic inbreeding analyses: Alternative estimates of inbreeding and coancestry coefficients were also calculated. In particular: (1) F estimated from the Genomic Relationship Matrix, GRM (FGRM); (2) the genomic inbreeding coefficient based on the difference between observed v. expected number of homozygous genotypes (FHOM); (3) the molecular coancestry coefficient (FMOLij) between individuals i and j; (4) the molecular inbreeding coefficient (FMOLi) of individual i, calculated as

FMOLi = 2 fMOLii−1 where fMOLii is the molecular self-coancestry.

Table 2: Estimated average of genomic inbreeding and coancestry coefficients for each cattle breed

Breed	F_{GRM}	F_{HOM}	F_{MOLi}	F_{MOLij}
Sahiwal	0.075	0.025	0.689	0.679
Vechur	0.034	0.012	0.614	0.640
Tharparkar	0.044	0.018	0.633	0.658
Gir	0.097	0.049	0.669	0.666

Genetic distance between all pairwise combinations of individuals (D) was estimated as one minus the average proportion of allele shared where the average proportion of allele shared was calculated as Dst using Plink v1.07. The average genetic distance between individuals drawn from the same breeds was 0.173 within the Tharparkar breed, 0.170 within the Sahiwal breeds, 0.172 within the Gir breeds and 0.203 within the Vechur breeds. The average genetic distance between individuals drawn from different breeds ranged from 0.187 ± 0.003 in (Tharparkar and Sahiwal) to 0.211 ± 0.006 in (Tharparkar and Vechur) the average genetic distances between the different breeds are shown in Table 3.

Table 3: Average genetic distances among the breeds.

Breeds	Tharparkar	Sahiwal	Vechur	Gir
Tharparkar	0.173	0.187	0.211	0.190
Sahiwal	0.187	0.170	0.205	0.191
Vechur	0.211	0.205	0.203	0.221
Gir	0.190	0.191	0.221	0.171

The NJ tree was constructed using the average genetic distances with the help of phylip v. 3.695 suite and visualized using the Figtree v 1.4.2 as shown in Figure.
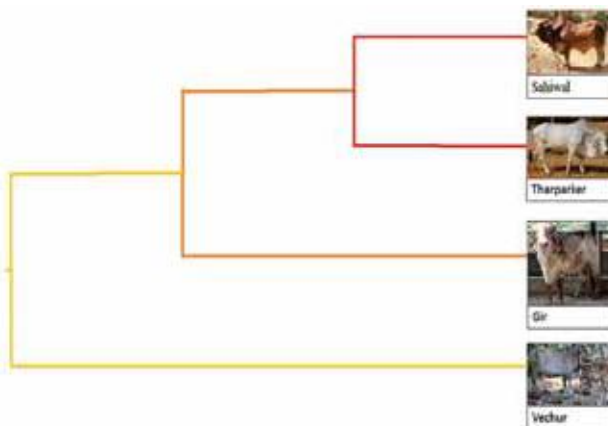
Figure: The rooted tree of the four breeds of Cattle visualized using the Figtree

Elucidating the mechanism of Pashmina fibre development: An OMICS approach

This project is funded by National Agricultural Science Fund, ICAR, New Delhi with the SKUAST-Kashmir being the lead centre and ICAR-NDRI, Karnal and ICAR-IASRI being the collaborating centres. The RNA-Seq data of Pashmina goats maintained at moderate temperature and cold / arid conditions was received from the lead centre SKAUAST, Kashmir. The data comprises of (i) three samples from two conditions, viz., one sample from moderate temperature and two samples from Cold/Arid temperature conditions (ii) two more sets of data having five samples each. In case - i, both the replicates of the cold/arid temperature samples were merged for further analysis. The quality control analysis has been done on the supplied transcriptome data. For paired end reads, pre-processing steps through Trimmomatic software have been followed for trimming and filtering of data. The adapter sequences were removed and quality filtering has also been done through the same software. A similar procedure was followed in case – ii also. The reference genome sequence of Cashmere goat (Yang, et al., 2013) was downloaded from NCBI and further indexed by Bowtie2. The trimmed transcriptome sequences were subjected to TopHat aligner for mapping. The mapped bam files of the transcriptome were used as input to the cufflink, cuffmerge and cuffdiff pipeline for the identification of the differentially expressed genes. After stringent filters, a total of 22 up / down regulated transcripts exhibiting fibre growth related functionality were found. Also, attempts were made to predict lncRNAs from a pipeline developed under the project. The selected lncRNAs were further analyzed for their function as well as prospective role in fibre related gene regulation

Modeling network of gene response to abiotic stress in rice (NFBSFARA)

Connexion Genotype-specific DEGs with Gene Regulatory Network

In order to decipher the genetic basis of salt tolerance, high-throughput sequencing of mRNA (RNA-Seq) was used and transcriptome changes of tolerant (CSR 27) and sensitive rice (BPT 5207) genotypes were analysed for each ten different time points. Within and between genotypes wise comparative experiments over ten time points were used for a) decoding possible temporal regulatory mechanism and b) mining unique salt responsive differentially expressed genes (DEGs) and associated pathways

from both the genotypes. It is hypothesised here that the progression of salt stress may have three distinct stages. Interestingly, both genotypes seems to be dynamic in terms expression behaviour during the stress time scale undertaken. Stage wise examination of DEGs reveals stage specific contrasting patterns of expression of genes, TFs, and associated pathways. Functional annotation of top ranked genes of tolerant genotype mainly includes ankyrin repeat domain-containing protein 28, retroposons, terpenoids (at early stage), putative metallothionein-like protein 3B, threonine synthase, O-methyltransferase (at middle stage) and putative acid phosphatase, CYP709B3 (at late stage). Merger of DEGs with miRNA-TF mediated synergetic gene regulatory network* showed genotype biased stage specific expression and substantiate the presence
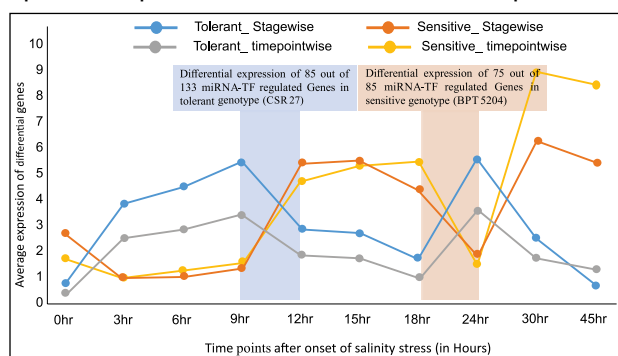
Figure: The mean expressions of filtered 8657 and 3821 DEGs at each time points were calculated from normalized FPKM values of tolerant and sensitive genotypes and plotted with respect to time points. Two change points (9-12hr and 18-24 hrs) were observed in the average expression values of DEGs during successive progression of salt stress. Differential expression of 85 out of 133 miRNA-TF regulated Genes in tolerant genotype (CSR 27) and differential expression of 75 out of 85 miRNA-TF regulated Genes in sensitive genotype (BPT 5204) was observed at first and second change points respectively.

of three distinct stages. The expression of 133 miRNA-TFs synergistically regulated target genes of the above network were checked for differential expression in within genotype experiments at their respective stages. It was observed that 85 out of 133 genes were differentially expressed specifically at the first transition point, i.e. early to middle stage, in the tolerant rice genotype. Whereas, 75 out of these 85 genes, were again differentially expressed specifically at the second transition point, i.e. middle to late stage, in the sensitive genotype. Further, pathways enrichment of these genes reveals their genotype specific behaviour at transition points. Back tracing from genes to miRNA reveals that two miRNA's viz. miRNA408 and miRNA164 were modulating these 85 genes. Here, genotype wise distinct behaviour of miRNA-TFs synergistically regulated genes particularly at transition points may have profound role in governing genotype-specific transcriptional dynamicity. However in-vitro driven deep examination of these observations is necessary

to establish the staged molecular mechanism of salt tolerance in rice.

hpcDATA: High Performer Computation for Differential Expression, Annotation & Transcriptome Assembly

The developed web based software for NGS analysis and annotation "High Performer Computation for Differential expression, Annotation & Transcriptome Assembly (hpcDATA) has been deployed on institute server, available over LAN, for testing (URL: http://192.168.7.45:8084/hpcDATA). The developed software is capable of De-Novo assembly of transcriptome sequence data, the workflow includes SRA toolkit, FastQC, Trimometic, trinity and Rsem tools. Altogether across above tools approximately 100 parameters have been customized tested and included in this pipeline. It can be also used for reference based analysis (workflow) of transcriptome data, which includes: SRA toolkit, FastQC, Trimmomatic, Bowtie, Tophat, Cufflink and Cuffdiff tools in the pipeline. Altogether across above tools approximately 135 parameters have been customized tested and included in the pipeline. Apart from that this toll has following modules:

i)   Differential gene identification module

ii) Annotation Module

iii) Project monitoring module

Differential Gene Identification: A separate module dedicated for differential gene analysis has been incorporated. It enables user for customized analysis of differential gene experiments, in both the cases of referenced and de-novo based assembly. Annotation module: This includes local MPI BLAST, Gene ontology analysis and Pathway analysis. Result tracking module: This module helps the user to get informed about the progress of the job submitted by him. After submitting the job the user need not wait for the job to finish. An email is sent to the user about the submission of the job with a link that helps him track his job status. Since the application would be used by many concurrent users the folder management is essential on the cluster too. The folders are created automatically by the project name. It has been taken care, that any number of concurrent users can work at the same time. Similarly, the folder management have been done on the web server to support more than one user using the same application. Job progress management: The user need not wait for the job to finish after submission. After submission the user receives an email that his job is submitted. After completion the user would again receive

an email that his job is completed and system is ready to show all the results. Additionally, a facility has also been provided to look at the status of the jobs submitted by a particular user by a separate web page. New design facility has been created for sample wise customization of analysis with case wise selection of different parameters of analysis. Previously, the tools were executed on the cluster

Figure: Home page of the developed online software-hpcDATA: High Performer Computation for Differential expression, Annotation & Transcriptome Assembly

with default inputs. The modification in the program is being done to add the functionality for changing the default values by the user.

Network Project on Transgenic in Crops

The preprocessed RAD-Seq data of 84 varieties of mango were subjected to de novo SNP mining using the STACKS software version 1.29, using denovo_map.pl script. parameters –m taking minimum of three identical raw reads required to create a stack, –M with minimum of two mismatches allowed between loci when processing single individual, –n with minimum of three mismatches allowed between loci when building catalog and –T with fifteen threads to execute. We identified 1.26 million high quality SNPs by sequencing double digested restriction site associated DNA (ddRAD) from 84 diverse mango cultivars from different regions of India and abroad.

Due to random distribution and low genome coverage of the ddRAD sequence reads, the sequence reads for the number of SNP loci common to all the samples was low. There were only 749 SNPs common to all the 84 mango varieties. The population structure in the 84 varieties was then determined based on these 749 common SNPs using the Bayesian, model based program, STRUCTURE version 2.3.4. The analysis revealed an optimum K value of two sub-populations, with a large number of admixed types. There were 49 cultivars in sub-population I and 35 cultivars in sub-population II.

To further analyze the genetic diversity and relationships among the 84 diverse mango cultivars their ddRAD sequences were aligned using BioEdit software. Phylogenetic tree was constructed using an improved version of the neighbour-joining algorithm, and visualized using FigTree v1.4.043. The phylogenetic tree grouped the 84 diverse mango cultivars into seven distinct clusters. A comparison of the population structure bar plot and the phylogenetic trees showed that the structure sub-population I comprising of 49 cultivars corresponded to phylogenetic clusters 1-6, whereas the subpopulation II comprising 35 cultivars corresponded to the phylogenetic cluster 7.

Figure. Population structure (A) and an unrooted phylogenetic tree (B) of 84 diverse mango cultivars based on 749 genome wide ddRAD SNPs and their associated DNA sequences, respectively. Correspondences between color-coded phylogenetic clusters 1-7 and STRUCTURE sub-populations I-II are also shown

All these data have been populated in MiSNPDb to develop genomic resources and is available at http://webtom.cabgrid.res.in/mangosnps. Only 749 SNPs were found common to all 84 varieties. Total number of SNPs discovered in a particular variety can be displayed. Also, the list of varieties having very same SNP along with type of haplotype with respect to varieties can be retrieved. It also has provision for haplotype, depth selection and selection of multiple varieties to get their common SNPs. Also, the position of respective SNPs can be displayed which can be further used for development of SNP discrimination/screening assay like FRET, beacon, scorpion or multiplexing. A user-friendly interface was developed using HTML/ PHP/ Javascript/ CSS language and server side scripting was employed using Apache Web Server. HTML, PHP and JavaScript are used for displaying the result.

Figure. Screen shot of the database

Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor

Stabilized various sex types like monoecious, pistillate and male lines and selected the line M 574 for the study which produced completely female, interspersed staminate flower types (ISF) and completely male lines with a single hermaphrodite flower at the top in Figure 1. For monoecious type, the cultivar DCS-107 was selected.

Twelve samples in 3 replicates and also RNA received from Indian Institute of Oilseeds Research were subjected to transcriptome sequencing using next generation sequencer. As the RNA failed to have the desired integrity and RIN, total RNA was isolated from all the samples and were used for development of sequencing library after isolation of

Sex types in castor
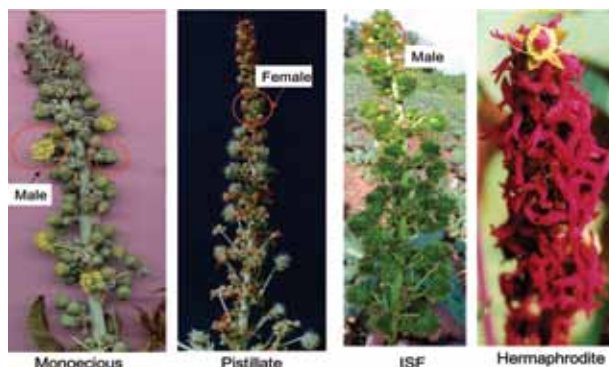
Figure 1. Different sex types in castor

mRNA from it. The mRNA library was sequenced in Next Generation Sequencer and the data generated for each sample is tabulated in Table.

Table 1. Data generated in different tissues of castor

S. No.	Sample Name	No of reads (in million)	Data generated
1	Leaf Sample	81.4	7.22 Gbp
2	Female Flower from pistillate plant	92.8	12.4 Gbp
3	Female zone from monoecious plant	86.2	10.98 Gbp
4	Male zone from monoecious plant	64.3	8.25 Gbp
5	Leaf L1: Flag leaf from M574 Pistillate line	16.7	1.7 Gbp
6	Leaf L1: Flag leaf from M574 male line	37.8	4.5 Gbp

S. No.	Sample Name	No of reads (in million)	Data generated
7	Leaf L1: Flag leaf from DCS-107	14.8	1.5 Gbp
8	F1: Female buds from a completely male line M574 (pistillate line)	16.7	1.7 Gbp
9	H: Hermaphrodite flowers	14.8	1.5 Gbp
10	M2: Male buds from monoecious line DCS-107	37.8	4.5 Gbp
11	M1: Male buds from a completely male line M574 (Completely male line)	39.2	4.4 Gbp
12	F2: Female buds from monoecious line DCS-107	39.5	4.6 Gbp

Multilabel Functional Classification of Abiotic Stress Related Proteins in Poaceae

In this study Uniprot data and GEO data has been used for geeting stress related genomic sequences. Uniprot data performed better in all the experiments since uniprot data is the protein data and protein is the final product of the gene. The GEO data however pertains to the mRNA data and additional levels of control beyond mRNA levels any influence the efficiency of classification. Better results were obtained in problem transformation than algorithm adaptation. Problem Transformation converts the input data into binary data and hence is more efficient. However, algorithm adaptation method used consumes less time than problem transformation method. A website was also developed for classification using both the methods.

Development of a Tool for Comparison of Protein 3D Structure using Graph Theoretic Approach

There is still an open challenge for protein structure comparison. Based on the review of literature, the graph theory approaches can be used for protein comparison. Many graph models can be created using various graph parameters. Generally, graph theory is used to represent/decipher complex spatial structure which is mutual connected and depended. The project was formulated for comparison of 3D protein structure using graph theoretic approach. We developed two methods namely (i) graph partitioning and alignment of graph partitions to derive global alignment of 3D structure of protein and (ii) graph properties and application of machine learning techniques. These methods have been implemented in MATLAB.
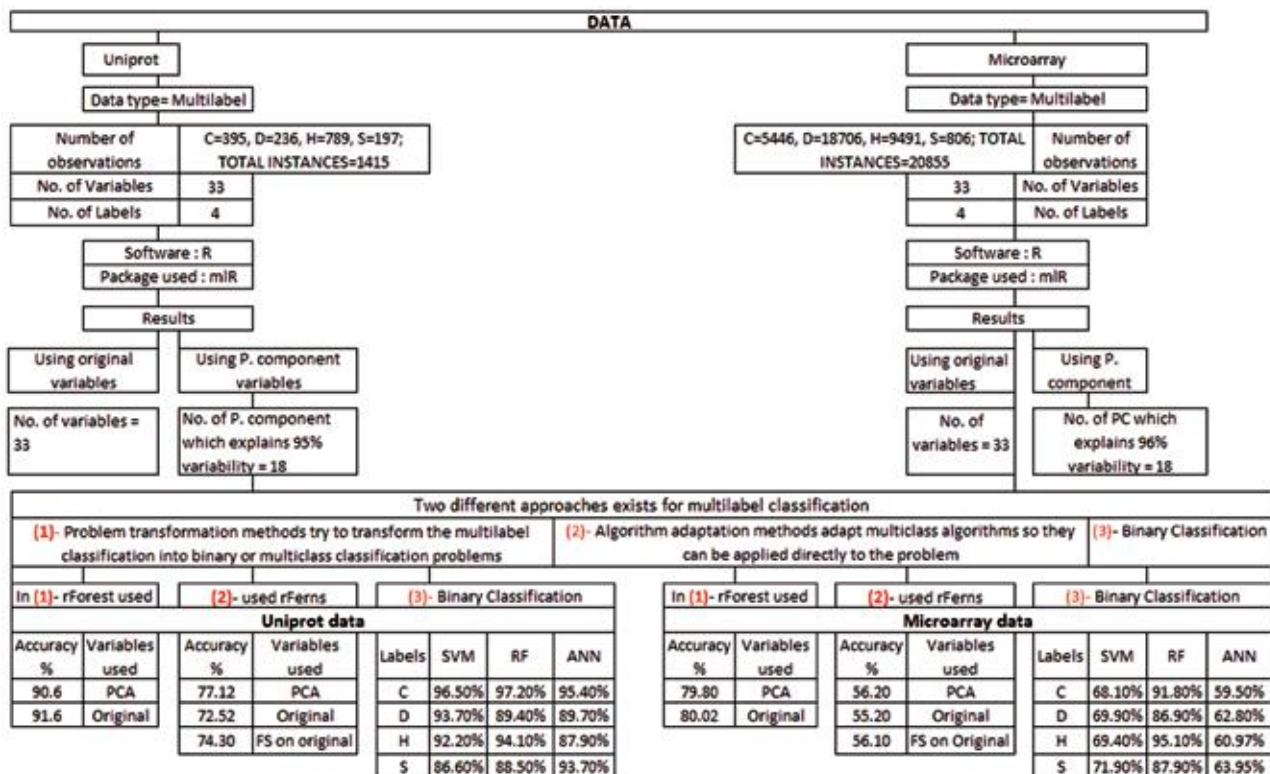
To evaluate the performance of these methods, cluster analysis using benchmark SCOP data set of 100 proteins have been performed and results are compared with two best existing techniques CE and jFATCAT. The benchmark data has proteins belonging to all major classes and number of residues are ranging from 51 to 1005. For cluster analysis, a number of clustering techniques such as Hierarchical clustering, K-Means, C-Means, Spectral K-Means have been used and various accuracy metrics are calculated. After analyzing these results, k-means clustering is found suitable over other clustering techniques. Recall, Precision and f-measure are considered as accuracy metrics to assess the performance of these models. The percentage of the precise clusters indicate the performance of protein 3D structure comparison algorithm.

Method 1: Graph Partitioning Method

An algorithm has been developed to calculate the similarity between two protein structure (Figure 1) based on i) Representing 3D protein structure into 2D graph model, ii) Partitioning the graph models into sub-graphs and iii) aligning the sub-graphs between pair of proteins and (iv) finally calculated similarity between pair of protein structures.

Method 2: Graph Properties Method

Another novel method has been developed to study the complexity of 3D structure of protein. The machine learning techniques have been used to find the similarity between two protein structures using graph properties of protein 3D structures. Figure 1 represents the workflow for the proposed method consisting of four steps namely, i) Representing 3D protein structure into 2D graph model, ii) Calculating graph properties iii) Calculate similarity and iv) Evaluation by cluster/classification.

The cluster analysis results of graph partitioning method are presented in table 1 with recall,
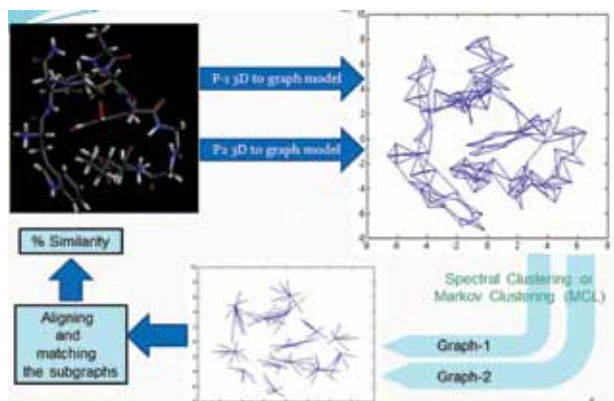
Figure 1: Workflow of graph partitioning method

precision, f-measure and random index as accuracy metrics. The accuracy based on R-index has been observed as 97% similarity with CE, 86% similarity with jFATCAT and 91% accuracy with proposed graph theory based method.

The graph properties method resulted with accuracy level of 65.50 % for the benchmark dataset. The analysis was performed using various combinations of threshold values to consider a connectivity of pairs between atoms distance less than 0.1, 0.2, 0.3, 0.4 and 0.5. The f-measure is found as 57.24 %, 59.40%, 63.33 %, 65.50 % and 65.50 % respectively at each class level clustering with values as 0.1, 0.2, 0.3, 0.4 and 0.5 respectively. The comparative values of f-measure for proposed graph properties based method (Best value has been taken with respect to various threshold levels), CE and jFATCAT are 65.50, 94.65, 63.33 respectably.

These methods were also evaluated with respect to proposed algorithm in terms of computational running time in performing the analysis of protein structure comparison. The earlier methods, CE and jFATCAT consumed 126 hours and 19 hours respectively to perform the experiment of 100 protein structures comparison on a desktop computer of 8 GB RAM having 64-bit Windows 7 OS and MATLAB version 2010. Under the same setup, the proposed algorithm takes 51 hours, 13 hours, 3 hours and 3 hours for distance threshold 0.1, 0.2, 0.3, 0.4 and 0.5 respectively. Thus, the proposed method performed significantly better in terms of computation time over CE and jFATCAT but the proposed graph based methods are showing improved performances over jFATCAT in terms of classification accuracy.

Development of 16s rDNA Rumen Microbes Specific Database

Data collection from public databases is approximately 209177 sequence data. Pre-processing and filtering has been done by sequence size and other criteria such as host, organism, species, origin, published articles. After pre-processing, 10539 sequence data has been selected for further development of database, phylogenetic tree and web portal. We created standard phylogenetic tree using the filtered 10539 data set. Here we have developed two types of databases such as BLAST and RDMBS databases. BLAST database is used for search sequence similarity of a novel sequence given by user. The BLAST search result in simple text has been presented to user and also presenting nearest 16s rRNAs to the given sequence in the stander phylogenetic tree. RDMS database is being used

for searching 16s rRNAs using key words. The web portal has been developed in three tier architecture, a) user interface has been developed using HTML, JAVA and CSS to search the database using key words, provision for input a novel sequence and view phylogenetic tree. b) PHP scripting language has been used as web server side scripting and background process MPI-BLAST is used for searching a given sequence is BLAST database. c) MYSQL database has been used to store 16s rRNAs data in RDBMS concept and MPI-BLAST database has used to store 16s rRNA sequence data.

Platform on Integrated Genomics Warehouse

Critical review has been done and identified the different databases related to genetic variants of rice. These databases are further being explored for the development of data marts. The attributes and other parameters have been identified by exploring these databases. Identification of parameters for genetic variants are SNP, SNP haplotypes, InDels, CNV and SSR parameters. The techniques and tools are being reviewed to integrate these variants with Genes and QTLs related information. The existing databases related to SSR's, CNV, SNP and InDels are being explored. The attributes related to these databases have been finalized and Source Schema development of these databases has been initiated.

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. A total budget of Rs. 44.822 lakhs has been allocated for the study. The information regarding the number of lines and the traits to be considered for study has been finalized.

ICAR Consortium Research Platform on Genomics: Computational and Analytical Solutions for High-throughput Biological Data

Guar Genome Assembly and Analysis (Data generated by NRCPB, New Delhi): The NGS data on five samples of guar crop has been received from the partner centre, ICAR-NRCPB and the assembly of genome sequence is under progress. The transcriptome data of guar genome available in public domain has been retrieved and assembled

by following standard transcriptome data analysis pipeline. SSRs have been identified and maintained in a standard format for necessary development of database. Primer designing for the identified SSRs has been done. Analysis for prediction of different types of ncRNAs [Fig. 1] and their interaction with ESTs [Fig. 2] using bioinformatics pipeline has been done.
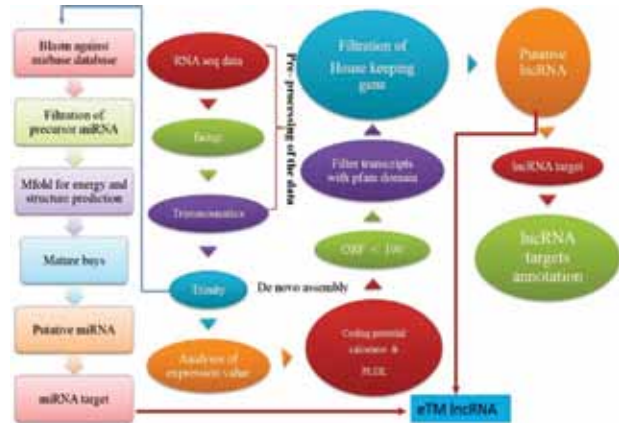
Fig.: An integrative computational pipeline for the systematic identification of noncoding RNAs (lncRNA and miRNA) and their targets.
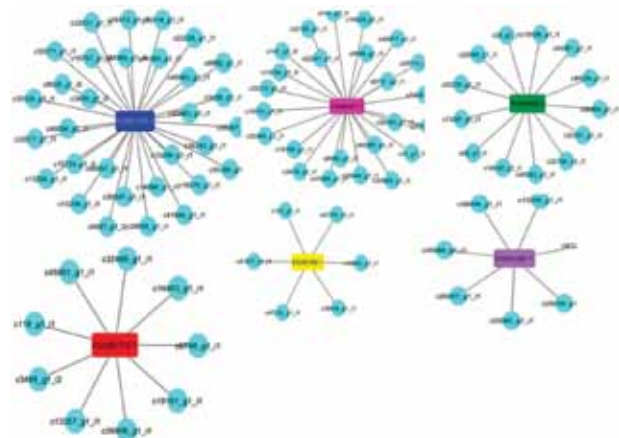
Fig.: Representation of predicted interaction between lncRNA and expressed genes (ESTs). The ellipse and rectangular nodes represent lncRNAs and expressed gene respectively.

Programme-5: Development of Informatics in Agricultural Research

National Information System on Agricultural Education Network (NISAGENET)

As per the decision of the Council, all the existing solutions developed by IASRI for the education division of ICAR has been merged under the umbrella of Agricultural Education portal of ICAR. Additional new initiatives like development of student portal has been started. A web responsive homepage has been developed and made available on Internet at

http://education.icar.gov.in. Following new function-alities have been developed under the project:

- Statement of expenditure (SoE) sub module under Budget Module for uploading SoE of each component has been developed.

- Demand of funds and guidelines sub module for uploading demand under each component is developed to facilitate filling of funds under different heads by the university nodal officer.

- Multiple new reports have been made to track the demand of funds for each module and release of funds by the education division. All the reports have been made browser compatible and can be viewed in Internet Explorer, Google Chrome and Mozilla Firefox. A number of reports have also been made web responsive for viewing on mobile phones/tablets.

Homepage of the Agriculture Education Portal

The existing NISAGENET system has been maintained for archival purpose and following functionalities were incorporated before the decision for development of education portal has been taken.

- Faculty profile module including basic data of faculty members along with their publication list, awards, courses taught, and their research areas has been enhanced to facilitate publishing their own information on the web through a web page address provided to each faculty. More than 1300 faculty members of various universities have built their web pages during this period.

- Regular contact and technical Support has been maintained with the Nodal Officers of each university for data uploading and validation in NISAGENET.

Management System for Post Graduate Education-II

The Management System for Post Graduate Education was designed, developed and implemented at IARI, IVRI, NDRI, CIFE and CAU.

IARI- PG School Management System

During the reporting period, designing, development and implementation of the Online Application System for Ph.D. entrance examination, IARI has been developed as a module of the MS-PGE system. The system was launched for filing up of the applications from the candidates on 7thFebruary, 2017 and about 3300 students are registered with the system. Out of which about 2500 applications were filled on-line. Multiple reports as per the requirements of the PG School official, IARI for allocating the examination center and for validating the participants have been developed. Support has been provided to solve the queries of the various users' w.r.t. application filling to candidates as well as for other modules such as student registration and result uploading.

Home page of Ph.D. Entrance Application Management Module

New type of mandatory course entitled" Compulsory Qualifying Course" for the students to qualify the course was introduced in the online system but its grades will not be counted in the OGPA of the student. Course No. PGS506 – History of Agriculture was converted from Compulsory to Compulsory Qualifying course at multiple places in the system like student grade sheet, marks sheet, progress report. Further, changed remarks of PGS506 to satisfactory or unsatisfactory. Modified the source code in the dean, guide, and professor levels in PPW/ORW modules for increasing performance of System. Changed AIM level to Associate Dean level and developed registered student report at admin level.

AMS CIFE at CIFE Mumbai (CIFE Academic Management System)

Following functionalities were developed and implemented at CIFE Mumbai

The process of examination is different in CIFE as compared to IARI. In CIFE, final examination papers are checked by the external faculty and marks are to be entered by the central examination cell. All other evaluation is done by the internal faculty. In order to implement the grade assignment process, customization of student's examination module has been done and implemented. Course schedule module was modified and all reported errors were removed, faculty can upload e-learning files and data in excel and .cvs format. Customized course modules for students to be compatible in browsers like Mozilla, Chrome and Internet Explorer. Online assignment upload module has been developed and implemented at CIFE, Mumbai. Customized the Upload profile photo module under faculty profile. Alumni report module customized and generated a discipline wise alumni report for batch (2014-16).Support provided to allocation of courses to faculty to Heads of various divisions and faculty for academic year 2016-17.Support is also provided on proactive basis to faculty so that they can complete their pending jobs in the system. All reported queries have been resolved. Online registration of all new M.F.Sc students, has been successfully completed under scheduled time table for the academic year 2016-17.

Home page of the Academic Management System, CIFE

MS-PGE at NDRI Karnal (NDRI Academic Management System)

Production instance of the system is installed and development of master database has been started in the month of Nov. 2016. All the students and faculty have been registered in the system. Multiple SKYPE/LYNC meetings have been conducted with NDRI officials. Customization of the system as per their requirements is in progress. Multiple reports have been customized to meet the requirements of NDRI.

Home page of the Academic Management System, NDRI

IVRI- Academic Management System

Production instance of the system is installed and development of master database has been started in the month of Jan. 2017. All the students of 1st year of M.V.Sc. have been registered and registration of faculty is also completed. Customization of the system as per their requirements is in progress.

Home page of the Academic Management System, IVRI

Results Framework Document Management System in ICAR (RFD-MS)

Refinement of the system, modifications, creation of reports, insertion of mandatory objects etc. has been done. The 'Prepare RFD' module has been modified, which allows the organization to prepare their result framework document year wise. The 'Print RFD' module has been modified, which allows to prepare

RFD reports for the specified period and to print the report. Report for targets and achievements have been redesigned.
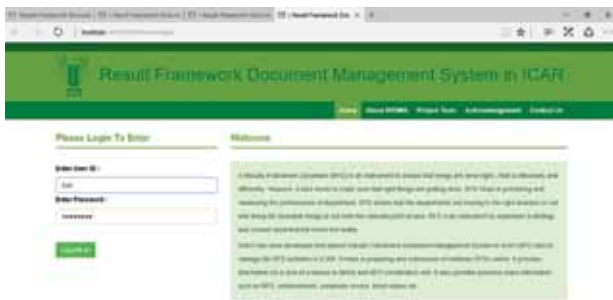
Knowledge Management System for Agriculture Extension Services in Indian NARES

An online portal viz. 'Krishi Vigyan Kendra Knowledge Network' has been developed to disseminate knowledge and information from KVKs to farmers. It has been hosted at ICAR – IASRI data center and available at URL (http://kvk.icar.gov.in/) (Fig.1). The portal was launched by the Union Minister of Agriculture and Farmers Welfare on 8th July, 2016 in New Delhi. It is a single window platform which provides information about KVK, package of practices related to agriculture and allied sector, facilities at KVKs, details of events organized by KVKs and agricultural contingency plan for most of the districts of India. A total number of 642 KVKs have been registered into this portal. The portal is having detail information on more than 25,000 KVK events. 546 KVKs have uploaded their facility details whereas 393 KVKs have uploaded package of practices into the portal. The portal has following reporting modules: Find KVK, Facilities, Upcoming Events, Ongoing Events, Past Events and Package of Practices. The portal has access to district-wise agro-meteorological advisory provided by India Meteorological Department (IMD) for the farming community. Agriculture contingency plan for 597 districts of India are available in the portal. The portal has farmer level detailed information on Cluster Field Level Demonstration (CFLD), pulses seed hub and Direct Benefit Transfer (DBT). Reporting modules for CFLD, pulses seed hub and DBT have been developed.

The portal has an integrated query module including simple and advance search facilities. Monitoring facility has been developed in the portal for ATARIs and ICAR Extension division. State wise and ATARI wise monitoring reports have been developed for KVK Profile, Events, Facilities and Package of Practices. KVKs can upload, view and update Monthly Progress Report (MPR) and Agriculture Extension MPR (AE-MPR) reports through the portal. ATARIs can view the consolidated reports of MPR and AE-MPR of the KVKs under their office.

A live cluster map has been incorporated into the portal to keep track of the users. More than 6 lakh of users have already visited this portal. A Dashboard monitoring system for various components of portal has been developed. A KVK Mobile App (Fig.2) for the farmers has been developed in the Android platform.

Fig.1: Home page of KVK Portal

Fig.2: KVK Mobile App

The app was launched by the Union Minister of Agriculture and Farmers Welfare on 21st December, 2016. The app is available at Google Play Store and consists of the following functionalities: KVK, Facilities, Package of Practices, Send Query, Upcoming Event, Past Event, Weather Advisory, Market, Change KVK and KVK Portal.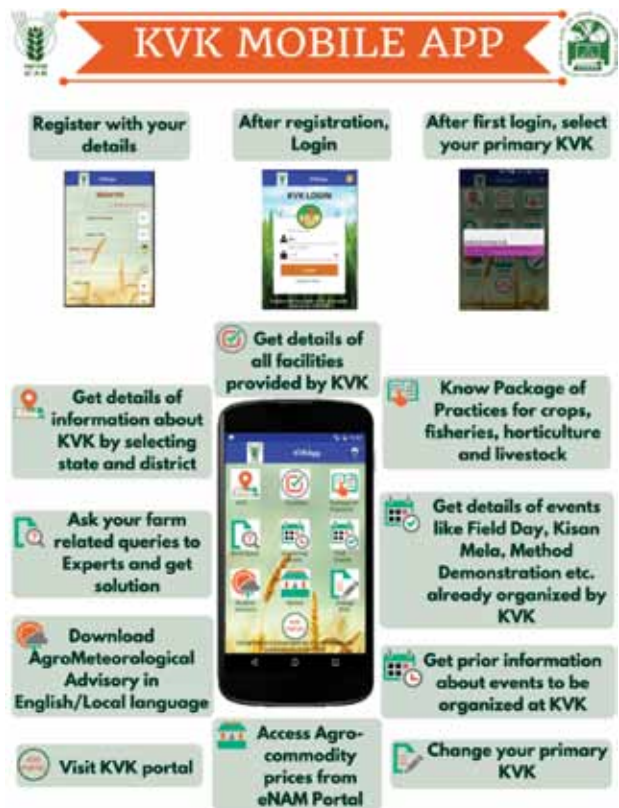 Farmers can ask any farm related query to the experts in KVK and get solution for that through this app. ICAR Email Ids for all KVK Heads have been created. A separate mailbox has been created for providing support to the portal users.

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

ISO 20000:2011 & ISO 27001:2013 External Surveillance Audit was successfully completed at ICAR DC on September 19 and it was recommended for continuation of the ISO 20000-1:2011 & ISO 27001:2013 standard by the BSI. Unified communication solution AD-16000, Mail Box Users 15878 and Lync user 10913 have been created till February 2017. About 40 website have been launched in Data Centre. ICAR Data Centre was inaugurated by Union Agriculture & Farmers Welfares Minister at IASRI on 21stDecember, 2016. Brochure of ICAR Data Centre was also released by the Minister.

ICAR-ERP has been implemented in 111 Institutes of ICAR including ICAR Headquarters and Agricultural Scientific Recruitment Board. For the effective implementation of ICAR-ERP, six knowledge enhancement trainings on HRMS & Payroll and SCM modules have been organized at five different locations, in which 138 personnel have attended from different institutes. Institute specific trainings on ICAR-ERP have been organized at IASRI for 279 personnel. The Payroll Module was successfully customized as per the 7th CPC and salary has been disbursed by 47 Institutes for the month of February, 2017.The Expenditure report on cash basis has been customized, tested and demonstrated to Finance Division of ICAR Headquarters.

End User Training & Support

- Four knowledge enhancement trainings (Two days) on "HRMS and Payroll modules" were organized, in which 87 personnel from different ICAR institutes have participated.

- Two knowledge enhancement trainings on Supply Chain Management (SCM) were organized, in which 51 personnel have participated from the different ICAR institutes

- Two days training on Payroll module was organized specially for IARI personnel during 27-28 June, 2016.

- One training programme on Supply Chain Management module (SCM) was organized specially for NDRI personnel during 04-05 July, 2016.

- One training programme on HRMS, payroll and SCM modules was organized specially for CIPHET, Ludhiana personnel during 16-20 August, 2016.

- Training programme on HRMS and Payroll modules was organized during 22-27 August, 2016 at Nagpur for Institutes (NBSSLUP, CICR and NRC for Citrus)

- Support is being provided from central help desk for effective use of ICAR-ERP.

- Training programs were organized at IASRI for the institutes personnel from DKMA, NBPGR, IARI, NCIPM, ASRB, ICAR HQ, NBSSLUP, IGFRI and IIWM

- One week training was organized at NIASM, Pune on ICAR-ERP system as well as CIRG, Makhdoom, Mathura.

- Online sessions were organized for ICAR-ERP through TeamViewer/Lync to the following institutes viz IIHR, NRC grapes, CAFRI, IVRI, CCRI, NRRI, ZPD,

- Prepared the instructions manual for entering the cadre strength in the system. Scientific sanctioned cadre strength has been uploaded in ICAR-ERP system for all the Institutes

- A Whatsapp group of ICAR-ERP Nodal Officers was created for effective and fast communications

- About 500 user were created for IVRI personnel

- A user instruction manual was prepared for updating the personnel information in HRMS module and sent to all the institutes.

Customization/Development of Reports

- Bill Tracking Report is made live to facilitate Directors and other top management to track the bills.

- Indent, Purchase Receipt, Material Issue functionalities have been implemented in IASRI.

- Eleven (11) New report have been customized viz Employee Tour report, Employee Payroll

Data, Non Plan Budget Vs Expenditure Report, Cash Based Budget Funds Inquiry Report, Vendor Details For All Employees, Scheme wise expenditure Report-Projects, Bank Details Report, DA Arrears Report, HR Administrative Report, Employee GPF Report, Passport Report.

- Some modifications have been made in HRMS/ SSHR module such as Changes in Joining Report, Leave Type LOV Sorting, Update and delete functionality in Employee Qualification

- Modification incorporated in 28 Reports viz., PAN Number column addition in Invoice Register, Multiple Changes in ICAR Invoice Register Report, Changes in ICAR Bill Report, Changes in ICAR TA Bill Report, Changes in ICAR HR Annual Increment Report, Changes in ICAR Purchase Requisition Report, Changes in ICAR employee, payment mode bonus report, Changes in Purchase Order Print Report, Changes in Transaction Count Report, Changes in ICAR Statement of Expenditure Report, Changes in ICAR HR Employee Profile Report, Changes in ICAR employee payroll data report, Changes in ICAR Payroll employee wise new pay register report output, Changes in ICAR Hqrs. leave pending for Approval report, PO Number column addition in Invoice Register, Types of purchase orders changed in report, Changes in ICAR Project Detail Report, Changes in ICAR Payroll Employee Wise New Pay Register Report, Changes in ICAR HR Pay Slip Report, Changes in ICAR Payroll Investment Declaration Report, Changes in ICAR HR Employees Qualification Report, Changes in ICAR HR Employee Publication Report, Changes in ICAR Invoice Register-Budget Head Wise, Cadre strength report, Scientists in Position & Vacant report and Transaction progress report.

Technology Assessed and Transferred

A new sampling methodology for estimation of Cotton production using double sampling approach under stratified two stage sampling framework, which is efficient and very cost effective than the existing methodology in operation, has been implemented in all the Cotton growing states of the country from 2015-2016 by Directorate of Economics and Statistics (DES), Ministry of Agriculture and Farmers Welfare, Govt. of India. This methodology was presented in the session on "Measuring productivity in agriculture, fishery, and forestry" in Seventh International Conference on Agricultural Statistics (ICAS VII) held during October 26-28, 2016 at Rome, Italy. The methodology was well taken by the global community and is available at FAO of the United Nations website which may be adopted by other countries in future.

A new sampling methodology for estimation of area and production of horticultural crops, which is efficient, simple, less time consuming and cost effective is being validated in six states of the country namely, Maharashtra, Tamil Nadu, Andhra Pradesh, Himachal Pradesh, Haryana and Madhya Pradesh under CHAMAN Project (2014-2017). After validation of the developed methodology, the developed methodology will be implemented in all the states of the country from 2018-2019 by Division of Horticulture, Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture and Farmers Welfare, Govt. of India.

A suitable sampling methodology for estimation of quantitative harvest and post harvest losses of major crops/commodities in India developed during previous study was implemented for conducting a National level survey during 2012-2014 covering 120 selected districts of the country and reliable estimates of percentage loss for 45 crops/commodities at different stages/channels i.e. from production to consumption were obtained. This methodology was presented in the session on "Post Harvest Losses" in Pre-Conference Workshop organized by the FAO, Rome, Italy on October 25, 2016 before Seventh International Conference on Agricultural Statistics (ICAS VII) held during October 26-28, 2016 at Rome, Italy. The methodology was well taken by the global community and is available at FAO of the United Nations website which may be adopted by other countries in future.

A sampling methodology for estimating crop area, yield and production under mixed and continuous cropping developed under the project was tested and validated in three different countries namely, Indonesia from Asian Region, Rwanda from African Region and Jamaica from Caribbean Region during December 2015-April 2016. The developed sampling methodology is likely to be adopted globally specially in developing countries in future by Food and Agriculture Organization of United Nations. This methodology is accepted by the FAO of United Nations and is published by the FAO as a Technical Report of Global Office. The report is available at FAO of the United Nations Global Strategy's website. Under this project, training of the developed methodology including Class room as well as field training of Crop Cutting Experiment (CCE) technique was imparted in all the three field testing countries. As a result of CCE training, Jamaica has adopted the CCE technique for crop yield estimation in the country.

The data entry software, developed 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", was implemented in the state of Gujarat and Odisha at the state headquarters for digitization of data.

Deployed the offline version of MAPI Software 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" in the state of Gujarat for data collection work in the Rabi season 2016-17.

Developed the online version of the Mobile Assisted Personal Interview (MAPI) Software 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" for data collection using smart phones with android operation system.

Developed online data analysis software for Area Level Small Area Estimation technique under the project entitled "Development of Innovative Approaches for Small Area Estimation of Crop Yield, Socio-economic and Food Insecurity Parameters".

Developed online data analysis software for Spatial Small Area Estimation technique under the project entitled "Development of Innovative Approaches for Small Area Estimation of Crop Yield, Socio-economic and Food Insecurity Parameters".

Developed R package WaveLetLongMemory and successfully uploaded in CRAN

Developed a computational method for species identification using DNA barcode. Based on this approach, a web server SPIDBAR (http://cabgrid. res.in:8080/spidbar/) has also been developed for easy identification of species by the taxonomist.

Developed a computational tool DCDNC (http://cabgrid.res.in:8080/DCDNC/) for discrimination of CDS sequence from intronic sequence, based on the sequence features derived with regard to methylation mediated substitution and spontaneous deamination. This tool has been validated in Cattle and Rice dataset. By using this server, user will get the output in terms of probability with which the submitted test sequence is predicted as coding sequence.

Developed web server DIRProt (http://cabgrid.res. in:8080/dirprot/index.html) for discriminating the insecticide resistance proteins from non-resistant proteins. Here, four types of resistance proteins encoded by four categories of insecticide resistance genes viz., Cytochrome P450, Acetylcholinesterase (AChE), Knock down resistance (KDR), resistance to dialdrin (RDL) have been considered. The server has been trained with DPC features i.e., di-peptide composition (DPC). Moreover, the SVM machine learning technique with the RBF kernel is used in the backgroung for prediction purpose.

Developed a web server iAMPpred (http://cabgrid. res.in:8080/amppred/) for predicting the propensity of a candidate peptide as antibacterial, antiviral or antifungal with certain probability. The performance of this server was found comparable with the existing tools (AntiBP, CAMP2, AntiBP23, AVPpred4, iAMP-2L, ClassAMP6 and EFCFCBF7) meant for prediction of anti-microbial peptides. The antimicrobial peptides predicted by this server will help enable the designing of peptide based antibiotics.

An R package, i.e. dhga was developed and available at https://CRAN.R-project.org/package=dhga for the users.

An R package, i.e. BootMRMR was developed and available at https://CRAN.R-project.org/package=BootMRMR for the users.

An R package, i.e. GSAQ was developed and available at https://CRAN.R-project.org/package=GSAQ for the users.

The Onion Genomic Resource: A genomics and bioinformatics driven resource for onion breeding: Onion Genomic Resource (OGR) has been developed as the open web resource freely accessible at http://webtom.cabgrid.res.in/ogr/ and has comprehensive information of assembly of available onion ESTs from public domain as well as the transcriptome data from *Allium cepa* with their annotations and functional significance. It is a valuable tool for confirmation of predicted ORF once the whole genome of onion is sequenced.

Coconut Transcriptome Database (CnTDB): The coconut transcriptome database (CnTDB) has been developed. The Coconut Transcriptome Database has five tabs *viz*., Home, Transcripts, Variants, DEG and supplements. "*Home*" page has the general information and utility of the database. Under the "*Transcript*" tab, user can search for expression

profile, transcription factor families, domain and family and pathways along with the BLAST option. Under the "*Expression profile*" tab, information of expression values in the form of FPKM of resistant and susceptible varieties along with blast results are shown. The "*Transcription Factor families*" search tab provides information of transcriptional factors. The tab "*Domain and family search*" shows the information of domains and families of transcripts, to which the hyperlinks are provided for direct link to EMBL-EBI Interpro database. Under the tab "*Pathways search*", information of differential expressed genes which are involved in pathways are provided with the enzyme name and enzyme ID. The maps are directly linked to KEGG database. The next tab, i.e., "*Variants*" has three features of search like SSR, SNPs and Indels. These tabs provide information of identified putative simple sequences repeats along with three sets of primers, single nucleotide polymorphism and indels, respectively. The tab "*DEG*", provides all information of identified differential expressed genes of resistant and susceptible cultivars. Besides, it also shows the blast results of each transcript..

Decoding of Karnal Bunt genome : Scientists from ICAR-Indian Institute of Wheat and Barley Research, Karnal and ICAR-Indian Agricultural Statistics Research Institute, New Delhi have sequenced the genome of the indigenous pathogen Karnal Bunt. This is a pride moment for the country having decoded one of the quarantine pathogen which restricts the trade of wheat due to international quarantine laws. Karnal bunt disease caused by the fungus *Tilletia indica* (Syn. *Neovosia indica*) is a serious concern due to strict quarantines affecting international trade of wheat. This disease is also called as partial bunt because only part of the kernel is damaged during infection. It is a quarantined pathogen and severe economic losses occur due to quarantine restrictions on export of wheat grain in the infected areas. Early detection of the pathogen strains is crucial for managing the infestation. The draft sequence of two monospridial and one dikaryon is a major landmark to understand the pathogen diversity, its mating behavior and to detect the pathogens at the earliest. The draft size of KB strains PSWKBGH-1, PSWKBGH-2 and PSWKBGH-3 were 37,460,344 bp, 37,216,861 bp and 43,736,665 bp, respectively. The results were published in the international journal of American Society of Microbiology, Genome Announcements (http://genomea.asm.org/content/4/5/e00928-16.

full). These genome sequences have been deposited at GenBank under the accession MAPW00000000 (PSWKBGH-1), MAPX00000000 (PSWKBGH-2) and MAPX00000000 (PSWKBGD-1-3).

iAMP: Improved prediction of Antimicrobial peptides (http://cabgrid.res.in:8080/dirprot/): Antimicrobial peptides (AMPs) are important innate immune molecules, which have been found effective against several pathogenic micro-organisms like bacteria, virus, fungus, parasites etc. AMPs have been found almost in all forms of life viz., animal, plant, bacteria, fungi constituting the first line of host defense against microbes. Due to the growing resistance of microbes against conventional antibiotics, AMPs are gaining attention as an alternative to chemical antibiotics worldwide. Identification and designing of AMPs through wet lab experiments may be resource intensive. Thus, computational identification will supplement in identifying and designing new antimicrobial agents. By using the computational tool, the best candidate peptide can be identified prior to synthesis and testing against microbes. In iAMPpred, three different categories of features have been used i.e., compositional features (pseudo amino acid compositions and normalized amino acid compositions), structural features (α-helix, β-sheet and turn structure propensity) and physico-chemical properties (isoelectric point, hydrophobicity and net-charge). The compositional and physico-chemical features were computed by using "Peptide" package of R-software, whereas the structural features were computed using TANGO software, available at http://tango.crg.es/. Support vector machine (SVM) is used in iAMPpred for prediction of AMPs and non-AMPs as it is a non-parametric and most widely used supervised learning technique in bioinformatics, attributed to its sound statistical background. The predictive ability of SVM mainly depends upon the type of kernel function that maps the input data to a high-dimensional feature space, where the observations belong to different classes are linearly separable by the optimal separating hyper plane. Here, the radial basis function (RBF) was used kernel, due to its wide and successful application in most of the AMP prediction studies. The svm function available in e1071 package of R-software was used for executing SVM model.

DIRProt: A web server for discriminating the insecticide resistance proteins from non-resistant proteins (http://cabgrid.res.in:8080/dirprot/) has been developed. Here, four types of resistance proteins are

encoded by four categories of insecticide resistance genes viz., Cytochrome P450, Acetylcholinesterase (AChE), Knock down resistance (KDR), resistance to dialdrin (RDL) protein categories have also been considered. The server has been trained with di-peptide composition (DPC) features. Moreover, the SVM machine learning technique with the RBF kernel is used in the background for prediction of insecticide resistant proteins.

SPIDBAR- Species Identification using DNA Barcode (http://cabgrid.res.in:8080/spidbar/) : The problem of species identification using DNA Barcode can be formulated as : given a reference library composed of DNA Barcode specimen sequences of known species and an unknown DNA Barcode sequence, recognize the latter into a species that is present in the library. Several methods have been developed and adopted to automatically classify a DNA Barcode sequence to a predefined species, such as tree-based methods, similarity-based methods and diagnostic methods. However, each method has its own advantage and disadvanatge. The SPIDBAR can be used for species identification using DNA Barcode with the help of Random Forest methodology. Here, initially the features vector has been developed on the basis of composition of frequency of k-mer of different size and RF supervised learning approach was employed for classification purpose. To run this server, the user has to provide the set of reference sequence with known species label (in BOLD format) and query sequence with hypothetical label (in BOLD format). Also, the user has to provide atleast two query sequence to run the SPIDBAR.

DCDNC: Discrimination of coding sequence (CDS) from non-coding sequence (http://cabgrid. res.in:8080/dcdnc/): This web server has been developed for discrimination of CDS sequence from intronic sequence. For each of the CDS and intron sequence, five different indices, based on methylation mediated substitution and spontaneous deamination, was computed. These indices have been developed in earlier study (Xia, 2005). The numerically coded intron and CDS sequences were then used as negative and positive instances for classification using binary Random Forest supervised learning approach. This approach has been validated in Cattle and Rice dataset. By using this server, user will get the output in terms of probability with which the submitted test sequence was predicted as coding sequence.The user has to supply only the test sequence (at least two) in FASTA format to run this server.

GinMicrosatDb: A Genome-Wide Microsatellite Markers Database for Sesame (Sesamum Indicum L.) has been developed (http:/backwin.cabgrid.res. in: 8080/Gingelly7). Whole genome sequencing of sesame variety 'Swetha' was used for development of microsatellite markers so as to ensure availability of substantial number of polymorphic markers for use in marker assisted breeding programs. This database consists of di-, tri-, tetra-, penta-, hexa- and compound microsatellites localized on both linkage groups and scaffolds with their genomic co-ordinates. It provides five sets of forward and reverse primers for each of the microsatellites along with the flanking sequences, product size, GC content, melting temperature etc. The distribution of microsatellites can be viewed and selected through a genome browser and or a physical map provided in the links.

Krishi Vigyan Kendra Knowledge Network Portal (http://kvk.icar.gov.in/) has been developed under the project "Knowledge Management System for Agriculture Extension Services in Indian NARES". KVK Portal provides basic information and facilities of KVK, District Agricultural Contingency Plan, Upcoming, Ongoing and Past Events organized by KVKs, Package of Practices related to Crop, Horticulture, Animal, and Fisheries, access to agro-meteorological advisory and Agricultural Commodity Market prices to farming community. To avail these services through mobile, a KVK Mobile App for farmers has also been developed for Android smart phone users and is available in Google Play Store. Farmers can ask any farm related query to the experts in KVK and get solution for that. ATARIs and Agricultural Extension division of ICAR can monitor the activities of KVKs through the KVK Portal.

CBP Vortal: CBP Vortal has been designed and developed at IASRI to facilitate the 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. System is hosted at IASRI server and can be accessed from the URL cbp.icar.gov.in. Different modules have been created for different types of users (Trainee, Course Coordinator, CAFT Director, Managers (DDG/ADG) and Vortal Administrator). The system has in-built work flows for effective training management dealing with proposal submission, approval, financials, participant application to feedback submission and report submission at the end of the training program.

It provides a platform for knowledge sharing in the form of e-books generated from the training program. Regular support is being provided through E-mail/ Phone to the Course Director/ CAFT Director and participants of the training program. Approx 1300 e-mail were answered along with providing support through phone calls.

ICAR Personnel Management Information System

ICAR Personnel Management Information System has been designed, developed and implemented across ICAR. The system was 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.

The system has following functionalities:

- Ability to add, modify, retire, transfer scientists belonging to various cadres such as scientist, senior scientist, principal scientist, RMP positions (HoDs, Director, ADG, DDG,DG).Service details of all scientists were updated by individual scientists/PME in-charge. ERP ids of scientist were also mapped to their service details.

- Workflow based system for posting of newly appointed scientists from NAARM to various institutes. Workflow starts from online application of scientists, forwarded by Director NAARM, and then posting by Under Secretary, Personal after getting approval by competent authority. The first implementation of this module was executed successfully in March 2017. Prior to this, user accounts were created for all NAARM-FOCARS trainee in PMS

- Content management facility has been incorporated in the PMS to facilitate management of Discipline, Institute, Designation, Cadre Type, SMD, State, Sanctioned Strength and Transfer Cycles.

- Exhaustive filtering facility with sorting has been added in PMS to facilitate quick retrieval of records.

- AIPR (Annual Immovable Property Return) upload functionality has been added.

- Workflow based Transfer application module consisting of 5 types of transfer cycle has been developed and is ready to be implemented.

Support was provided across ICAR institutes to resolve reported issues from time to time like programming bug, deletion of wrongly uploaded AIPRs, change in sanctioned strength of institutes, discipline names, ERP ID etc.

Antimicrobial Peptide Prediction tool for aquaculture industries: Constant rise in microbial diseases in fish, plant, animal and human is alarming, thus discovery of their antidote is imperative. Use of antibiotic in aquaculture further compounds the problem by development of resistance, consequent consumer health risk by biomagnification. Antimicrobial peptides (AMPs) have been highly promising as natural alternative to chemical antibiotics. Though AMPs are molecules of innate immune defense of all advance eukaryotic organisms but fish being heavily dependent on their innate immune defense has been a good source of AMPs with much wider applicability. Machine learning based prediction method using wet lab validated fish AMP can accelerate the AMP discovery using available fish genomic and proteomic data. Earlier AMP prediction servers are based on multi phyla/species data, we report here the world's first AMP prediction server in fishes. It's freely accessible at http://webapp.cabgrid.res.in/ fishamp/. Total of 151 AMPs related to fish collected from various databases and published literature were taken for this study. For model development and prediction, N-terminus residues, C-terminus residues and full sequences were considered. Best models were with kernels polynomial-2, linear and radial basis function (RBF) with accuracy of 97%, 99% and 97%, respectively. We found that performance of Support Vector Machine (SVM) based models is superior to Artificial Neural Network (ANN). This in silico approach can drastically reduce the time and cost of AMP discovery. This accelerated discovery of lead AMP molecules having potential wider applications in diverse area like fish and human health as substitute of antibiotics, immunomodulator, antitumor, vaccine adjuvant and inactivator and also for packaged food can be of much importance for industries.

BanSatDB: Whole genome based database of putative and experimentally validated microsatellite markers of three *Musa* spp.: Banana (Genus *Musa;* Family *Musaceae*) has valuable nutritional content of vitamin C, B6, minerals and dietary fibre and is considered to be rich energy source due to carbohydrates accounting for 22-32% of fruit weight. Molecular markers have significant importance in crop improvement because of their usefulness in

population genetic studies. Availability of whole genome sequence and *in silico* approaches has revolutionised bulk marker discovery. *BanSatDb* (Banana Microsatellite Database) available at http://webtom.cabgrid.res.in/bansatdb/ report world's first banana whole genome marker discovery having 1.1 lakh markers from 11 chromosomes of *Musa acuminata*, 1.07 lakh markers from draft sequence of *M. balbisiana* and 1.24 lakh markers from recently published *M. itinerans* draft assembly, along with 580 markers mined from published literature. It has been developed using MySQL, Apache and PHP. User can retrieve markers through multiple search parameters like chromosome number, microsatellite type, repeat type, copy number, microsatellite length, pattern of the repeat motif itself and the location of the marker on the chromosome. These markers can be used for DUS test of variety identification and MAS in variety improvement program. They are

also proved to be helpful in classification of *Musa* germplasm to distinguish individual accessions and in the development of a standardized procedure for genotyping. These marker can also be used in gene discovery and QTL mapping. Database presents wide source for developing and implementing new approaches for molecular breeding, which are required to accelerate the crop productivity.

Developed an R-software package, termed as *minimalRSD*, for the generation of minimally changed run sequence for Response Surface Designs (RSDs) and hosted at https://cran.r-project.org/web/packages/minimalRSD/ index.html. This package consists of three series of designs viz., central composite designs (CCD) with full as well as fractional factorial points (half replicate) and Box Behnken designs (BBD) with minimally changed run sequences.

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 in the sequel.

Degree Coursed

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:

i)   Ph.D. (Agricultural Statistics)

ii)   M.Sc. (Agricultural Statistics)

iii) Ph.D. (Computer Application)

iv) M.Sc. (Computer Application)

v)   Ph.D. (Bioinformatics)

vi) 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 and Computer Application, are offered at this Institute while the courses in Agricultural Sciences are offered at 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)	07	05
2	M.Sc. (Agricultural Statistics)	07	06
3	Ph.D. (Computer Application)	03	00
4	M.Sc. (Computer Application)	06	04
5	Ph.D. (Bioinformatics)	05	00
6	M.Sc. (Bioinformatics)	05	05

Faculty members of P.G. School, IARI in Agricultural Statistics

S. No.	Name	Year of Induction
1.	Dr. U.C. Sud, Director	1995
2.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	1995
3.	Dr. Rajender Parsad, Principal Scientist	1995
4.	Dr. Anil Rai, Principal Scientist	1995
5.	Dr. K.N. Singh, Principal Scientist	2011
6.	Dr. Lal Mohan Bhar, Principal Scientist	1998
7.	Dr. Tauqueer Ahmad, Principal Scientist	1998
8.	Dr. Amrit Kumar Paul, Principal Scientist	1998
9.	Dr. A.R. Rao, Principal Scientist	1998
10.	Dr. Girish Kumar Jha, Principal Scientist (at IARI)	1999
11.	Dr. Cini Varghese, Principal Scientist	2000
12.	Dr. Himadri Ghosh, Principal Scientist	2004
13.	Dr. Prachi Misra Sahoo, Senior Scientist	2002
14.	Dr. Hukum Chandra, National Fellow	2003
15.	Dr. Amrender Kumar, Senior Scientist (at IARI)	2003

16.	Md. Wasi Alam, Scientist	2003
17.	Dr. Prawin Arya, Principal Scientist	2003
18.	Dr. Anil Kumar, Principal Scientist	2010
19.	Dr. Ranjit Kumar Paul, Scientist	2011
20.	Dr. Mir Asif Iqubal, Scientist	2011
21.	Dr. B.N. Mandal, Scientist	2011
22.	Dr. Susheel Kumar Sarkar, Scientist	2011
23.	Dr. Eldho Varghese, Scientist	2011
24.	Dr. Kaustav Aditya, Scientist	2012
25.	Dr. Bishal Gurung, Scientist	2013
26.	Dr. Sukanta Dash, Scientist	2013
27.	Dr. Arpan Bhowmik, Scientist	2014
28.	Dr. Ankur Biswas, Scientist	2015
29.	Dr. Ajit, Principal Scientist	2015
30.	Dr. Kanchan Sinha, Scientist	2016
31.	Dr. Anindita Datta, Scientist	2017

Faculty Members of P.G. School, IARI in Computer Application

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

Faculty Members of P.G. School, IARI in Bioinformatics

S. No.	Name	Year of Induction
1.	Dr. Anil Rai, Head (CABin)	2010
2.	Dr. A.R. Rao, Professor (Bioinformatics)	2010
3.	Dr. Rajender Parsad, Principal Scientist	2010
4.	Dr. Seema Jaggi, Principal Scientist	2010
5.	Dr. T.R. Sharma, Principal Scientist	2010
6.	Dr. T. Mahapatra, Principal Scientist	2010
7.	Dr. K.V. Bhat, Principal Scientist	2010
8.	Dr. S.S. Marla, Principal Scientist	2010
9.	Dr. Sudeep Marwaha, Principal Scientist	2010
10.	Dr. Kishore Gaikwad, Senior Scientist	2010
11.	Dr. T. Napolean, Senior Scientist	2010
12.	Dr. P.K. Singh, Senior Scientist	2010
13.	Dr. A.K. Mishra, Senior Scientist	2010
14.	Dr. U.B. Angandi, Senior Scientist	2014
15.	Dr. S.B. Lal, Scientist	2010
16.	Mohd. Samir Farooqi, Scientist	2010
17.	Ms. Anu Sharma, Scientist	2010
18.	Dr. Sunil Archak, Scientist	2010
19.	Dr. D.C. Mishra, Scientist	2010
20.	Dr. Sarika, Scientist	2010
21.	Sh. Sanjeev Kumar, Scientist	2010
22.	Dr. Mir Asif Iquebal, Scientist	2013
23.	Dr. Monendra Grover, Senior Scientist	2013
24.	Dr. K.K. Chaturvedi, Scientist	2014

Dissertations Approved

Ph.D. (Agricultural Statistics)

i) **Name of Student: Kader Ali Sarkar**
Guide: Dr. Seema Jaggi

Roll No.: 9946

Thesis Title: Experimental designs for comparing two disjoint sets of treatments in the presence of systematic trend

In agricultural experiments, there may be situation where the interest is to test a set of new varieties of a crop with already existing varieties that are known to be good for different purposes and conditions and to determine which of the varieties perform better in comparison to the existing varieties. In such situations, block designs that estimate the treatment contrast, between treatments from two different sets, more precisely are desirable and such designs are known as Balanced Bipartite Block (BBPB) designs. However, in agricultural field experiments conducted in smaller units with no gaps, the estimates of treatment differences may deviate because of the interference from the treatments applied in neighbouring units. For example, the response on one plot may be affected by the insecticides applied to that plot and also insecticides applied to its neighbouring plots. This interference from neighbouring units can contribute to variability in experimental results and lead to substantial loss in efficiency. Also, presence of systematic

trend in the experimental design may affect the performance of the experiment. In order to manage such situations, a suitable arrangement of treatments over plots within a block has to be made such that the arranged design is balanced for neighbouring treatments and is capable of completely eliminating the effects of trend. This thesis deals with BBPB designs with or without neighbour effects incorporating trend component. The information matrices for estimating direct as well as neighbour effects incorporating trend component have been derived. The conditions for a block design with neighbour effects to be trend resistant have also been obtained. Further, methods of constructing Trend Resistant BBPB designs (TR-BBPB) and Trend Resistant Neighbour BBPB designs (TR-NBBPB) have been discussed. TR-NBBPB designs so obtained are totally balanced for estimating direct and neighbour effects of treatments. The general efficiency balance properties of these designs have been studied. Two series each of TR-BBPB and TR-NBBPB designs are found to be general efficiency balanced. SAS codes have been developed to obtain the information matrix and variances of contrasts for TR-BBPB and TR-NBBPB designs.

ii) **Name of Student: Mrinmoy Ray**
   Guide: Dr. Anil Rai

   Roll No.: 9948

   Thesis Title: A study on technology forecasting in agriculture

   In this study, four Technology Forecasting (TF) tools viz., Trend Impact Analysis (TIA), Analytical Hierarchical Process, Goal-Objective Strategy (GOS) tree and Grey modeling technique have been studied in the field of agriculture. In TIA a new approach is proposed using time series intervention model. In this proposed methodology data requirement is less, all-possible number of scenarios can be generated, Monte Carlo simulation is not required and scenarios can be easily modified. This proposed approach has been empirically illustrated for wheat yield scenario at All-India level. For this, three pre-specified events/ technology impacts have been considered, as if they were said to occur in future in the long run. The events are, heat tolerant wheat variety breeding technology, rust

resistant wheat variety breeding technology and increase in temperature (event). In these events, first two will have positive impacts, third will have a negative impact. Apart from this in baseline forecasting the first step of TIA a new hybrid model is developed combining Autoregressive integrated moving average (ARIMA) and Wavelet Neural Network (WNN). As a case study, wheat yield of India has been considered to evaluate the forecasting performance of the proposed hybrid model. The proposed method is superior as compared to ARIMA and existing hybrid ARIMA-ANN approach for the considered time series. Fuzzy AHP is modified which can compute the priority weight by directly dealing with the data provided by experts without requirement of pairwise comparison matrix. GOS tree was employed to compute the priority weight for the same datasets as in case of fuzzy AHP. Comparison of fuzzy AHP and GOS tree reveals that in some criteria's fuzzy AHP was better than GOS tree and for some criteria's they are at par. Grey model was utilized for forecasting hybrid rice yield of Bihar state of India. In addition, genetic algorithm technique was employed to find the optimal parameters of the model. It is observed that implementation of genetic algorithm improved the precision of the model.

iii) **Name of Student: Pradip Basak**
    Guide: Dr. U.C. Sud

    Roll No.: 10253

    Thesis Title: Use of calibration approach for estimation of finite population regression coefficient involving two-stage sampling design

    Survey data are generally multivariate in nature and therefore, many a times, the objective of the survey is to establish the pattern of relationship between variables rather than estimation of simple parameters like means or totals. When the variables are quantitative in nature and the interest is to find causal relationship then regression analysis may be an appropriate method. The well-known ordinary least squares approach for the estimation of regression coefficient is based on the assumption that sample elements are independent and identically distributed. This assumption of independence holds good if

the data are collected through simple random sampling with replacement design. But it does not hold good for others sampling schemes. Now a day, most of the survey designs are complex in nature involving stratification, unequal probabilities of selection, clustering, multi-stages and multi-phases etc. From the regression analysis point of view, any deviation from independence assumption leads to complications in the form of error variance-covariance model. In addition to this the classical finite population sampling theory, also requires survey weight of sample elements to be incorporated in the regression analysis of survey data. Modified approaches such as to use sampling design weights in the estimation procedure has been used by Kish and Frankel (1974). If there is availability of auxiliary information along with the variables under study then the theory of calibration approach can be used for estimation of finite population regression coefficient in the case of two-stage survey design which is widely used in large scale surveys. We proposed three different calibrated estimator of population regression coefficient based on the availability of auxiliary information at the PSU and SSU level. The expression for its variance and variance estimator is also obtained using Taylor series linearization method. We demonstrated the improved performance of our proposed estimators as compared to existing estimator using a real data based simulation study.

iv) **Name of Student: Achal Lama**
     Guide: Dr. Girish Kumar Jha

     Roll No.: 10256

     Thesis Title: Investigations on Bayesian multivariate time series models

     The use of Bayesian framework in time-series modelling has gained a lot of popularity in recent years, mainly due to its advantages over the classical estimation techniques and also the advances in computing facilities which aids the computation of posterior densities much more easily. In this study, efforts were made to model the multivariate time-series data using VAR, MGARCH and ANN models under Bayesian framework. In case of BVAR model, we optimized the values of the hyper-parameters using Genetic Algorithm (GA) for three prior specifications

namely Minnesota, Normal-Wishart and Independent Normal-Wishart and further the forecasting performances of the model were also compared with the baseline specification of each prior in terms of RMSE. The BVAR model with optimized hyperparameters of the priors outperformed the model with baseline prior specification in terms of forecasting performance. The prediction ability of volatility spillover of the MGARCH model was studied under Bayesian and classical estimation procedure using BEKK specifications. In addition to it, we also identified the correlation structure of the volatility process that existed in the series under study using the estimates of DCC model under Bayesian and classical framework. We found superior performance of the Bayesian framework for both variants of MGARCH model. Further, effort was also made to study the ANN model under Bayesian paradigm for multivariate time-series data and a complex biological data set. For both the data sets, Bayesian regularized ANN model outperformed the simple ANN model in terms of RMSE in training and testing set. Thus, from this study we could conclusively infer that the models estimated under Bayesian framework provided superior results as compared to the models estimated by classical approaches.

v) **Name of Student: Himadri Shekhar Roy**
    Guide: Dr. L.M. Bhar

    Roll No.: 10257

    Thesis Title: Study of nonlinear statistical models for pest population dynamics in northern region of India

    Agriculture is full of uncertainties, so, reliable and timely forecasts provide important and useful input for proper, foresighted and informed planning and management. Generally pests, diseases and adverse weather are emerging as an added threat to the production. Under the changed scenario today, forecasting of various aspects relating to agriculture are becoming essential. In time series framework, we may often find correlated count observations. To deal with discrete variate time series INAR model is well developed. In the present study, INAR model is introduced and different properties are described. Prediction has been done to evaluate the performance of the model and also compared with Poisson regression.

It is seen that INAR model is better than Poisson regression. In agriculture, we often encounter the problems where the response variable is categorical in nature.i.e.we do not get quantitative data rather some gradation. For example, pest/disease population is categorized like severe, mild, occurrence or nonoccurrence etc. When one level is nested on another level, such type of design is called multilevel or nested design. For analysis of categorical data, logistic regression model is most appropriate, because it has a nice interpretation in terms of odd ratio also. In case of multilevel categorical data analysis, some of the categories may become very small owing to limited number of observations. This is a main problem in multilevel categorical data analysis, because in such case, estimation becomes difficult because of small size of a category. Keeping all these in mind, the estimation in multilevel categorical data with small samples has been proposed. The logistic regression fails to model binary data from clustered, multi-level because of dependency among the observations. Under such situation, random effects can be included in the linear predictor of the logistic regression model to allow for correlated responses. The Bayesian paradigm provides a natural approach to inference in mixed models. We consider that the response variable is binary in nature. We assume different prior distributions for the random intercepts parameters. Odd ratio and median odds ratio is calculated and comparison has been done. Appropriate programs for the detailed study is written in SAS and R software.

M.Sc. (Agricultural Statistics)

i)   **Name of Student: Priyanka Anjoy**
     Guide: Dr. Ranjit Kumar Paul

     Roll No.: 20515

     Thesis Title: Wavelet methods for forecasting volatile agricultural conmmodity prices

Theoretical and empirical researches on time-series modeling and forecasting is rapidly emerging, whereas agricultural price forecasting is one of the challenging areas in this domain. The observed features of many temporal price data set constitutes asymmetric volatility, nonlinearity, non stationarity and modeling all these features often goes beyond the capability of single forecasting models, namely Autoregressive integrated moving average (ARIMA), Generalized autoregressive conditional heteroscedastic (GARCH) or Artificial neural network (ANN). Due to the limitations of the traditional statistical approach that is generally used for dealing with non-stationary and nonlinear characteristic, the decomposition approach is gaining popularity. In search of an improved alternative to the classical econometric tools in the financial markets prediction, implementing wavelet based hybrid approach for modeling volatile price series has been discussed thoroughly. Maximal overlap discrete wavelet transform (MODWT) is advocated to represent the series at multi-resolution level and combined with GARCH or ANN class of models to outperform the individual forecasting results. The investigation reveals that proposed Wavelet-GARCH and Wavelet-ANN hybrid models have outperformed over the individual forecasting models up to a greater extent. The price of different agricultural commodities namely wholesale price of Onion, Potato and Tomato in different markets of India and also the export price of Onion form India has been considered for the present investigation. Modeling strategy and out-of-sample forecasts has been provided for the price data sets along with relevant discussion, results and inferences. The comparison of different forecasting models has been done on the basis of Relative mean absolute prediction error (RMAPE), Mean square prediction error (MSPE), Root MSPE (RMSPE) and also by using Diebold-Mariano (DM) test statistic. The study reveals the relative ability of hybrid models in volatility forecasting and particularly the efficiency of denoising approach rendered by wavelet transform.

ii) **Name of Student: Kuldeep Aswal**
     Guide: Dr. Seema Jaggi

     Roll No.: 20516

     Thesis Title: Designs for diallel cross experiments incorporating neighbour effects

Plant breeding programmes are conducted to study genetic properties of inbred lines involved in the crosses in order to develop improved crop varieties. Through these

programmes, combining capacities of the lines are studied. Diallel cross plans are the most commonly used plans to study the combining abilities of the lines which includes the general combining ability (gca) and specific combining ability (sca). The gca of an inbred line is the average performance of the hybrids which this line produces with other lines chosen from a random mating population and the sca refers to a pair of inbred lines involved in the cross. Generally, in breeding experiments, where the treatments are the crosses that are laid out in block design setup, it is assumed that the observations from each plot receiving a cross is not affected by any other sources. However, there may arise neighbor effects from the crosses in the adjacent neighbouring plots in a block i.e., the response on a given plot is affected by the crosses on the neighbouring plots. For such situations, neighbour balanced designs are used. A block design for diallel crosses is said to be neighbour balanced if each line has all the crosses appearing as neighbours equal number of times. This study deals with obtaining block designs for complete and partial diallel cross experiments balanced for neighbour effects. Series of complete and incomplete block designs for complete diallel crosses have been obtained and are found to be variance balanced. Another series of block designs are obtained for partial diallel crosses and the designs are found to be partially variance balanced depending on the association scheme used for obtaining partial diallel crosses which are group divisible, triangular and circular association schemes in this study. A SAS macro has been developed that generates complete block designs for complete diallel crosses balanced for neighbour effects. A catalogue of designs for number of lines ≤ 20 has been prepared listing the parameters of the designs. SAS code using PROC IML for generating the information matrix for diallel cross incorporating neighbour effects has been developed. Incorporating neighbour effects into the model for diallel cross results in more precise estimation of gca effects.

iii) **Name of Student: Gopal Saha**
Guide: Dr. L.M. Bhar

Roll No.: 20517

Thesis Title: Detection of outliers in linear time series in agricultural data

The poper analysis and accurate interpretation of time series data related to agriculture like yield data, price data or export data is an important concern among both farming community and policy makers. Presence of outliers is most common in these data series. The conclusions drawn through analyzing the data series having outliers may be erroneous. It is, therefore, important to identify the time points where outliers are present and then remove the effect of the outliers from the corresponding residual series. In this study, an iterative method based on the procedure proposed by Chang and Tiao (1983) along with use of robust estimate of error variance is presented. The power of this iterative procedure in detecting outliers is also investigated. The methodology is illustrated using monthly wholesale price index data of several agricultural commodities like onion, tomato etc. and the price data of ripe-mango from the district of Howrah, West Bengal. The result of the study clearly indicates that the multiple outlier detection technique using the robust estimate of error variance can successfully detect all the outliers present in the data series. In this study, another attempt is made to detect outliers in presence of masking. As detection of multiple outliers is very difficult in presence of masking, therefore an iterative method is studied that includes the joint test for patches of additive outliers in order to solve the problem of masking. This unmasking technique is based on the method proposed by Sanchez and Pena (2003). The power of the unmasking procedure is also judged using the above mentioned data series. All the results of this study indicates that use of the iterative procedure of outlier detection along with the above mentioned unmasking procedure can successfully detect all the correct outliers even if masking is present in that data series.

iv) **Name of Student: Amit Saha**
Guide: Dr. K.N. Singh

Roll No.: 20518

Thesis Title: Integration of single exponential smoothing with state space formulation

Most of the time series models including

ARIMA model are written in state space form and estimate the parameters using Kalman filter technique, which is a promising approach to deal with time-dependent parameters. A heartening feature of Kalman filter is that it provides the minimum mean squared error (MMSE) estimates for linear model. On the other hand, single exponential smoothing (SES) is the most popular and widely used method among all the exponential smoothing techniques. The reasons for its popularity are that it is simple to understand, easy to implement with a simple numerical program and can provide a good forecast. The present study is an attempt in this direction, where the basic equation of SES is used as the state equation and parameters are estimated using Kalman filter in conjunction with Prediction error decomposition form of the likelihood. It has been shown that the use of state space formulation along with SES and Kalman filtering gives better prediction accuracy when compared to using SES alone. This has been illustrated with different application to agricultural field. The results show that, with the same input data, the state space approach of exponential smoothing yields better prediction results with lesser MSE, mean absolute error (MAE) and mean absolute percentage error (MAPE) compared to using SES alone. This integration of SES with state space formulations in agricultural field will open a new era in agricultural forecasting.

v) **Name of Student: Subhrajit Satpathy Guide: Sh. S.D. Wahi**

    Roll No.: 20519

    Thesis Title: Splice site prediction in agricultural organism based on Pre-mRNA secondary structure information and sequence based features

Almost 70% of total population in India depends on agriculture for their livelihood. Among the important agricultural organisms in India, it is rice within the food grains and cattle within animals. India stands first in milk production and second in rice production following China worldwide. Thus, understanding their genomes and unrevealing the hidden information in it, will help enable the genetic improvement of these agricultural organisms resulting an increase in the corresponding agricultural products. Thus,

annotation of their genome is an essential task for this purpose. One of the important steps in genome annotation is the prediction of splice sites in a gene. Though, a lot of work has been done on the prediction of donor and acceptor splice sites, still there is a need to develop a more accurate and reliable method for acceptor splice site prediction. Further, most commonly used splice site prediction methods do not consider the secondary structural elements of mRNA. Hence, here an attempt has been made to compare the performance of the proposed acceptor splice site prediction method with and without including secondary structure features along with sequence based features. Initially, the cattle genome is collected from UCSC genome browser and the rice genome is collected from TIGR FTP site. The features of pre-mRNA secondary structure for 3'splice site prediction is studied and 3'splice site prediction accuracies is compared under inclusion and exclusion of pre-mRNA secondary structure information. The proposed method involves the use of the SVM classifier which is implemented using the "e1071" package of R- Software. The results shows that the values of performance metrics like sensitivity, specificity, precision, recall etc. increase when the secondary structure of splice site is considered. Further, APR and nucleotide density features along with secondary structure features are found to give better accuracy of approximately 90% with the SVM classifier. The above study proves that including the secondary structure along with sequence based features, increases the performance accuracy of the prediction methods. In addition, the proposed approach can be used as a complementary method to the existing acceptor splice site prediction methods.

vi) **Name of Student: Nobin Chandra Paul Guide: Dr. Prachi Misra Sahoo**

     Roll No.: 20520

     Thesis Title: Statistical techniques for discrimination and acreage estimation of fruit crops using hyperspectral satellite data

Horticultural crop plays a unique role in India's economy therefore reliable and timely estimates of area under horticulture crops are

of vital importance. Present methods of crop acreage estimation rely heavily on sample survey approach which is time consuming for a diversified and large country like India. Modern space technology with the advance tools of Remote Sensing, GIS and GPS may be an alternative option for estimating area under horticultural crops. The advantage of using satellite data is that it provides both synoptic view and the economies of scale, since data over large areas could be gathered quickly from such platforms. Generally till now, multispectral remote sensing data has been used for effectively discriminating field crops and estimating area under crops. But major limitation of multispectral data is lesser number of bands which may not be able to discriminate fruit crops. Hyper spectral data has relatively large number of bands which helps in discriminating fruit crops easily and more effectively. This study has been undertaken to investigate statistical techniques for discrimination of fruit crops and to estimate the acreage and map existing orchards of fruit crops using hyperspectral satellite data. The four tier hierarchical statistical techniques has been proposed for discrimination of fruit crops which includes one way ANOVA, CART, Jaffries-Matusita (J-M) Distance and Linear Discrimination Analysis (LDA). Initially starting with 2151 band, after ANOVA these bands were reduced to 1876 and were further reduced to 10 after using CART. J-M distance analysis was performed on these ten wavebands to check whether these wavebands could discriminate different fruit crop pairs. The overall accuracy was assessed using LDA. The study has been conducted on three areas which include Sabour in Bihar, Meerut in Uttar Pradesh and IARI, New Delhi. Further the area under mango orchards was estimated using hyper spectral image of Meerut district. The estimates were compared with actual area under mango orchards measured using Global Positioning System (GPS) and the total area under mango was predicted. This study concludes that hyper spectral data has more discriminative power than the multispectral data for discriminating fruit crop. The proposed four tier statistical method can be utilized efficiently for discrimination of fruit crop orchards. The study also reveals the scope of hyper spectral remote sensing in acreage estimation of fruit crops.

M.Sc. (COMPUTER APPLICATION)

i) **Name of Student: M Ashraful Haque
Guide: Dr. Sudeep Marwaha**

Roll No: 20536

Thesis Title: Mobile app for information retrieval on pest and disease in crops

In last few years, tremendous improvement has been seen in the field of mobile technology. This enhancement has made the smart phones and mobile apps, an integral part of human life. These days, the smart phones and mobile apps have made remarkable changes in all sectors of the Indian economy. The mobile apps are being used everywhere from highly developed cosmopolitan cities to the rural villages. In this study, an attempt has been made to develop a mobile application named 'AGRIdaksh' for the Indian farmers. This mobile application is aimed to provide timely and valid information to the farmers about the problems related to the crop protection such as diseases, insect-pests, nematodes, weeds and physiological disorder. This app can also help the farmers in selecting proper insect-pests resistant and disease resistant varieties of different crops. The farmers are able to send their queries along with images and videos related to crop protection to experts and the agricultural scientists. This is a two-step process. In the first step, farmers' queries are stored in the database according to the selected domain such as diseases/pest/varieties. In the second step, experts can view the query along with images/videos and then can suggest possible solution of the problems. In this thesis, the 'AGRIdaksh' app has been developed on the android platform with minimum SDK version of API 15: Android 4.03 (Ice Cream Sandwich). The application is based on the n-tier architecture of the software development. The client-side interface is the android application itself which is implemented by the JAVA programming language and XML. The next layer is a web service layer that act as an intermediate interface between the android application and the database in the server. The web service has been developed in JAVA programming language. The server side layer contains core classes like database connection, the connection between other layers. The database layer contains the data of

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the maize crop related to the crop protection, varieties, farmer queries and user details. Several APIs such as kSOAP2 API, JDBC API has been used for interconnection among various layers. The application has been tested for the maize crop and provided the intended results as specified. The developed android application 'AGRIdaksh' would be of great use to the farmers to deal with crop losses due to the biotic agents and making farming a profitable venture.

ii) **Name of Student: Shbana Begam**
   Guide: Dr. Rajni Jain

   Roll No.: 20537

   Thesis Title: Web based information system on groundwater resources

   Groundwater is a promising but limited resource. According to official reports, our country is facing acute problem regarding over-exploitation of groundwater in Punjab, Haryana and western part of UP whereas in Eastern part of the country underutilization of groundwater is recognized. Information related to groundwater resources are available from different sources and in a different format. Mostly, it is in the form of published reports either in pdf format or printed media. A web-based system of groundwater resources is built to solve the problem of data which is available in heterogeneous format and observation well wise. Observation on well are made at different places to record the groundwater data. The application has been developed using NetBeans IDE with Java programming language. Client side interface is implemented using HTML, CSS and JavaScript. Server side has been implemented using JSP for providing platform independence and dynamic nature to the software. SQL Server 2012 has been used for creating the database. Application will be hosted on Apache Tomcat web server. Some features of the developed software called GIS (Groundwater Information System) includes good security by means of authenticated login, two categories of users (admin and client), comprehensive reporting facilities in the form of district wise, cluster wise, basin wise based on search criteria of year and state. Database maintenance activities like update, delete and insertion can be done by authorized admin. The software has been validated using ground

water resources data from Odisha state. In future, software can be upgraded by developing mobile based application and or integrating software with modules for developing clusters.

iii) **Name of Student: Parvez Mallick**
    Guide: Dr. A.K. Choubey

    Roll No: 20538

    Thesis Title: Mobile application for plant quarantine regulations to import in India

    India is a very large country where 69% of total population depends on Agriculture. Agriculture has a great role in Indian economy because it contributes significantly about 14.8% in 2013-14 to the Gross Domestic Product. The percentage share of import and export of plant commodities have been of the order 3.22% and 13.79% of national import and export in 2013-14. There has always been the possibility of moving exotic insect pests, diseases and weeds from other country to India. Exotic pest and diseases introduced into India cause a huge damage to Indian agricultural trade. For these reasons to prevent the introduction of various exotic pests, diseases and weeds from other countries or within states of country, legal restrictions are enforced which is commonly known as Plant Quarantine. Plant Quarantine regulations at national level are known as Domestic Quarantine as well as at international level known as Foreign Quarantine. The implementation of the quarantine measures are assisted by legal approval, called quarantine laws. It acts as an important technique or procedure to exclude exotic pests from the crop. Efficient implementation of quarantine is extremely emphasized to manage pests, consequently which helps in sustaining the productivity of crops. Now mobile phones are very much preferable to the common men. Information can easily be shared through the mobile application. At present Plant Quarantine import regulations are presented in pdf form hence it is a tedious process for the user to find their specific requirement. It is very hard to know for an importer at any situation about this regulations whether any plant commodity is prohibited or allowed to import in India. Thus the need arises to provide the information in searchable manner. Import regulations are enlisted in four schedules with justification, condition, additional declaration

on the basis of Commodity, Country of origin of the commodity, Category of the Commodity, Plant Part of the Commodity. This thesis presents the requirement analysis, design, development and testing of an android based mobile application with different features which provides information about import regulations related to Commodity, Country Of Origin, Category, Plant Part which is promulgated by the Directorate of Plant Protection, Quarantine & Storage, Department of Agriculture, Cooperation & Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India to prevent the entry and spread of dangerous pests and pathogens.

iv) **Name of Student: Sonica Priyadarshini Guide: Dr. Alka Arora**

Roll No.: 20539

Thesis Title: Mobile application for chlorophyll content estimation in rice

Agriculture plays a vital role in India's economy. As India's economy is dependent on agriculture therefore focus is on increasing the productivity. The abiotic environmental factors affect the crop growth and yield. Chlorophyll content is an important parameter which acts as an indicator of plant growth, deficiency of major nutrients and plant health. Nitrogen (N) is a key element found in chlorophyll molecules. Chlorophyll content is almost proportional to N content of the leaf. Rice is one of the main food crops of India thus ICAR-Indian Agriculture Research Institute (IARI) is conducting different experiments on rice varieties to study the affect of abiotic factors in different conditions. In order to effectively store, analyze and share different experimental data related to phenomics parameters, a system with the name mPhenoDB has been developed at ICAR- Indian Agricultural Statistics Research Institute (IASRI). mPhenoDB system can store data in different formats (image, records, files). This web based system has the provision for storage and analysis of image data for leaf area estimation and chlorophyll content estimation. With the realization of usage of smart phones the idea of development of mobile application was taken up in this study to facilitate non-destructive method based on image analysis for chlorophyll estimation. The mobile based application for estimation of

chlorophyll content has been developed using N-tier architecture: Client Side interface Layer (CSIL), Web Service Layer (WSL), Server Side Application Layer (SSAL) and Database Layer (DL). Mobile application has been developed for Android platform. Application is user friendly and users can easily get the quick reference of chlorophyll estimation with click of a button. The application interface provides information and action for capturing and cropping pictures for users. Correspondingly RGB count and Chlorophyll content is estimated. This application is feasible to run on any device with Android platform. Application design is generic which can be extended to other formulae and different crops.

M.Sc. (Bioinformatics)

i) **Name of Student: Ms. Soumya Sharma Guide: Dr. Sunil Archak**

Roll No.: 20531

Thesis Title: Identification and characterization of enhanced disease susceptibility(EDS1) in Solanum melongena using in silico analysis

Brinjal is an important vegetable crop of India. Despite the importance of brinjal there is little molecular and genetic information available for Brinjal. As a vegetable crop, brinjal suffers from major crop losses due to pests and diseases. Recent advances in genetic engineering technologies for example target specific genome editing using CRISPER/cas9 have empowered the scientific community with the most important weapon for modulating genomes for desired phenotypes. It requires detailed information of the gene and its function for being a suitable candidate for genetic editing. Enhanced Disease Susceptibility1 (EDS1), a key regulator of plant defense could become a suitable target for gene editing to manipulate host resistance. Arabidopsis thaliana EDS1 (AtEDS1) is the most deeply studied EDS1 protein with crystal structure in PDB (4NFU). In the present study an attempt to extract detailed information regarding this protein in brinjal has been done. Brinjal EDS1 (SmEDS1) protein coding sequence is extracted from brinjal genome database using tblastn taking AtEDS1 as a query sequence. Prediction of the coding sequence refined

with the help of transcriptome assembly data. *SmEDS1* gene has been found in the contig Sme2.5_09498.1 of eggplant draft genome assembly. The gene has 1806 nucleotide long coding sequence encoding for 602 amino acid long protein. The gene has the most common architecture with three exons as compared to EDS1 protein coding genes from other families. The comparative analysis of SmEDS1 protein along with 46 other species EDS1 proteins proved the strong sequence and structural conservation of this protein among plants. The incongruence in the sequence and structure based phylogenetic trees was observed that could be attributed due to the influence of difference between global alignment and conservation of sequence signatures or it could be possibly explained by the fact that sequences are related by phylogeny whereas structures by constraints on their functions and regulations. Deeper analyses of phylogenetic relationships based on EDS1 will facilitate its genetic manipulation for agronomic purposes.

ii) **Name of Student: Nalinikanta Choudhury**
    Guide: Dr. Sudeep Marwaha

Roll No.: 20532

Thesis Title:An in-silico study on synteny between cattle and buffalo genome

Among the livestock animals in India, cattle and buffalo are highly important that contribute a lot to the livestock industries and in turn to the economy of the country. Various genomic improvement programs are being carried out throughout the country for the improvement of cattle and buffalo breeds. Genome sequencing of both the species are almost complete. Though the cattle genome is well finished, the buffalo genome is only drafted and that too with very small coverage. From the unfinished genome of buffalo, it is highly necessary to find out the agriculturally important genes. This is only possible by annotating it's genome by a comparative analysis with well finished genome of cow, a member of its own family. Nowadays, Genome browsers are very popular in the field of genome annotation by facilitating the graphical visualization of genomic elements on the genome and comparison of the genome of two or more organisms. Though the cow genome browser has already been developed with Btau_4.0, not a single genome browser

is available for buffalo in the public domain. Thus, in this study an attempt has been made to develop the buffalo genome browser, cow genome browser with an updated version of genome and one synteny browser to map the homologous contigs of both the animals using GBrowse software. The GBrowse is configured with MySQL at the back end, Apache web server at the front end for visualization and a middle layer of Bioperl modules for genome annotation purposes. The developed browsers are believed to help the research communities to gather the knowledge about cattle and buffalo genome and the homologous genes present between the two species. This will also help to annotate the unknown genes of buffalo genome which is not well annotated till date. Further, the annotation of buffalo genome will help the breeders to know the genes responsible for agriculturally important trait which in turn will help in the development of trait specific buffalo breeds.

iii) **Name of Student: Anubhav Roy**
     Guide: Dr. Seema Jaggi

Roll No.: 20533

Thesis Title: Study on change points in genomic sequences

The genomes of complex living organisms are profoundly organized. Sometimes heterogeneity in relation to a particular biological property or more than one property prevails throughout the sequence of an organism. These properties may be GC (Guanine-Cytosine) content, copy number variations, Single Nucleotide Polymorphism (SNP) frequency etc. It means some areas on the genome are distinct. These kinds of areas are termed as segments with minimum heterogeneity within segments and maximum heterogeneity between segments and are useful assessing procedure to characterize a sequence data. Many higher organisms show such segmental pattern of variation and GC content of genome is known to follow such segmental pattern of variation. Change-points describe the boundaries between two dissimilar segments and help to understand biological locations of the start point of heterogeneity within a sequence of genome. In the present study, sliding window methodology has been developed and used to divide the

heterogeneous genome into many segments and identify the change points/ change-point intervals. A single chromosome (number 5) of Rice and whole genome of Escherichia coli has been considered to detect the region where significant changes are occurring regarding GC content. Observations on GC content are taken by selecting an appropriate window size of the data. Different segment sizes and sliding sizes are defined, appropriate probability distribution is fitted to the data of each segment and the parameters of each segment are estimated. Similarity between segments is checked sequentially based on the parameter chosen. Appropriate test procedure is applied to test the significance of the parameters of two neighbouring segments. The non-significant segments are combined and accordingly change-points/ change-point intervals between two dissimilar segments are determined. This process is continued for all the segments until the last change-point is found. It is found that as the sliding size increases, the number of significant segments increases. A SAS macro has been developed to execute this procedure by defining different segment sizes and sliding sizes. The significant sequences were subjected to BLAST (Basic Local Alignment Search Tool) to identify the total number of genes in each segment.

iv) **Name of Student: Sandeep Kumar Verma**
   Guide: Dr. Mir Asif Iquebal

Roll No.: 20534

Thesis Title: Deciphering genes associated with root wilt by RNA-seq approach in coconut (Cocos nucifera)

In coconut, scientifically known as *Cocos nucifera* from the family Arecaceae, Root Wilt Disease (RWD) caused by phytoplasma is the major biotic stress leading to greater economic loss. The paired end Illumina HiSeq 2000 transcriptome data of RWD resistant and susceptible coconut varieties from public domain were used for identification of differentially expressed genes along with their annotation to see the pathways associated with plant immunity against RWD. De novo assembly using trinity and CAP3, followed by abundance estimation was done. Assembly resulted in 395554 contigs and N50 value of 1901 bp. We got 22021 differential expressed

genes and 133 pathways from KEGG analysis. Also, disease resistant genes such as NBS-LRR domain, PR1, PR4, pathogenesis-related genes transcriptional activator PTI5-like gene, thaumatin-like protein, HSP70 and glutathione S-transferase were also found in the study.MAPK-3, MAPK-5, MAPK-13 and transcriptional factors *viz.,* WRKY, bZIP, MYB, TCP and RLK were also found in the study. The identified novel transcripts as well as differential expressed genes which play an important role in crop defense against root wilt disease will be of great use for coconut breeders in improvement program. The findings of this study can be used further for genomic enrichment of coconut palm once its whole genome is sequenced.

v) **Name of Student: Bulbul Ahmed**
   Guide: Dr. Mir Asif Iquebal

Roll No.: 20535

Thesis Title: Development of transcriptome signature of different stages of Lac insect (Kerrialacca)

The natural gift, *she*llac, mainly grown in south east Asian countries, is the resinous substance produce by Lac insect (Kerria lacca). It has wide applications in surface coating industry, adhesive industry, electrical industry, pharmaceutical industry, confectionery industry, cosmetics industry etc. The paired end Illumina data of Kerria lacca of four stages, viz., larva, crawler, fertilized female and adult stages from public domain were used for identification of differentially expressed genes at different stages of lac insect along with their annotation. De novo assembly was done using trinity, followed by abundance estimation and identification of differentially expressed genes. Assembly resulted in 157017 contigs and N50 value of 1374bp. All pair-wise combinations of stages were made to identify the differentially expressed genes. Further, stage specific differentially expressed genes were identified on the basis of fold change value and p-value less than 0.05. At all the four stages, 40 signature differentially expressed genes were identified. 3, 7, 20 and 3 pathways were identified at larva, crawlers, fertilized female and adult stages, respectively. A total of 80,761 SSRs, 110289 SNPs and 10657 Indels were also identified from all the four

combined stages. The genomic enrichment of lac insect in terms of markers' discovery, stage specific genes, and pathway studies targeting commercially important bio-molecules from this study would be useful for lac breeders. Our study reports the first massive genomic resource for lac. Since the whole genome of lac insect is not available, the findings of this study will supplement the genomic information of whole genome sequencing in future.

Awards to Students

- Ms. Priyanka Anjoy: (M.Sc., Agricultural Statistics) IARI Merit Medal 2017

- Shyamsunder Parui (Agricultural Statistics)

  ➢ Nehru Memorial Gold Medal 2016 of IASRI for being Best M.Sc. (Agricultural Statistics) Student during the Annual Day of the Institute

  ➢ Best M.Sc. Thesis 'Construction of Latin hypercube designs' from Society of Application of Statistics in Agriculture and Applied Sciences (SASAA), BCKV, Mohanpur, WB

- Supriya Purru (Bioinformatics): First Best Poster Award during 70th Annual Conference organized from 21-23 November, 2016 at ICRISAT, Hyderabad on the following paper:
  P, Supriya, S, Sarika, R, Saurabh, Rao, AR, and Bhat, KV. Genome wide mining of microsatellites in sesame (Sesamum indicum L.)

- Shwetank Lall (Agricultural Statistics): Second Best Poster Award during 70th Annual Conference organized from 23-25 November, 2016 at ICRISAT, Hyderabad on the following paper:
  Lall, S, Jaggi, S, Varghese, E, Varghese, C and Bhowmik, A. On construction of D-optimal designs for logistic regression model.

- Arfa Anjum (Bioinformatics): Third Best Poster Award during 70th Annual Conference organized from 23-25 November, 2016 at ICRISAT, Hyderabad on the following paper:
  Anjum, Arfa, Jaggi, Seema, Varghese, Eldho, Lall, Shwetank, Rai, Anil, Bhowmik, Arpan, Mishra, D.C. and Sarika. Mixture distribution approach for identifying differentially expressed genes in microarray data of Arabidopsis thaliana.

- Asif Khan (Bioinformatics): Nehru Memorial Gold Medal 2016 of IASRI for being Best M.Sc. (Bioinformatics) Student during the Annual Day of the Institute.

- PN Somanna (Computer Application): Nehru Memorial Gold Medal 2016 of IASRI for being Best M.Sc. (Computer Application) Student during the Annual Day of the Institute.

Annual Day Celebrations

The Annual Day of the Institute was celebrated on July 2, 2016. Dr. T.C.A. Anant, Secretary and Chief Statistician of India presided over the function and Dr. Ramesh Chand, Member Niti Aayog, Delhi delivered the Nehru Memorial Lecture. Dr. Kanchan Kumar Singh, Assistant Director General (Farm Engineering), ICAR, New Delhi was the Guest of Honour.

Teacher's Day

The Teacher's Day was celebrated on 5th September, 2016 in which Dr. S.D. Sharma was Chief Guest and Dr. V.K. Sharma was the Honoured Teacher.

Research Fellowships

During 2016-17, 44 Ph.D. and 36 M.Sc. students received research fellowship. 32 Ph.D. students received IASRI fellowship at the rate of Rs.13,125/- p.m. in addition to Rs 10,000 /- per annum as the

contingent grant. 01 Ph.D. student received ICAR SRF Scholarship @Rs.12,000/- p.m. in addition to Rs.10,000/- per annum as contingent grant. 03 Ph.D. students received Rajeev Gandhi Fellowship @ Rs.16,000/- P.M. 03 Ph.D. students received DST-Inspire scholarship @ Rs.18,000/-+30% H.R.A. P.M. in addition to Rs.20,000/- per annum as contingent grant. 03 Ph.D. student received National Fellowship @ Rs.16,000- P.M. in addition to Rs.10,000/- P.A. as contingency grant. 13 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 8640/- p.m. in addition to Rs.6000 /- per annum as the contingent grant and 21 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.

Strengthening of Post Graduate Programme

On the basis of funds received from P.G. School, IARI, the teaching program in the discipline of Agricultural Statistics, Computer Application and Bioinformatics were strengthened.

Educational/Study Tour

A study/educational tour was organized during 18-21 February 2017 for the M.Sc. and Ph.D. students of ICAR-IASRI of all the three disciplines, viz. Agricultural Statistics, Computer Application and

Bioinformatics to visit the institutes located in Dehradun, viz., Forest Research Institute (FRI), ICAR-Indian Institute of Soil and Water Conservation (ICAR-IISWC) and Indian Institute of Remote Sensing (IIRS) for having an exposure to the research activities of the respective institutes and to acquire practical knowledge on the courses studied as a part of their course curriculum.

Agricultural Education Day

Agricultural Education Day was celebrated on December 3, 2016. A Declamation Contest was organized for the students on Data Science: Its Importance and Role in Agricultural Education.

Management System PG School, IARI

PG School, IARI Management System developed at IASRI is helping in achieving the objective of giving online access to various resources and making the PG programme paperless. The system is available to students, faculty members, scientists and administrative staff of PG School, IARI, It has following sub modules:

- Courses Management
- Student Management
- Faculty Management
- Administration Management
- E-Learning

Courses for the Academic Session 2016-17 (Agricultural Statistics)

Code	Course Title	Credits		Course Instructors 2016-17
		L	P	
Trimester-III (2015-16)				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Sarika, Ajit, Kaustav Aditya
AS 503	Basic Sampling and Non-parametric Methods	2	1	A. K. Gupta, Wasi Alam, Ankur Biswas
AS 563	Statistical Inference	4	1	K.N. Singh, Arpan Bhowmik, Prabina Kumar Mehar
AS 564	Design of Experiments	3	1	Seema Jaggi, Eldho Varghese
AS 566	Statistical Genetics	3	1	S. D. Wahi, L.M. Bhar, A.K. Paul, Upendra Kumar Pradhan
AS 662	Advanced design for Multi-factor Experiments	2	1	Rajender Parsad, Sukanta Dash
AS 664	Inferential Aspects of Survey Sampling and Analysis of Survey Data	2	1	Tauqueer Ahmad, Hukum Chandra, U.C. Sud
AS 667	Forecasting Techniques	1	1	Amrender Kumar, Bishal Gurung
AS 668	Bayesian Inference in Survey Sampling	1	1	Hukum Chandra, U.C. Sud
AS 691	Seminar	1	0	A.R. Rao
Trimester-I				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Susheel Kr. Sarkar, Wasi Alam, Anil Kumar
AS 501	Basic Statistical Methods	2	1	Mir Asif Iquebal, Prakash Kumar
AS 550	Mathematical Methods	4	0	Cini Varghese, Himadri Ghosh
AS 560	Probability Theory	2	0	K.N. Singh
AS 561	Statistical Methods	2	1	Seema Jaggi, Ranjit Kumar Paul, Eldho Varghese
AS 567	Applied Multivariate Analysis	2	1	A.R. Rao, Bishal Gurung
AS 568	Econometrics	2	1	G.K. Jha, Prawin Arya, Ravindra Singh Shekhawat
AS 569	Planning of Surveys/ Experiments	2	1	U.C. Sud, Prachi Misra Sahoo, Sukanta Dash
AS 572	Statistical Quality Control	2	0	Wasi Alam, Deepak Singh
AS 600	Advanced Design of Experiments	1	1	Rajender Parsad, Cini Varghese
AS 601	Advanced Sampling Techniques	1	1	Hukum Chandra, Prachi Misra Sahoo, Ankur Biswas
AS 602	Advanced Statistical Genetics	1	1	A.K.Paul
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, B.N. Mandal
AS 691	Seminar	1	0	Eldho Varghese
Trimester - II				
PGS 504	Basic Statistical Methods in Agriculture	2	1	Eldho Varghese, Arpan Bhowmik, Kaustav Aditya
AS 502	Basic Design of Experiments	2	1	Susheel Kumar Sarkar, Sukanta Dash, Sunil Kumar Yadav
AS 551	Mathematical Methods in Statistics	4	0	Cini Varghese, Himadri Ghosh, Sukanta Dash

Code	Course Title	Credits		Course Instructors 2016-17
		L	P	
AS 562	Advanced Statistical Methods	2	1	Seema Jaggi, Ranjit Kumar Paul, Arpan Bhowmik
AS 565	Sampling Techniques	3	1	Anil Rai, Tauqeer Ahmed, Ankur Biswas
AS 570	Statistical Modeling	2	1	Ranjit Kumar Paul, Bishal Gurung, Wasi Alam
AS 573	Demography	2	0	Prawin Arya, Wasi Alam
AS 605	Advanced Statistical Inference	1	1	K.N. Singh, L.M. Bhar
AS 607	Stochastic Processes	3	0	Himadri Ghosh
AS 661	Advanced Designs for Single Factor Experiments	2	1	Cini Varghese, B.N. Mandal
AS 663	Advanced Theory of Sample Surveys	2	1	Tauqueer Ahmad, Hukum Chandra
AS 665	Advanced Statistical Methods for Population Genetics	2	1	A.K. Paul, Prabina Kumar Meher
AS 691	Seminar	1	0	Bishal Gurung

Courses for the Academic Session 2016-17 (Computer Application)

Code	Course Title	Credits		Course Instructors 2016-17
		L	P	
Trimester – III (2015-16)				
CA 503	Statistical Computing in Agriculture	1	2	Rajender Parsad, Ranjeet Kumar Paul, Sukanta Dash
CA 563	Operating System	2	1	N. Srinivasa Rao, Soumen Paul
CA 568	Software Engineering	2	0	A.K. Choubey
CA 567	Computer Networks	2	1	S.N. Islam, Mukesh Kumar
CA 571	Modeling and Simulation	2	1	Anshu Bharadwaj
CA 613	Artificial Neural Networks	2	1	Anshu Bharadwaj, G.K. Jha
CA 614	Knowledgebase Systems for Semantic Web	2	1	Sudeep, Alka Arora
CA 691	Seminar	1	0	Mukesh Kumar
Trimester I				
CA 502	Introduction to Computer Application	1	1	S.N. Islam, Samir Farooqi
CA 551	Mathematical Foundations in Computer Application	4	0	Sukhanta Dash, Sunil Kumar Yadav
CA 552	Computer Oriented Numerical Methods	2	1	Pal Singh, Deepak Singh
CA 560	Computer Organization and Architecture	3	0	Anil Rai, Shaloo
CA 561/ BI 505	Principles of Computer Programming	2	1	K.K. Chaturvedi, S.B. Lal
CA 565	Compiler Construction	2	1	Soumen Pal, A.K. Mishra
CA 569	Web Technologies and Applications	2	1	S.B. Lal, Anu Sharma
CA 570	Computer Graphics	2	1	Pal Singh, Sangeeta Ahuja
CA 575	Artificial Intelligence	2	1	Rajni Jain, Sudeep
CA 611	Design and Analysis of Algorithms	2	1	Sudeep, Mukesh Kumar
CA 621	Advances in Data Mining	2	1	Anshu Bhardwaj, Rajni Jain
CA 691	Seminar	1	0	K.K. Chaturvedi

Code	Course Title	Credits		Course Instructors 2016-17
		L	**P**	
Trimester II				
CA 501	Computer Fundamentals and Programming	3	2	Pal Singh, Ajit, Sangeeta Ahuja
CA 562	Object Oriented Analysis and Design	2	1	Sudeep, Shaloo
CA 564	Data Structures and Algorithms	2	1	A.R. Rao, A.K. Mishra
CA 566/ BI 507	Data Base Management System	2	2	S.B. Lal, Soumen Pal
CA 572	GIS and Remote Sensing Techniques	2	1	Prachi Mishra Sahoo, Anshu Bhardwaj
CA 573	Data Warehousing	2	1	Samir Farooqi, K.K. Chaturvedi
CA 577	Data Mining and Soft Computing	2	1	Anshu Bhardwaj, Anu Sharma, Alka Arora
CA 578	Information Security	2	1	Mukesh Kumar, A.K. Choubey
CA 612	Fuzzy Sets and Rough Sets	2	1	Sudeep, Rajni Jain, Alka Arora
CA 691	Seminar	1	0	Rajni Jain

Courses for the Academic Session 2016-17 (Bioinformatics)

Code	Course Title	Credits		Course Instructors 2016-17
		L	**P**	
Trimester – III (2015-16)				
BI 502	Protein Structure Analysis	2	1	Anil Rai, Sarika
BI 503	Computational Biology	2	1	A.R. Rao, D.C. Mishra
BI 504	Evolutionary Biology	2	1	Sunil Archak, A.K. Mishra
BI 612	Quantum Theory and Applications in Biology	2	1	Monendra Grover
BI 691	Seminar	1	0	Sarika
Trimester - I				
BI 501/ MBB 509/ GP 540	Introduction to Bioinformatics	2	1	KV Bhatt, AR Rao, Amol Kumar Solanke
BI 505/ CA 561	Principles of Computer Programming	2	1	KK Chaturvedi, SB Lal
BI509/BIO601	Nucleicacids	2	1	Archna Sachdev, Archna Singh, Vinutha T., Suneha Goswami
BI 510/ MBB 501	Principles of Biotechnology	4	0	Ramcharan Bhatt Acharya, Debasis Pattan Ayak, Amol Kumar Solanki
BI 511 /BIO 501	Basic Biochemistry	4	1	Anil Dahuja, Shelly Praveen, Suresh Kumar, Aruna Tyagi
BI 512	Advanced Programming in Bioinformatics	2	2	UB Angadi, Anu Sharma
BI 514	Statistical Techniques in Bioinformatics	3	1	Seema Jaggi, DC Mishra, MS Farooqi
BI 601	Genome Assembly and Annotation	1	2	Sanjeev Kumar, DC Mishra
BI 602	Biomolecular Modelling and Simulation	2	1	UB Angadi, M. Grover, Anil Rai
BI 613	Parallel Programming and Algorithm Development	2	1	SB Lal, KK Chaturvedi
BI 614	Biological Network Modelling and Analysis	2	1	Sanjeev Kumar, Samarendra Das
BI 691	Seminar	1	0	SB Lal

Code	Course Title	Credits L	P	Course Instructors 2016-17
		Trimester - II		
BI 506	Computational Genomics	3	1	Mir. A. Iquebal, D.C. Mishra, Sarika
BI 507/ CA566	Data base Management System	2	2	S.B. Lal, Mukesh Kumar, Soumen Pal
BI 508	Computer Application in Bioinformatics	2	1	S.B. Lal, K.K. Chaturvedi
BI 603	Machine Learning Techniques in Bioinformatics	2	1	Sanjeev Kumar, Mir Asif Iquebal
BI 604	Computational Techniques for Transcriptomics and Metabolomics	1	1	A.R. Rao, Samir Farooqi
BI 624	Genome Wide Association Study	2	1	K.V. Bhatt, Sunil Archak, T. Napolean
BI 691	Seminar	1	0	Samir Farooqi

Board of Studies for Academic Year 2016-17

Agricultural Statistics

1. Dr. Seema Jaggi, Professor (Agricultural Statistics)   Chairperson
2. Dr. U.C. Sud, Director   Member (Ex-officio)
3. Dr. Tauqueer Ahmad, Principal Scientist   Member
4. Dr. Amrender Kumar Jha, Senior Scientist   Member
5. Dr. Susheel Kumar Sarkar, Scientist   Member Secretary
6. Sh. Shwetank Lall, Student   Students' Representative

Computer Application

1. Dr. Sudeep Marwaha, Professor (CA)   Chairman
2. Dr. U.C. Sud, Director   Member (Ex-Officio)
3. Dr. A.K. Choubey, Head, (CA)   Member
4. Dr. Mukesh Kumar, Scientist   Member
5. Smt. Anshu Bhardwaj, Scientist   Member Secretary
6. Sh. Chandan Kumar Deb   Students' Representative

Bioinformatics

1. Dr. A.R. Rao Professor (Bioinformatics)   Chairman
2. Dr. U.C. Sud, Director   Member Ex-officio
3. Dr. Kishore Gaikwad, Principal Scientist   Member
4. Dr. Sunil Archak, Senior Scientist   Member
5. Dr. Sarika, Scientist   Member Secretary
6. Ms. Arfa Anjum   Students' Representative

Central Examination Committee for Academic Year 2016-17

Agricultural Statistics

1. Dr. U.C. Sud, Director
2. Dr. Seema Jaggi, Professor (Agricultural Statistics)
3. Dr. Anil Rai, Head, CABin
4. Dr. Lal Mohan Bhar, Head, Statistical Genetics
5. Dr. Rajender Parsad, Principal Scientist
6. Dr. G.K. Jha,Principal Scientist
7. Dr. Cini Varghese, Principal Scientist

Computer Application

1. Dr. U.C. Sud, Director
2. Dr. Sudeep Marwaha, Professor (Computer Application)
3. Dr. A.K. Choubey, Head, Computer Application
4. Dr. Mukesh Kumar, Senior Scientist
5. Dr. K.K. Chaturvedi, Senior Scientist
6. Dr. Anu Sharma, Scientist

Bioinformatics

1. Dr. U.C. Sud, Director
2. Dr. A.R. Rao, Professor (Bioinformatics)
3. Dr. Anil Rai, Head CABin
4. Dr. T. Nepoleon, Senior Scientist
5. Dr. U.B. Angadi, Senior Scientist

National / International Training Programmes

Senior Certificate Course in Agricultural Statistics and Computing

Senior Certificate Course in Agricultural Statistics and Computing was organized for the benefit of research workers engaged in handling statistical data collection, processing, interpretation and employed in research Institute of the Council, State Agricultural Universities and State Government Departments, etc. & foreign countries including SAARC countries. The main objective of the course was to train the participants in the use of latest statistical techniques as well as use of computers and software packages. The course was organized during the period June 20, 2016 to Nov. 19, 2016. The Course comprise of two independent modules of three months duration each. One officer participated in both the modules. Module – I was organized during June 20, 2016 to August 20, 2016. Module-II was organized during September 01, 2016 to November 19, 2016. One officer participated in Module–I and two officers participated in Module-II.

Senior Certificate Course	Course Director
Module-I	Sh. S.D. Wahi (till 31st August, 2016) Dr. Ajit (from 1st September, 2016 onwards)
Module-II	Sh. S.D. Wahi (till 31st August, 2016) Dr. Ajit (from 1st September, 2016 onwards)

Topic	Instructor
Module-I	
Statistical Methods	Md. Wasi Alam, Dr. Arpan Bhowmik, Sh. Raju Kumar
Official Agricultural Statistics	Dr. Ankur Biswas
Use of Computers in Agricultural Research	Dr. Amrit Kumar Paul, Sh. Pal Singh, Dr. Kaustav Aditya
Module-II	
Sampling Techniques	Dr. Kaustav Aditya, Sh. Raju Kumar
Statistical Genetics	Dr. Amrit Kumar Paul, Sh. Samrendra Das, Sh. Upendra Pradhan
Design of Experiments	Dr. Eldho Varghese, Dr. Arpan Bhowmik, Md. Harun

Programmes under Centre of Advanced Faculty Training (CAFT)

S.No.	Title	Course Coordinators	Period	No. of Participants
1	Machine Learning Tools and Techniques for Agricultural Data Sets for knowledge Discovery	Dr. Anshu Bhardwaj Dr. Soumen Pal	August 03 - 23, 2016	10
2	Advances in Experimental Data analysis	Dr. Eldho Varghese Dr. Arpan Bhowmik	October 06 - 26, 2016	25
3	Advanced Computational and Statistical Tools for Omics Data Analysis	Dr. S.B. Lal Dr. K.K. Chaturvedi	December 01 - 21, 2016	19
4	Advances in Statistical Modeling and Forecasting in Agriculture	Dr. Bishal Gurung Mr. Mrinmoy Ray	December 23 - January 12, 2017	25
5	Recent Analytical Techniques in Statistical Genetics and Genomics	Dr. L.M. Bhar Mr. Samrendra Das	January 17 - February 06, 2017	25
6	Computational Approaches for Next Generation Sequencing (NGS) Data Analysis in Agriculture	Dr. Mir Asif Iquebal Dr. Sarika	February 08 - 28, 2017	25

Winter School

S.No.	Title	Course Director/ Co-Director	Period	No. of Participants
1	Designing and Analysis of Cropping Systems Experiments	Dr. Anil Kumar Dr. Sukhanta Dash	September 07 - 27, 2016	21
2	Advanced Statistical Techniques in Genetics and Genomics	Dr. Amrit Kumar Paul Sh. Samrender Das	March 02 - 22, 2017	17

Training Programmes for Technical Personnel

S.No	Title	Course Coordinator	Period	No. of Participants
1	Computer Application	Dr. N. Srinivasa Rao Dr. Anshu Bhardwaj	July 18 – 23, 2016	22
2	Networking: Basics and Management	Sh. S.N. Islam Dr. Soumen Pal	July 25 – August 01, 2016	22
3	Experimental Data analysis	Dr. Cini Varghese Dr. B.N. Mandal	August 24 – September 06, 2016	19
4	Cyber Security	Dr. Mukesh Kumar Dr. Sudeep Marwaha	September 27 – October 05, 2016	23
5	Statistical Techniques for Agricultural Data analysis	Dr. Seema Jaggi Dr. Arpan Bhowmik	November 02 – 11, 2016	23
6	Introduction to Bioinformatics	Dr. Monendra Grover Dr. D.C. Mishra	November 08 – 21, 2016	14
7	Web Designing, Development and Maintenance using Open Source Software	Sh. Pal Singh Dr. Sudeep Marwaha	February 18 – 27, 2017	13
8	ICAR ERP	Dr. Anshu Bhardwaj Dr. Mukesh Kumar	March 20 – 25, 2017	23

Other Training Programmes/Workshop

S.No.	Title	Course Coordinator	Period	No. of Participants
1	जैवमिति मे सांख्यिकी तकनीक विषय पर हिन्दी कार्यशाला	श्री प्रकाश कुमार	मई 31—जून 02, 2016	15
3	हिन्दी तिमाही प्रगति रिपोर्ट का प्रपत्र भरने और प्रेषण तथा हिन्दी एवं अंग्रेजी के आवती रजिस्टरों का रखरखाव	श्रीमती उशा जैन	सितम्बर 21, 2016	34
4	Basic Statistical Techniques using SAS	Dr. Susheel Kumar Sarkar Dr. Anindita Dutta Dr. Harun	December 12 – 15, 2016	14
5	Statistical Modeling and Forecasting Techniques for Agricultural Data	Sh. Rajeev Ranjan Kumar Sh. Santosha Rathore Sh. Ravinder Singh Shekhavat	February 09 – 14, 2017	10

ICAR-IASRI

NEWS

Volume 21   No. 3   October-December, 2016

- Research Activities
- Awards and Recognition
- Human Resource Development
- Panorama of Activities
- Publications
- Lectures Delivered
- Participation
- Consultancy/Advisory Services
- Personnel

From Director's desk...............

This Newsletter highlights salient research achievements, training programmes and workshops organized and other significant activities performed at the Institute during the period under report.

Approaches for modeling and construction of Transcription Regulatory Networks, after denoising the raw noisy gene expression data and approaches using vector autoregressive models and sparse autoregressive vector models using wavelet transformed gene expression data for time-series gene expression experiments, have been developed. The developed approaches were applied to salinity and aluminum stresses in rice and soybean respectively. Two R packages namely dlbge (https://cran.r-project.org/web/packages/dlbge) and waveletGRN have also been developed.

ICAR-Data Centre was inaugurated and KVK Mobile App was launched at ICAR-IASRI by Shri Radha Mohan Singh, Union Minister for Agriculture and Farmers Welfare. This digitization process in agriculture will help the farming community by encouraging technology, training and analysis of data by KVK portal and through its mobile app hosted at ICAR Data Centre of the Institute.

Seven training programmes were organized during this period. One Hindi workshop has also been organized. Scientists of the Institute received recognitions and have visited various countries viz. Rome-Italy, Addis Ababa-Ethiopia on different assignments. During the period, four new research projects were initiated. Scientists of the Institute have published 27 research papers, one popular article, 10 manual/pamphlets and developed one package. Scientists of the institute have participated in different conferences/symposia/workshops etc. in various capacities and invited lectures/lectures were also delivered. Scientists have also provided consultancy/Advisory services to students and scientists of different Institutes. It is hoped that the contents of the document would be informative and useful to scientists in NARES. Any suggestions for improving the contents of the newsletter further would be highly appreciated.

UC SUD

ICAR-IASRI

Annual Report
2015-16

Sugarbeet *(Beta vulgaris L. ssp. vulgaris)*

ICAR - Indian Agricultural Statistics Research Institute

Library Avenue, Pusa, New Delhi - 110012
www.iasri.res.in

ISO 9001:2008 Certified Institute
ISO/IEC 20000 & ISO/IEC 27001 Certified Data Centre

कृषि अनुसंधान डाटा पुस्तिका

AGRICULTURAL RESEARCH

DATA BOOK 2016

भारतीय कृषि अनुसंधान परिषद्
कृषि भवन, नई दिल्ली-110 001

Indian Council of Agricultural Research
Krishi Bhawan, New Delhi - 110 001

भाकृअनुप-भारतीय कृषि सांख्यिकी अनुसंधान संस्थान
लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110 012

ICAR-Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi - 110012

सांख्यिकी-विमर्श
2016-17

अंक 12

http://kvk.icar.gov.in

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लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110 012
www.iasri.res.in
आईएसओ 9001:2008 प्रमाणित संस्थान
आईएसओ/आईईसी 20000 तथा 27001 प्रमाणित डाटा केंद्र

6

AWARDS

Dr. Rajendra Parsad

- Recieved NAAS Recognition Award 2015-16 for significant contributions to Social Sciences in XIII Agricultural Science Congress 2017 organized at University of Agricultural Sciences, GKVK, Bengaluru during February 21-24, 2017.

Dr. A.R. Rao

- Conferred as Fellow, National Academy of Agricultural Sciences (NAAS) under section Social Science, in the AGM held on 5 June 2016 at NASC Complex, New Delhi

- Awarded as Fellow, Indian Society of Genetics and Plant Breeding, New Delhi on February 11, 2017 at B.P. Pal, Auditorium, I.A.R.I., New Delhi-110012.

- Prof. P.V. Sukhatme Gold Medal - Awarded by the Indian Society of Agricultural Statistics, New Delhi at ICRISAT, Hyderabad, India on 21 November, 2017 in recognition of making significant contributions in the field of Agricultural Statistics.

- Received Fellow-Award-2016 given by Society for Applied Biotechnology, Tamil Nadu.

Dr. R.K. Paul

- Received Young Scientist Award in Social Sciences for the biennium 2015-16 from National Academy of Agricultural Sciences (NAAS) in the 13th Agricultural Science Congress held at UAS, Bengaluru on 21 February, 2017.

Dr. Sukanta Dash

- Received the MN Das Memorial Young Scientist Award at SKUAS&T, Jammu in the 19th Annual Conference of Society of Statistics, Computer and Application on 8th March, 2017.

Dr. P.K Meher

- received Dr. G.R. Seth Memorial Young Scientist Award from Indian Society of Agricultural Statistics for the year 2016-17 at ICRISAT, Hyderabad during November 21-23, 2016.

Sh. Samarendra Das

- Received Netaji Subhas-ICAR International Fellowship for pursuing Ph. D. in Foreign University.

Dr. Hukum Chandra

- Conferred as Fellow of the National Academy of Agricultural Sciences.

Dr. M. A. Iquebal

- Received "SESR Computational Biologist 2016" from Society for Educational and Scientific Research.

Best Papers

- **Dr. R.K. Paul** was the co-author in the D.K. Desai Award for best paper by Indian Society of Agricultural Economics in 2016 for the following paper:

  Wani, M. H., Paul, R. K., Bazaz, N. H. and Manzoor, M. (2015). Market Integration and Price Forecasting of Apple in India. Indian Journal of Agricultural Economics, 70 (2), 169-181.

- **M.A. Iquebal, Sarika Jaiswal, Anil Rai and Dinesh Kumar** were the co-authors in the 1st Best paper award in International Conference on Agricultural Sciences and Food Technologies for Sustainable Productivity and National Security organized at University of Agricultural Sciences, Bengaluru, India during August 25-27, 2016 for the research paper entitled "Identification of MYMIV resistant genes using transcriptome profiling approach in Vigna mungo" authored by authored by Rahul Singh Jasrotia, Neeraj Kumar, M. A. Iquebal, Sarika Jaiswal, Pramod Kumar Yadav, Anil Rai and Dinesh Kumar.

Dr. Arpan Bhowmik

- Best paper award as co-author in the ISEE National Seminar on "Information and Communication Management Concerning Climate Smart Agriculture for Sustainable Development and Poverty Alleviation " at Rajmata Vijaraje Scindia Krishi Viswavidyalaya (RVSKVV), Gwalior, MP during 28-30 November, 2016 authored by Rabeesh K.Verma, Monika Wason, R.N.Padaria, Premlata Singh, Sujit Sarkar and Arpan Bhowmik.

Best Posters

Dr. A.R. Rao

- Coauthor in the 1st Best poster award in

International Conference on Statistics & Big Data Bioinformatics in Agricultural Research organized by ISAS at ICRISAT, Hyderabad during 21-23 November, 2016 for the research paper entitled "Genome Wide Mining of Microsatellites in Sesame" authored by Supriya, P., Sahu, S., Rai, S., Rao, A.R. and Bhat, K.V.

Dr. A.R. Rao

- Coauthor in the Best poster award in International Conference on InterDrought-V organized at ICRISAT, Hyderabad during 21-25, February, 2017 for the research paper "Comparison of genomic selection models for drought tolerance in sub-tropical maize" authored by Mittal, S., Arora, K., Rao, A.R., Mallikarjuna, M.G., Gupta, H.S. and Thirunavukkarasu, N.

Drs. Seema Jaggi, Eldo Vergese, Anil Rai, Arpan Bhowmik, D.C.Mishra and Sarika

- Coauthors in the 3rd best poster award in International Conference on Statistics & Big Data Bioinformatics in Agricultural Research at ICRISAT, Hyderabad during 21-23 November, 2016 for the research paper entitled "Mixture distribution approach for identifying differentially expressed genes in microarray data of Arabidopsis thaliana" authored by Anjum, Arfa, Jaggi, Seema, Varghese, Eldho, Lall, Shwetank, Rai, Anil, Bhowmik, Arpan, Mishra, D. C. and Sarika.

Drs. Seema Jaggi, Eldo Vergese, Cinni Vergese and Arpan Bhowmik

- Coauthors in the 2nd best poster award in International Conference on Statistics & Big Data Bioinformatics in Agricultural Research at ICRISAT, Hyderabad during 21-23 November, 2016 for the research paper entitled "On construction of D-optimal designs for logistic regression model." authored by Lall, Shwetank, Jaggi, Seema, Varghese, Eldho, Varghese, Cini, and Bhowmik, Arpan.

RECOGNITION

Dr. Anil Rai

- Member of IMC of NIAP, New Delhi.

- Representative of D.G. ICAR as a Member of National Committee on " Data Analytics"

- Member, RAC of National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI) Bangalore.

- Chairman of Board of Studies in Bioinformatics

- Chairman of the Committee related to implementation of e-Office in ICAR

Dr. S.B. Lal

- Member Secretary, Board of Studies of Computer Applications

Md. Sameer Farooqi

- External Examiner for conducting Practical Examination for the Course(s) at IVRI.

- External Examiner for conducting MA/ M.Sc. III Semester Examination for the Course at Department of Statistics and Operations Research, AMU, Aligarh.

Dr. K.K. Chaturvedi

- Special Invitee in the Institute Management Committee of ICAR-NRCPB, New Delhi

- Reviewer, Journal "International Journal of Sustainable Agricultural Management and Informatics".

- Appointed as Reviewer to review the research articles for 16th Intl. Conference on Computational Sciences and Applications (ICCSA' 2016) at Beijing University of Posts and Telecommunications, Beijing, China.

- Appointed as Reviewer to review the research articles for 5th Intl. Conference on Reliability, Infocomm Technologies and Optimization (ICRITO' 2016) at Amity University Noida.

- Reviewers, International Journal of Computer and Information Technology (IJCIT, http://www. ijcit.com/index.php). ISSN 2279-0764.

- Member, Reviewers Board, Aloy Journal of Soft Computing and Applications (AJCSA, http:// www.ajsca.org).

Dr. Sarika

- Worked as Course Co-director for the Course FBT 506: Bioinformatics Tools and Genetic Engineering (1+1) of the M.F.Sc. (2014-16) II Semester at ICAR-CIFE, Mumbai.

Dr. M.A. Iquebal

- Working as Member, Scientific Board, Online Journal of Bioinformatics.

Dr. D.C. Mishra

- Member Secretary of Evaluation Committee for publication of "ICAR-IASRI Annual Report" in Hindi

Dr. Mukesh Kumar

- Chaired one session among Oral Presentations: Four Concurrent Sessions during the 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu.

- Acted as co-convener of the technical session: Synthesis of Statistics and Informatics in Relation To Hill Ecosystem, 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu.

Dr. Rajender Parsad

- Chaired Contributed paper presentation session during National Symposium on Statistics for Sustainable Agricultural Development organized at ICAR-NBSS&LUP, Regional Centre, Kolkata to commemorate the Birth Centenary of Late Professor P.K. Bose.

- Convened a Session on theme on Big Data analytics during International Conference on Statistics and Big Data Bioinformatics in Agricultural Research (70th Annual Conference of Indian Society of Agricultural Research) organized at ICRISAT, Hyderabad.

- Co-Chair of Special session on Big Data and Evidence-based Agronomy as part of 4th International Agronomy Congress held at New Delhi.

- Delivered Professor PV Sukhatme Endowment Lecture on Significance of Experimental Designs in Agricultural Research: Status and Challenges during VIII International Symposium on Statistics and Optimization in conjuction with XXXVI Annual Convention of Indian Society of Probability and Statistics

Dr. Anil Kumar

- Acted as a Rapporteur in the Technical Session on Current Status and Future Challenges in Research in Agricultural Statistics during XVII National Conference of Agricultural Research Statisticians, held at IIFSR, Modipuram.

- Acted as a Rapporteur in the Technical Session II: Publication Repository and Interportal Harvester during the second workshop of Nodal Officers of KRISHI:ICAR Research Data Repository for Knowledge Management at NASC Complex and ICAR-IASRI, New Delhi.

Dr. Susheel Kumar Sarkar

- Received Certificate of Appreciation from Department of Public Health Dentistry, Faculty of Dentistry & Centre for Culture, Media & Governance, Jamia Milia Islamia University

- Chaired a contributory paper session on Recent Advances in Statistics (Session-I) on 21.11.2016 in International Conference on Statistics & Big Data Bioinformatics in Agricultural Research (70th Annual Conference of ISAS) at ICRISAT, Hyderabad.

- Acted as appoterur in technical session III on Current Status and Future Challenges in Teaching and Human Resource Development in Agricultural Statistics and Informatics in National conference of Agricultural Research Statisticians.

- Acted as Rapporteur in Technical Session-I on Data inventory Repository at Second Workshop of Nodal Officers/Officer Incharge of Data Management organized at NASC, Pusa, New Delhi.

Dr. Arpan Bhowmik

- Acted as Rapporteur for the Technical Session I: Data Inventory Repository during the second workshop of Nodal Officers of KRISHI:ICAR Research Data Repository for Knowledge Management at NASC Complex and ICAR-IASRI, New Delhi.

- Acted as Moderator for the Group Discussion session of Group 2 (AICRP-FIM and AICRP-PHET) during the workshop for UNIT LEVEL DATA REPOSITORY under KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) at ICAR-IASRI.

Dr. Seema Jaggi

- Esteemed Panelist in the panel discussion session on Sharing of Experiences on Best Practices for Enhanced Teaching-Learning during the Centre of Advanced Faculty Training (CAFT) on Enhancing Training and Teaching Competencies through Innovative Educational

Methodologies and Instructional Technologies organized by Division of Agricultural Extension, IARI.

- Visited the Department of Statistics, University of Calcutta, Kolkata during under the Visiting Faculty Scheme of UGC sponsored DSA (Department's Special Assistance) program.

Dr. Cini Varghese and Dr. Eldho Varghese

- Acted as Rapporteur for a special session on "Statistical tools for farming system data analysis" in the XVIII National Conference of Agricultural Research Statisticians (NCARS) held at ICAR-IIFSR, Modipuram, Meerut.

Dr. R.K. Paul

- Delivered one invited talk on "STATISTICAL MODELS FOR FORECASTING RAINFALL IN DIFFERENT AGRO-CLIMATIC ZONES OF INDIA" in the eighteenth National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP).

- Delivered full day lecture on time-series analysis in the FDP on Application of Statistical Tools and Data Analysis in Research at Jagannath International Management School (JIMS) Vasant Kunj, New Delhi.

Dr. P.K. Meher

- Received Dr. MN Das Memorial Young Scientist appreciation certificate from Society of Statistics, Computers and Applications for the year 2016-17.

Sh. Samarendra Das

- Received Netaji Subhash ICAR, International Fellowship to do Ph.D. in U.S.A.

Dr. L.M. Bhar

- Acted as Co-convener for a session on "Statistical Genetics and Genomics in International Conference of 70th I.S.A.S. Conference at ICRISAT, Hyderabad.

- Acted as convener for a session in eighteenth National conference of Agricultural Research Statistician on "National Priorities in Agricultural Statistics and Informatics" at ICAR-IIFSR Modipuram, Meerut.

- Worked as External Member IRC Meeting of ICAR-NCIPM.

- Delivered an invited talk on "Some challenges on statistical genetics and genomics" in the eighteenth National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP).

Dr. A.K. Paul

- Worked as External Member IRC Meeting of ICAR-NCIPM.

- Conducted the International Conference of 70th I.S.A.S. Conference at ICRISAT, Hyderabad as conference Advisory committee member. Chaired the session "Recent advances in Statistics".

- Attended qualifying viva-a-voice exam for two Afgani Foreign sudents at IARI, Agronomy Division.

- Worked as rapporteur for the Technical Session VI: Statistical applications and modelling with special reference to natural resource management and agricultural engineering and Plenary Session: Presentation of Reports by Conveners and Summary of Recommendations in Eighteenth National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP). Presented the rapporteur reports in the plenary session of the conference.

- Acted as Nodal officer for newly Joined ARS Probationer Orientation Programme.

- Working as a Nodal Officer for the programme Mere Gaon Mera Gaurav and Mkisan portal.

Dr. Tauqueer Ahmad

- Invited by FAO of the United Nations, Rome as invited speaker for oral presentation of a research paper entitled "Sampling methodology for estimation of harvest and post harvest losses of major crops and commodities" in the session on "Post Harvest Losses" in Pre-Conference Workshop (Global Strategy Outreach Workshop on Agricultural Statistics) organized by FAO, Rome, Italy before Seventh International

Conference on Agricultural Statistics at Rome, Italy with full funding by FAO of the United Nations, Rome.

- Invited by FAO of the United Nations, Rome to participate in Seventh International Conference on Agricultural Statistics at Rome, Italy with full funding by FAO of the United Nations, Rome.

- Received Appreciation Letter from Dean, P.G. School, IARI for excellent teaching in the discipline of Agricultural Statistics.

- Invited by Ministry of Statistics and Programme Implementation, Govt. of India to attend the "10th Statistics Day 2016" function to be held at Vigyan Bhawan, New Delhi.

- Invited by the FAO of the United Nations for participation in the Validation meeting on "Improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" and brief session on "Measuring vegetable production" at FAO headquarters, Rome, Italy.

- Invited Speaker in the session on "Post Harvest Losses" in Pre-Conference Workshop organized by FAO, Rome, Italy before Seventh International Conference on Agricultural Statistics (ICAS VII) held at Rome, Italy.

- Invited Speaker in "International Conference on Statistics & Big Data Bioinformatics in Agricultural Research" under 70th Annual meeting of India Society of Agricultural Statistics (ISAS) held at ICRISAT Campus, Hyderabad.

- Invited Speaker in the Workshop on "Standardization of sampling methodology for crop yield estimation at lower level in the context of Crop Insurance" held at ICAR-IASRI, New Delhi.

- Member of Institute Technology Management Unit (ITMU), IASRI.

- Nodal Officer, Minority 15 point PM Programme

- Member, Consultancy Processing Cell (CPC) of the Institute.

- Chairman, Hindi Translation Outsourcing Committee for technical translation of News Letter and Annual Report in Hindi.

Dr. Hukum Chandra

- Guest of Honour, delivered inaugural address in the Statistics Day Programme, organized by NSSO, Ministry of Statistics & Programme Implementation, Government of India at Giridih.

- Member Award Committee, Cochran-Hansen Award 2017 for the Young Survey Statisticians by the International Association of Survey Statisticians, 2017.

- International Consultant for the Food and Agricultural Organization of the United Nations in the project on "Country Statistical Capacity Assessment and Strategic Planning in Agricultural Statistics in Sri Lanka" under Global Strategy to Improve Agricultural and Rural Statistics", Colombo, Sri Lanka.

- Expert Member, "Ethiopia Statistics from Space" project under Global Strategy to Improve Agricultural and Rural Statistics, organized by the Food and Agricultural Organization of the United Nations, Addis Ababa, Ethiopia.

- Expert and Panelist, Ministry of Health & Family Welfare, Govt of India to review projects of Population Research Centre, Trivandrum, Kerala.

- Expert Member, Madras Institute of Development Studies, Chennai.

- Expert Member, Ministry of Health and Family Welfare Govt of India and UNICEF for possibility of getting district/sub district estimates of health indicators through Small area estimation techniques, Nirman Bhawan, New Delhi.

- Elected Member, International Statistical Institute, The Netherland.

- Invited Speaker, an invited technical session on "Advances in Statistical Sampling" in the 70th Annual Conference of Indian Society of Agricultural Statistics, an International Conference on Statistics & Big Data Bioinformatics in Agricultural Research, held at ICRISAT Hyderabad.

- Invited Speaker, Symposium on "Recent Developments in Sample Surveys" in the 25th International conference of the forum for interdisciplinary Mathematics Statistics and Computational Techniques, Jaipur.

- Invited Speaker, National workshop on Improvement of Agricultural Statistics organized by Directorate of Economics & Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India.

- Invited Speaker, International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan.

- Invited Speaker, workshop on Standardization of Sampling Methodology for Crop Yield Estimation at Lower Level in the Context of Crop Insurance, ICAR-IASRI, New Delhi.

- Jury Member, Student Papers Award Session, International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan.

- Jury Member, Poster Paper Award Session, International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan.

- Chaired Contributed Technical Session, International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan.

- Chaired Student Invited Papers Session, International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan.

- Chaired a Contributed Technical Session, the 19th Annual Conference of Society of Statistics, Computer & Application, Sher-e-Kashmir University of Agricultural Sciences- Jammu.

- Invited Speaker in the 18th National Conference of Agricultural Research Statisticians held at Modipuram.

Dr. Ankur Biswas

- Invited speaker, 18th National Conference of Agricultural Research Statisticians entitled "National Priorities in Agricultural Statistics and Informatics" at ICAR-IIFSR, Modipuram, Meerut, Uttar Pradesh organised jointly with ICAR-IASRI.

- Invited speaker, "National Workshop on Improvement of Agricultural Statistics" organized by Directorate of Economics & Statistics at Symposium Hall, Pusa Complex, New Delhi.

Dr. Sudeep Marwah

- Invited as an expert to prepare National Agriculture Higher Education Project (NAHEP) document, EFC, and ToR for Agriculture Education Digital Information System (AEDIS).

- Acted as a member of Selection Committee Meeting for MSME scheme 'Entrepreneurial and Managerial Development of SMEs through Business Incubators' under 'Arise Selection Day'.

- Convened a session on Data Management in the International conference on Statistics & Big Data Bioinformatics in Agricultural Research" organised at ICRISAT, Patancheru, Telangana.

Dr. Mukesh Kumar

- Worked as Transparency Officer and RTI Nodal Officer.

- Worked as co-convener 19th Annual National Conference of Society of Statistics, Computer and Applications.

- Worked as Member Secretary for Data Disaster Management Committee.

Sh. Pal Singh

- Worked as member of Institute Grievance committee.

Offices in Professional Societies and Research Journals

Society of Statistics, Computer and Applications

Dr. Rajender Parsad	Executive President
Dr. L.M. Bhar	Joint Secretary
Dr. Alka Arora	Member Executive Council
Dr. Seema Jaggi	Member Executive Council
Dr. B.N. Mandal	Member Executive Council
Dr. Hukum Chandra	Member Executive Council
Dr. Anshu Bhardwaj	Member Executive Council

Journal of Society of Statistics, Computer and Applications

Dr. Rajender Parsad	Executive Editor
Dr. Lalmohan Bhar	Managing Editor
Dr. Alka Arora	Associate Editors
Dr. Hukum Chandra	Associate Editors

Indian Society of Agricultural Statistics

Dr. UC Sud	Secretary
Dr. Amrit Kumar Paul	Joint Secretary

Dr. S.K. Sarkar	Joint Secretary
Dr. Ranjit Kumar Paul	Member, Executive Council
Shri Sudhir Srivastava	Member, Executive Council
Dr. Mir Asif Iquebal	Member, Executive Council
Dr. Sukanta Dash	Member, Executive Council
Dr. Ankur Biswas	Member, Executive Council
Dr. Sarika	Member, Executive Council
Dr. Anshu Bharadwaj	Member, Executive Council
Md. Samir Farooqi	Member, Executive Council
Dr. Kaustav Aditya	Member, Executive Council

Journal of the Indian Society of Agricultural Statistics

Dr. UC Sud	Coordinating Editor
Dr. AK Choubey	Coordinating Editor
Dr. Anil Rai	Coordinating Editor

Model Assisted Statistics and Applications

| Dr. Eldho Varghese | Associate Editor |

Journal Progressive Research: An International Journal

| Dr. Sukanta Dash | Member, Editorial Board |

International Journal of Agricultural and Statistical Science

| Dr. Anil Kumar | Member, Editorial Board |

International Journal of Essential Sciences

| Dr. Anil Kumar | Member, Editorial Board |

Indian Research Journal of Extension Education

| Dr. Anil Kumar | Associate Editor |

Journal of Wheat Research

| Dr. Rajender Parsad | Member, Editorial Board |

Journal of the National Academy of Agricultural Sciences

| Dr. Rajender Parsad | Associate Editor |

Institute of Applied Statistics and Development Studies

| Dr. Rajender Parasad | Member, Governing Body |

Journal of Statistical Theory and Practice

| Dr. Rajender Parsad | Associate Editor |

Bureau of Indian Standards

Dr. Rajender Parsad	Member, Management and Systems Division Council
	Member, MSD 3: Statistical Methods for Quality and Reliability
	Member, SD3:3.4 Basic Statistical Methods

International Statistical Institute

| Dr. Rajender Parasad | Elected Member |

International Association of Survey Statisticians

| Dr. Hukum Chandra | Member, Executive Council 2015-2019 |

MARUMEGH Kisan e-Patrika

| Dr. Ravindra Singh Shekawat | Member Editorial Board |

Journal of Agro-ecology and Natural Resource Management

| Dr. Wasi Alam | Member, Editorial Board |

Journal of Energy Research and Environmental Technology

| Dr. Wasi Alam | Member, Editorial Board |

International Journal of Social Sciences & Economic Environment

| Dr. Bishal Gurung | Member, Editorial Board |

Computer Society of India, Delhi Chapter

| Dr. Alka Arora | Chairman, Nomination Committee |
| Dr. Sudeep Marwaha | Chairman, Nomination Committee |

Annals of Agricultural Research

| Sh. S.N. Islam | Member, Editorial Board |

Society for Application of Statistics and Allied Sciences-RASHI

| Dr. Soumen Pal | Member, Editorial Board |

American Research Journal of Computer Science and Information Technology

| Dr. Anshu Bharadwaj | Member, Editorial Board |

Indian Journal of Genetics and Plant Breeding

Dr. A.R. Rao   Member, Editorial Board

Journal of Food Legumes

Dr. M.A. Iquebal   Subject Editor

International Journal of Genetics and Genomics

Dr. M.A. Iquebal   Member, Editorial Board

सांख्यिकी विमर्श

Dr. Ajit   Chairman-Editorial Board
Dr. Anil Chikara   Member-Editorial Board
Dr. D.C. Mishra   Member-Editorial Board
Dr. S.K. Sarkar   Member-Editorial Board
Sh. B.J. Gahlot   Member-Editorial Board
Sh. S.K. Singh   Member-Editorial Board
Mrs. Usha Jain   Member-Editorial Board
Sh. Naresh Chand   Member-Editorial Board

Journal of Statistical Theory and Practice,

Dr. Rajender Parsad   Associate Editor (Nominated)

Journal of Society of Statistics, Computer and Applications

Dr. Hukum Chandra   Guest Editor

Journal of Statistical Theory and Practice

Dr. Hukum Chandra   Associate Editor

Journal of Model Assisted Statistics and Applications

Dr. Hukum Chandra   Associate Editor

Developments in Statistical Science - An International Journal

Dr. Hukum Chandra   Member, Board of Editors

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KRISHI - Knowledge based Resources Information Systems Hub for Innovations in agriculture, is an initiative of Indian Council of Agricultural Research (ICAR) to bring its knowledge resources on a to all stakeholders at one place. The portal is being developed as a centralized data repository system of ICAR consisting of Technology, Data generated through Experiments/ Surveys/ Observational studies, Geo-spatial data, Publications, Learning Resources etc.

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Linkages and Collaborations 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 the AICRP on IFS	ICAR-IIFSR, Modipuram	01 April 2012	31 March 2017
2.	Planning, designing and analysis of 'On Farm' research experiments planned for AICRP on IFS	ICAR-IIFSR, Modipuram	01 April 2012	31 March 2017
3.	Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments	AICRP on LTFE ICAR-IISS, Bhopal	01 April 2012	31 March 2017
4.	Modelling network of gene responses to abiotic stress in rice	ICAR-NRCB, New Delhi, ICAR-DRR, Hyderabad, ICAR-DKMA, New Delhi, CDAC, Pune (NFBSFARA)	01 April 2013	31 March 2017
5.	Information system for planning and analysis of experiments on All-India Coordinated Research Project on Vegetable Crops	AICRP, ICAR-IIVR, Varanasi ICAR-NAARM, Hyderabad	05 February 2014	31 March 2017
06.	Development of innovative approaches for small area estimation of crop yield, socio-economic and food insecurity parameters	ICAR, Lal Bahadur Shastri Young Scientist Award	09 December 2013	31 March 2017
07.	Network project on market intelligence	ICAR-NIAP, New Delhi (ICAR, DARE)	13 February 2014	31 March 2017
08.	Development of 16s rDNA rumen specific microb database	ICAR-NIANP, Bangalore	01 April 2014 (IASRI association w.e.f. 23 July 2014)	31 March 2017
09.	Tobacco Agridaksh: An online expert system	ICAR-CTRI, Rajahmundry	20 October 2014	20 October 2017
10.	Network project on impact assessment of agricultural research and development	ICAR-NIAP, New Delhi (ICAR)	01 January 2015 (IASRI association w.e.f. 12 January 2015)	31 March 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
11.	ICAR network project on transgenics in crops	ICAR-NRCPB, New Delhi	27 January 2015	31 March 2017
12.	Developing a comprehensive web based system for agriculturally important microbes.	NBAIM, Mau.	01 April 2015	31 March 2017
13.	Computational identification and modelling of genetic variation in relation to performance traits in buffaloes.	CIRB, Hisar	06 June 2015	31 March 2017
14.	Genomic data analysis for identification of economically important markers and viral diagnostics in pulses.	IIPR, Kanpur	06 June 2015	31 March 2017
15.	Computational approach for harnessing genome information and its integration with wheat phenome for efficient varietal development.	IIWBR, Karnal	15 June 2015	31 March 2017
16.	Mining and validation of candidate gene markers and screening on antimicrobial peptides of black pepper and small cardamom.	IISR, Kozhikode, Kerala	15 June 2015	31 March 2017
17.	Bioinformatic analysis of sequence data of brinjal and bitter gourd for identification of functional and regulatory genes for traits of economic importance.	NBPGR, New Delhi	16 June 2015	31 March 2017
18.	Molecular and computational approach to delineate metabolic pathways for better carbohydrate utilization in Labeo spp.	CIFA, Bhubaneshwar	16 June 2015	31 March 2017
19.	Elucidating the mechanism of Pashmina fibre development: An OMICS approach.	SKUAST-K, Srinagar NDRI, Karnal	01 July 2015	30 June 2018
20.	Microbial domain research projects on computational aspects.	NBAIM, Mau	03 July 2015	31 March 2017
21.	Development of database repertoire for Clostridium perfiringens strains prevalent in causing Enterotoxaemia in goats.	CIRG, Makhdoom	04 July 2015	31 March 2017
22.	Development of database on SNPs associated with economically important traits of Indian goats.	CIRG, Makhdoom	04 July 2015	31 March 2017
23.	RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system biology approach.	NRCPB, New Delhi	08 July 2015	31 March 2017
24.	ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Funded by ICAR Headquarter Plan Scheme under XII Plan period (2012-2017).	NAARM, Hyderabad, NBSS&LUP, Nagpur, ICAR-IARI, New Delhi, DKMA, New Delhi, CMFRI, Kochi, CRIDA, Hyderabad	24 July 2015	31 March 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
25.	Identification of genetic polymorphisms for pathogenicity in Vibrio sp.	CIBA, Chennai	19 August 2015	31 March 2017
26.	Metagenomic applications and transcriptomes profiling for inland aquatic environmental health surveillance.	CIFRI, Barrackpore	01 September 2015	31 March 2017
27.	Cluster ensemble algorithms for germplasms evaluation on Chickpea	NCIPM, New Delhi, NBPGR, New Delhi	18 September 2015	17 September 2016
28.	Network project on computational biology and agricultural bioinformatics under two sub-projects: Sub-project 1: Gene regulatory networks modeling for heat stress responses of sources and sink for development of climate smart Wheat. Sub-project 2: Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids.	ICAR-IARI, New Delhi	26 November 2015	31 March 2017
29.	Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor. Funded by Extramural funded under Crop Sciences Division.	ICAR- IIOR, Hyderabad	21 January 2016	31 March 2017
30.	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 2017
	Government of India			
31.	Whole genome sequencing and development of allied genomics resources in two commercially important Fish-Labeo rohita and clarias batrachus	ICAR-NBFGR, CIFA, AAU (DBT)	28 January 2014	09 September 2017
32.	Whole genome based SNP mining and development of breed signatures for dairy and dual purpose indigenous cattle	ICAR-NBAGR, Karnal ICAR-NDRI, Karnal (DBT)	09 July 2014	08 July 2017
33.	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 and Farmers Welfare (MoA), Government of India.	16 September 2014	15 June 2017
34.	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 and Farmers Welfare, Government of India, New Delhi.	16 February 2015	31 August 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
35.	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 August 2017
36.	Stochastic differential equation models and their applications to agriculture.	Science and Engineering Research Board (SERB), New Delhi.	06 November 2015	05 November 2018
37.	Impact of ICT in Agricultural Education in India. Funded by ICAR Extra Mural Research Projects-Agricultural Extension Division.	Agricultural Extension Division, ICAR.	08 April.2016	31 March 2017
38.	Forecasting Agricultural output using Space Agrometeorology and Land based Observations (FASAL). Funded by IMD, New Delhi.	IMD, New Delhi	13 April 2016	31 March 2017
39.	Smallholder's productivity and agricultural growth through technology, sustainable intensification and ecosystem services.	ICAR- IARI, New Delhi	13.04.2016	31 March 2017
40.	Incomplete split-plot designs: construction and analysis. Funded by SERB.	Science and Engineering Research Board (SERB), New Delhi.	16 August 2016	15 August 2019
41.	Standardization and validation of scales for measuring socio-psychological constructs related to risk adjustment and entrepreneurship behaviours of farmers. Funded by ICAR Extra Mural Research Project (Under Agricultural Extension division).	Agricultural Extension Division, ICAR.	05 September 2016	31 March 2017
42.	Development of varietal and hybrid technologies of pearl millet [Pennisetum glaucum (L). R. Br.] For higher yield and nutritional improvement. (Collaboration with ICAR-IARI)	ICAR-IARI, New Delhi, NRCPB, New Delhi, FS&PHT, SSA&C	26 September 2016	31 March 2019
43.	In silico analysis of data for identification of functional alleles for stress tolerance and quality traits using bioinformatics in Potato.	ICAR-CPRI, Shimla	12. September 2016	31 March 2017
44.	Assessment of post harvest losses in fruits and vegetables and strategies for their reduction in Andman and Nicobar Islands.	ICAR-CIARI	01 June 2015 (Association of IASRI w.e.f. 03 October 2016)	31 May 2017
45.	Creating awareness for efficient use of ICT and MOOCs in agriculture education. Funded by Extramural.	Extramural, ICAR	01 November 2016	31 March 2017

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
46.	Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in Rice and Wheat – Phase II. Funded by National Agricultural Science Fund (NASF).	IARI, New Delhi, Indian Institute of Technology, New Delhi, National Rice Research Institute, Cuttack, National Agricultural Science Fund (NASF).	01 January 2017	31 March 2018
47.	Management and impact assessment of farmer first project. Funded by ICAR farmer first programme under KVK scheme (ATARI-I)	ICAR- NIAP, New Delhi, NAARM, Hyderabad, DKMA, New Delhi	14 February 2017	31 March 2018
48.	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
49.	Creating a fully characterized genetic resource pipeline for mustard improvement programme in India. Funded by National Agricultural Science Fund (NASF)	PAU, Ludhiyana, ICAR-IARI, New Delhi, GBPAUT	01 January 2017	31 December 2019
Consultancy Studies				
50.	Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping	FAO (Food and Agriculture Organization), Rome	18 December 2014	17 October 2016
51.	Testing and validation of alternative methodology developed by IASRI for estimation of area and production of horticultural crops in Madhya Pradesh State.	DAC, Ministry of Agriculture, GOI	01 June 2015	28 February 2018
52.	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, GOI	06 August 2015	05 May 2018

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Sample Survey Resource Server is a web resource created with a goal to disseminate research in theory, application and computational aspects of sample survey among the statisticians in academia,practicing statisticians involved in advisory and consultancy services, scientists in the National Agricultural Research System, and the statisticians involved in conducting large scale sample surveys, particularly in the National Statistical System with focus on agricultural statistical system.This resource focuses on propagating research in sample survey including designing a survey, estimation procedures with support of online software for computing purposes, analysis of survey data, e-learning, etc. This resource is useful to surveyors in agricultural sciences, biological sciences, social sciences, industry and in statistical organizations in the centre and the states in planning and designing surveys and then in analysing the complex survey data generated. One important feature of the resource is the Discussion Forum that aims at providing online advisory and consultancy to the surveyors in general and surveyors in agriculture in particular. This forum also provides a platform to establish a network of statisticians, survey statisticians and survey practitioners. Another important feature of the resource is the link "Ask a Question" through which the user can ask questions and seek clarifications through Email.

The ultimate objective of this resource is to provide e-advisory services. Electronic books on theory of sample surveys and survey data analysis techniques with emphasis on agriculture are also available on this resource.

An online software package is available for the analysis of survey data. It is expected that the material provided at this server would help the survey practitioners in general and in agricultural sciences in particular and those survey practitioners involved in planning,

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Estimation of Population Mean

Estimation of Population Proportion

An Interesting Reading

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MAPI: Mobile Assisted Personal Interview

List of Publications

Referred Research Journals

1. Achal, L, Jha, GK, Gurung, B, Paul, RK, Bharadwaj, A and Parsad, R (2016). A Comparative Study on Time-delay Neural Network and GARCH Models for Forecasting Agricultural Commodity Price Volatility, in the *Indian Journal of Agricultural Statistics*, **70(1),** 7-18.

2. Adaka, P, Singh, A, Dhiman, P, Chandrika, KSVP, Walia, S, Sirohi, A, Jain, A , Khandelwal, M, Kumar**,** A and Parmar, BS (2017). Hydrogel based formulations of Tagetes patula root extract and MgSO4 to control Meloidogynae incognita in cucumber. *Allelopathy J.*, **40(2)**, 173-186.

3. Aditya, K (2016). Estimation of domain mean using two stage sampling in the presence of non-response. *IJRSS*, **6(5)**.

4. Aditya, K and Chandra, H (2016). Estimation of crop area and yield at state and national level based on reduced sample sizes. *Samikshya*, **10**, 06-11.

5. Aditya, K, Sud, UC and Chandra, H (2016). Calibration Approach Based Estimation of Finite Population Total under Two Stage Sampling. *Journal of Indian Society of Agricultural Statistics*, **70(3),** 219-226.

6. Aditya, K, Sud, UC, Chandra, H and Biswas, A (2016). Calibration Based Regression Type Estimator of the Population Total under Two Stage Sampling Design. *Journal of Indian Society of Agricultural Statistics*, **70(1)**, 19-24.

7. Ahmad, T, Sahoo, PM and Jally, SK (2016). Estimation of area under agroforestry using high resolution satellite data. *Agroforestry Systems*, **90(2)**, 289-303.

8. Ajit, Dhyani, SK, Handa, AK, Newaj, R, Chavan, SB, Alam, B, Prasad, R, Ram, A, Rizvi, RH, Jain, AK, Uma, Tripathi, D, Shakhela, RR, Patel, AG, Dalvi, VV, Saxena, AK, Parihar, AKS, Backiyavathy, MR, Sudhagar, RJ, Bandeswaran, C. and Gunasekaran, S (2016). Estimating carbon sequestration potential of existing agroforestry systems in India. *Agroforestry Systems*, **90(4)**. DOI 10.1007/ s10457-016-9986-z .

9. Alam, NM, Sarkar, SK, Jana, C, Raizada, A, Mandal, D, Kaushal, R, Sharma, NK, Mishra, PK and Sharma, GC (2016). Forecasting Meteorological Drought for a Typical Drought Affected Area in India using Stochastic Models. *J. Ind. Soc. Agril. Soc.*, **70(1)**, 71-81.

10. Alam, W, Chaturvedi, A, Kumar, A, Singh, KN and Sinha, K (2016). Sequential testing for decision making in the management of mustard aphid using size-biased negative binomial distribution. *Int. J. Agricult. Stat. Sci*. **12(2)**, 531-535.

11. Angadi, UB, Anandan, S, Gowda, NKS, Rajendran, D, Devi, L, Elangovan, AV and Jash, S (2016) Feed Assist-An Expert System on Balanced Feeding for Dairy Animals, *AGRIS*

on-line Papers in Economics and Informatics, **8**(3), 3 -12.

12. Badoni, S, Das, S, Sayal, YK, Gopalakrishnan, S, Singh, AK, Rao, AR, Agarwal, P, Parida, SK and Tyagi, AK (2016) Genome-wide generation and use of informative intron-spanning and intron-length polymorphism markers for high-throughput genetic analysis in rice. *Scientific Reports*, **6**, 23765 (DOI: 10.1038/srep23765).

13. Barman, D, Kundu, DK, Pal, S, Chakraborty, AK, Jha, AK, Mazumdar, SP, Saha, R and Bhattacharyya, P (2017). Soil temperature prediction from air temperature for alluvial soils in lower Indo-Gangetic plain, *International Agrophysics*, **31(1),** 9-22.

14. Basak, P, Sud, UC and Chandra, H (2016). Calibration Approach Based Estimator of Finite Population Regression Coefficient under Two-Stage Sampling Design. *International Journal of Agricultural and Statistical Sciences*, **12 (2)**, 415-422.

15. Behera, BK, Baisvar, VS, Kumari, K, Rout, AK, Pakrashi, S, Paria, P, Das, A, Rao, AR & Rai, (2017). The complete mitochondrial genome of the Asian stinging catfish, Heteropneustes fossilis (Siluriformes, Heteropneustidae) and its comparison with other related fish species. Mitochondrial DNA Part B, **1:1**, 804-805, DOI: 10.1080/23802359.2016.1219628.

16. Behera, TK, Rao, AR, Amarnath, R, Kumar, RR (2016). Comparative transcriptome analysis of female and hermaphrodite flower buds in bitter gourd (Momordica charantia L.) by RNA sequencing. *The Journal of Horticultural Science and Biotechnology*, **91(3)**, 250-257.

17. Bhati, J, Chaduvula, PV, Kumar, S, Marla, SS and Rai, A (2016); In-silico prediction and functional analysis of salt stress responsive genes in Rice (Oryza sativa), *Journal of Rice Research* **4:** 164. DOI:10.4172/2375-4338.1000164.

18. Bhati, J, Jethra, G, Sharma, A and Rai, A (2016). In Silico Prediction and Characterization of microRNAs from pigeon pea [*Cajanus cajan* (L.) Millsp.]. *Indian Journal of Biotechnology*. **15,** 477-484.

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- An instruction manual for Mobile Assisted Personal Interview (MAPI) software for its implementation in data collection work using MAPI in Uttar Pradesh and Gujarat.

- An instruction manual for Data entry software and provided it to the state headquarters for initiation of data entry work in Assam, odisha, Uttar Pradesh, Karnataka and Gujarat.

Macros Developed

- Kumar, P. developed SAS macros for path analysis and Excel work sheet for nonparametric stability measures, Selection Index and genetic gain. Developed an excel program to analyze triple test cross data.

Next Generation Sequencing (NGS) Data Publised in NCBI

- Genome Sequence Submitted and Published: The draft genome assembly of the three stains of Karnal Bunt, *Tilletia indica* has been deposited at GenBank with the following accession numbers: BioProject: PRJNA325874: Karnal Bunt (*Tilletia indica*) Whole Genome sequencing and assembly (BioSamples: SAMN05257085: PSWKBGH_1; SAMN05257086: PSWKBGH_2 and SAMN05257087: PSWKBGD_3) (ICAR- IIWBR: Pradeep Sharma, Ratan Tiwari , MS Saharan, Indu Sharma; ICAR-IASRI: Sarika Jaiswal, M.A. Iquebal, U.B. Angadi, Anil Rai, Dinesh Kumar)

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- अमृत कुमार पॉलज, रंजीत कुमार पॉल, समरेन्दर दास एवं विजय पाल सिंह 2017। नये अप्राचलिक स्थिरता मापदण्डो के कुछ विकास, 69–76

- राजेन्द्र सिंह तोमर एव राजेन्द्र प्रसाद (2017)। इन्डियन एन.ए.आर.एस. सांख्यिकीय संगणना पोर्टल द्वारा सांख्यिकीय विश्लेषण, 77–86

- संतोष राठौड़, कमलेश नारायण सिंह, बिशाल गुरूंग, राजीव रंजन कुमार, मृन्मय राय, प्रकाश कुमार, नीरज बुढ़लाकोटी एवं रविंद्र सिंह शेखावत (2017)। कर्नाटक में कृषि विविधीकरण : एक सांख्यिकीय मूल्यांकन, 87–91

- अमृत कुमार पॉल, रंजीत कुमार पॉल, एल. एम. भर, सविता वधवा एवं सत्यपाल सिंह (2017)। आनुवंशिकता के आकलन पर गैर–सामान्य और अग्राहय अनुमान का प्रभाव, 92–96

- मान सिंह एवं तौकीर अहमद (2017)। दोनों दिशाओं में फसल की बुवाई पंक्तियों में होने पर उपज आकलन के लिए फसल की बुवाई पंक्तियों में होने पर उपज आकलन के लिए फसल कटाई प्रयोग विधि, 97–103

- ऊषा जैन (2017)। संस्थान की राजभाषा यात्रा, 104–107

- द्विजेश चन्द्र मिश्र, नीरज बुढ़लाकोटी, संजीव कुमार, एस बी लाल एवं राजीव रंजन कुमार (2017)। टी ए जी पी टी: जीन एक्सप्रेशन डाटा पर आधारित ट्रेट से सम्बन्धित जीन की पहचान के लिए वेब सर्वर, 108–111

- ऊषा जैन (2017)। दैनिक स्मरणीय शब्द-शतक, 112–114

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Training Calender

Consultancy and Advisory Services

Advisory services for researchers in NARES and other organizations were pursued rigorously and various training programmes were conducted as consultancy (details given in Chapter-5).

International Consultancy

Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping (FAO funded project)

This project was awarded to ICAR-IASRI by Food and Agriculture Organization (FAO) of the United Nations under the "Global Strategy to Improve Agricultural and Rural Statistics" of FAO with an approved budget of US Dollar 4,18,163 (Four lakh eighteen thousand one hundred sixty three). It was initiated on 18 December, 2014 and continued up to 17 October 2016. This project was under Institutional Consultancy mode and ICAR-IASRI was selected for undertaking this study through competitive process of International bidding.

Under this project, sampling methodologies for estimation of crop area and yield under mixed and continuous cropping has been developed for different situations prevailing in different countries. Three different approaches namely, (i) Cadastral map based approach, (ii) Area Frame approach and (iii) Household approach have been proposed under this study.

The developed methodology was 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. Primary data collection was completed in Indonesia and Jamaica using Computer Assisted Personal Interviewing (CAPI) and in all the three countries using Paper Assisted Personal Interviewing (PAPI) methods.

Technical Report-4 and Technical Report-5 were prepared. Presentations on Technical Report-4 and Technical Report-5 were made in the Validation Meeting at FAO Headquarter, Rome during September 07-08, 2016. Technical Report-6 i.e. Methodological Report was submitted to the FAO after incorporating the comments and has been cleared by the FAO. Editorial comments have also incorporated for its publication by the FAO.

The Technical Report-6 entitled "Methodology for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping" has been published by the FAO as Technical Report of the Global Office. Technical Report-7 was prepared in the form of a Chapter of a Hand Book to be published by the FAO. The Technical Report-7 was submitted to the FAO before date of completion of the project.

The developed sampling methodology is likely to be adopted globally specially in developing countries in future by Food and Agriculture Organization of United Nations. This methodology is accepted by the FAO of United Nations and is published by the FAO as a Technical Report of Global Office. The report is available at FAO of the United Nations Global Strategy's website. Under this project, training of the developed methodology including Class room as well as field training of Crop Cutting Experiment (CCE) technique was imparted in all the three field testing countries. As a result of CCE training, Jamaica has adopted the CCE technique for crop yield estimation in the country.

Supervision of field work (area enumeration and detailed survey) in Jamaica during June 2016

Supervision of field work (area enumeration and detailed survey) in Rwanda during April 2016.

Dr. Rajender Parsad and Dr. Eldho Varghese

Advised Ms. Lakshmi, Ph.D. student from the Division of Horticulture, IARI on the analysis of data generated from an experiment done using Semi-Latin square design with 8 units (These eight units are some factorial combinations of 3 factors + 1 control) in the row-column intersection. Further, she was also advised to use RSM to study the significance of these factorial effects on the response variables.

Dr. Seema Jaggi and Dr. Eldho Varghese

Ms. Laneesha from the Division of Entomology, IARI was advised on PROC NLIN of SAS for fitting nonlinear models to the data on rate of development and Ambient temperature pertaining to an experiment to study the toxicity of two Insecticides on egg parasitoids. She was suggested to use the case study available at SSCNARS portal (http://www.iasri.res.in/sscnars/cs_animal.htm) for getting the syntax for the same.

Dr. Rajender Parsad and Dr. B.N. Mandal

Dr. Amrit Kaur Mahal, PAU, Ludhiana was advised on generation of alpha design with v=200, b=60, r=3, k=10, Efficiency factor (E) 0.8747253.

Dr. Rajender Parsad

- Dr. Deobrata Sarkar, Principal Scientist (Biotechnology), ICAR-CRIJAF, Barrackpore, Kolkata was advised on the PROC MIXED Statements to be used for the analysis of data generated from an experiment conducted to study the effect of 225 entries (genotypes) in 3 locations over 2 years, in field experiments, each of which was laid out in a 15 x 15 simple lattice (i. e. with 2 replications) design.

- Dr. Aravind Kumar Shukla, Project Coordinator, AICRP on Micronutrients, ICAR-IISS, Bhopal was advised on the analysis of data generated from Split Plot design with 6 main plot treatments as Varieties V1=GW-322   V3=HI 8627   V5= HI-1500 V2= Jw-3211 V4=HW2004   V6=C-306 and subplot treatments as T1-Control, T2-100 kg ZnSO4 Soil, T3- 3 Foliar spray, T4= 100 ZnSO4+ 3 Foliar spray, T5 -100 kg ZnSO4 Soil + 25% N and T6=Foliar Zn + 25% N. The varieties V1, V3 and V5 are Zn efficient and V2, V4 and V6 are Zn inefficient. For comparing Zn efficient and Zn inefficient cultivars, he was advised on contrast analysis on Main Plot treatments.

Dr. Eldho Varghese

- Provided advisory services to Ms. Hema, a Ph.D. student from the Division of Agricultural Extension, IARI on the use of nonparametric tests for testing various hypothesis framed as part of a study on *Farmer - led Innovations and their Techno-economic Feasibility for Scaling up* where the measurements have been made either in nominal or in ordinal scale.

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- Dr. Dipakar Mahanta, Scientist, VPKAS, Almora was advised on the procedure of pooled analysis of data pertaining as experiment conducted under factorial setup over different years. Available SAS code has been modified to perform said analysis and provided to him.

- Mr. Vinod Kumar P, an M.Sc. student from the division of Entomology was advised on the use of territorial map in discriminating presence of a species (*Holotrichia serrata*) over different locations based on several phenotypic characters.

- Dr. V. Santhy, Principal Scientist, Crop Improvement (CICR), Nagpur was advised on the use of R software for working out the Cophenetic correlation of marker data and also provided modified syntax for working out the same.

- Mr. Debasis Guloi, Scientist, division of SSAC, IARI was advised on the use of PCA for selecting minimum data set (MDS) for constructing soil quality index.

- Dr. Supradip Saha, Senior Scientist, Division of Agricultural Chemicals, IARI on RSM for the optimization of four responses viz., Curcumin yield, Ar, Alpha, Beta using Design Expert software. The input variables taken for the study were time and temperature.

Dr. Sukanta Dash

- Advised a Ph.D. student Gaurendra Gupta to go through the EGD for his experiment. He wants to conduct experiment in which he will grow pigeon pea in Kharif season with 9 different treatments including control and then same treatments with two level each will grow for wheat in Rabi season.

Dr. Arpan Bhowmik

- Mr. Shahabuden Khwahany, an Afgan national student from of CESCRA, IARI, New Delhi was advised on the use of PCA for assessing the impact of biogas slurry application on green house gas emission and soil microbial properties. ANOVA was also performed for identifying best treatment combination among six different treatments.

- Genetic component analysis was performed based on the data from the experiment of Dr. Partha Saha, a scientist from the Division of Vegetable Science, IARI, New Delhi. Phenotypic correlation and variance, genotypic correlation and variance, environmental correlation and variance along with heritability were obtained.

Dr. B.N. Mandal

- Advised Dipti Nayak, Ph.D. Student, IGKV, Raipur on principal component analysis of soil chemical, physical and biological data.

- Advised Akshay Sahkare, Ph.D. student, IARI, on factorial CRD analysis with two factors: varieties and presence/absence of stress condition.

- Advised Sh. Rishiraj, Scientist, Agronomy Division IARI on combined analysis of split plot data

- Advised Sh. Akshay Sahkare, in-service PhD student, IARI on augmented design analysis.

Mr. Sunil Kumar Yadav

K.S.V. Poorna Chandrika, Scientist at IIOR, Hyderabad has been advised about regression analysis to study the effect of various constituents on water absorption of foam sheet.

Dr. Anindita Datta

- A Ph.D. Student, Sukanya Som of P.G. School, ICAR-IARI was advised to do Wilcoxon signed rank test to find out whether significant difference existed between knowledge scores of farmers before and after experiencing the e-module or not.

- Dr. Naga Mani, Assistant Professor at Agricultural College, ANGRAU, Hyderabad was advised to use CRD for different combination of bioagents(treatments) tested against soil borne pathogen and RBD for per cent inhibition of Aspergillus,R.bataticola and S.rolfsii pathogens inhibited by different bacteria.

- An M. Sc. Student, Sumit kumar Dey from P. G. School, I.A.R.I was advised on the procedure of analysis using SAS of an experiment conducted in factorial CRD. The experiment was impact of elevated carbon dioxide and cyanobacterial inoculation on growth, yield and nitrogen fixation in legumes under different doses of phosphorus. There was three factor i.e. Carbon dioxide, cyanobacterial inoculation and doses of phosphorus.

Mohd. Harun

- Dr. RichaVarshney, Scientist (Insect Ecology) at National Bureau of Agricultural Insect Resources,

Bengaluru has been guided regarding the analysis ofthe fitting of nonlinear logistic model. It was based on previous studies where cubic logistic regression between proportion of prey consumed and prey density was used to determine shape. The CATMOD and NONLIN procedures of SAS was used to carry out the analysis.

- An M.Sc. Student, Hansraj Bhardwaj from Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur was advised on the procedure of analysis using SAS of an experiment conducted in simple lattice design of 13 x 13 with two replications. The number of genotype compared in the study includes165 lines with four checks. He was also advised on contras analysis for making comparison among lines versus checks.

Dr. Santosha Rathod

- Carried out "Trend analysis of Weather data of Raichur, Karnataka", M.Sc. thesis work of Ms. Banashree, Department of Agricultural Extension, UAS, Raichur.

- Carried out Data Envelopment Analysis of Ms. Subhlaxmi, Ph.D. Scholor (Agril. Economics), IAS BHU, Varanasi.

- Carried out cluster analysis of Mr. Raghunandan, Ph.D. Scholor (GPB), ICAR-IARI, New Delhi.

- Carried out RBD Data analysis of Ph.D. Research work of Laxmipati, Ph.D. Scholar, ICAR-IARI was carried out in SAS 9.4.

- Carried out data analysis (Polynomial model fitting) of Mr. Mahadevswamy, Scientist, SBI Coimbatore.

- Carried out Split plot design of Mr. Tayeeb, Ph.D. Scholor (Hort), UHS Bagalkot.

- Analyzed Path analysis and cluster analysis data of Mrs. Madhuri Arya, Jr. Scientisit – cum – Assistant Prof., Tirhut College of Agriculture, Dholi, Bihar in R software.

- Carried out analyzed Factorial experiment in RCBD of Mr. Panduranga, Ph.D. Scholar, ICAR-IARI, New Delhi in SAS v.9.4.

Dr. Wasi Alam

- Provided advisory service to the student (Miss Shraddha Ahirwar, Roll No. 20506) of Dr. Murtaza Hasan, Principal Scientist, IARI, New Delhi on completely randomized design and parametric tests.

- Carried out ANOVA analysis for postharvest treatments in tuberose of Dr. Mam C Singh, Principal Scientist, Centre for Protected Cultivation Technology, ICAR-Indian Agricultural Research Institute, New Delhi.

Dr. Mrinmoy Ray

- Advised Priyanka Anjoy M.Sc. (Agril. Stat.) Student of ICAR-IASRI about fitting procedure of Wavelet Neural Network (WNN) in Matlab.

- Suggested Tilak Mondal, Scientist, VPKAS-Almora how to analysis RBD using SAS and SPSS.

- Analysed Colour index data for Dr. Madhubala Thakrey, Scientist, ICAR-IARI.

Dr. Vishal Gurung

- Dr. Amrit Lamichane, Scientist, IIPR, Kanpur was advised to perform one-way analysis of variance with two factors to compare based on different temperatures and different substrate used.

- Dr. Ibandalin Mawlongban, Scientist. N*ational Research Centre* on Rapeseed-Mustard (NRCRM) was advised to use one-way analysis of variance and also to perform Tukey's HSD to compare a group of genotypes.

- Dr. Hemlata Bharti was advised on the use of hierarchical clustering procedure for grouping 52 genotypes based on some morphological characters.

- Ms. Mamta Mehar, Research Collaborator, International Food Policy Research Institute was advised on the use of Logistic and Gompertz model for studying the diffusion of Mobile technology.

- Advised Dr. H.R. Sardana, Principal Scientist (Entomology), National Centre for Integrated Pest Management on the use of Poisson and Negative Binomial distribution for fitting the count of pest.

- Advised Mr. Achal Lama, Ph.D. student on the use of R software packages for fitting various multivariate GARCH models for volatile datasets.

- Advised Dr. Rashmi Yadav, Senior Scientist (Agronomy), National Bureau of Plant Genetic Resources on use of Combined Over Year

Uniformity (COYU) analysis, Combined Over Year Distinctiveness (COY-D) analysis and Stability analysis for measurable (quantitative) characters of Amaranth and Buckwheat taken at different locations over the years.

- Advised Ms. Lungkudailiu Malangmeih, RA at ICAR-NIAP, New Delhi on the use of logit and probit model using SAS.

- Guided Ms. Priya Sharma, from Delhi University for her two months internship at ICAR-IASRI.

- Advised Dr. Ibandaling Mawlong, Scientist, Bharatpur on the use of regression and tukey grouping using SAS software.

- Advised Ms. Omem Tamut, a Ph.D. student, to use cluster analysis and Principal Component analysis for her research work.

Dr. Ravindra Singh Shekhawat

- Assisted Dr. Madhusudhan Bhattarai, IFPRI, New Delhi on determinants and diffusion of agricultural technology.

Dr. Rajeev Ranjan Kumar

- Carried out data analysis (trend analysis) of Mr. Pawanjeet Kumar, Ph.D. Student, Division of Ag. Engineering, IARI, New Delhi.

- Carried out co-integration analysis analysis of Mr. Vikram Yogi, Ph.D. Student, Division of Ag. Economics, IARI, New Delhi.

Dr. Hukum Chandra

- As International Consultant for the Food and Agricultural Organization (FAO) of the United Nations in the project on "Country Statistical Capacity Assessment and Strategic Planning in Agricultural Statistics in Sri Lanka" under Global Strategy to Improve Agricultural and Rural Statistics", Colombo, Sri Lanka.

- Advised Ms. Ankuri Agrawal, Ph.D. student, Department of Statistics, Kumaun University, Uttarakhand, on Statistics Methodology being used in her thesis.

- Advised to Dr. Mega Goel, HAU, Hissar, on Statistics Methodology for crop yield estimation and future research scope.

- Advised to Dr. VP Chaudhary, Sr. Scientist (FMP) & Dr. Nisha Verma, Scientist, IIFSR, Modipuram, Meerut, Uttar Pradesh, about sampling design related to their project.

- Provided advise to Dr. KC Pandey, Project Coordinator (RES), CIAE, Bhopal, Madhya Pradesh, on Sampling Methodology for Energy Survey Data.

Dr. Ankur Biswas

- Provided advisory to M.Sc. Agril. Stat. student, Nobin Chandra Paul, ICAR-IASRI on analysis of hyperspectral remote sensing data using SAS.

- Provided advisory to Ph.D. Agril. Stat. student, Pratyush Dasgupta at ICAR-IASRI on SAS programming for simulation of bootstrap technique for variance estimation under Ranked Set Sampling using Multiple Frame Approach.

Dr. A.K. Paul

- Guided two scholars of STAR COLLEGE SKUAST Kashmir about the use of SAS software for Genetics and Breeding for their research work.

Dr. R.K. Paul

- Provided advisory to Dr. Tapan Mandal, Senior Scientist, NBPGR regarding regression analysis and test of hypothesis in SAS.

- Provided advisory to Ms. Priyanka Solanki, Ph.D. student of Agri. Business Management from Deptt. of Agri. Economics, College of Agriculture, S.V. Rajasthan Agricultural University and provided advisory to Dr. Fazil Hasan, Div. of Entomology, IARI for fitting of Nonlinear Model for estimation of data set.

- Provided three days training programme regarding price forecasting techniques to Radhika A.M, Noushad A.K, Rohini K, Sachu Sara Sabu, the project staff of network project on market intelligence at Kerala Agricultural University.

Dr. P.K. Meher

- Provided advisory service to Jitendra Kumar, a Ph.D. student at CCSU, Meerut, UP. Genome wide association analysis was performed in wheat crop, where the records on 330 genotypes with 13 different traits (both phenotypic and nutritional) were used. Besides, on each genotype 17937 markers were used. The genome-wide association mapping was performed using multi-locus mixed mode (MLMM) and multi-trait mixed model (MTMM) approach, using R-software.

- Provided advisory service to Vandana Jaiswal, a Post doc student at National Botanical Research Institute, Lucknow, UP. Genome wide association analysis was performed in cotton crop, where the information on 291 genotypes with 11 phenotypes was used. Besides, 17937 markers were used for the analysis. The genome-wide association mapping was performed using multi-locus mixed mode (MLMM) and multi-trait mixed model (MTMM) approach, using R-software. Besides, epitasis interaction analysis was also performed using selected highly significant markers.

- Provided advisory service to Vijay Gehlot, a Ph.D. student at CCSU, Meerut, UP. Genome wide association analysis was performed in wheat crop, where the records on 313 genotypes with 9 different traits in four different locations, under irrigated and rain fed condition were used. Besides, on each genotype 17937 markers were used. The genome-wide association mapping was performed using multi-locus mixed mode (MLMM) and multi-trait mixed model (MTMM) approach, using R-software. Besides, epitasis interaction analysis was also performed using selected highly significant markers.

- Provided advisory service to Sudhir P. Nawathe, a research scholar at Dept. of mycology and plant pathology, BHU Varanasi, UP. Performed genome-wide association mapping using multi-locus mixed model (MLMM). The analysis was conducted on 55 wheat genotypes, where the information on 8 traits (Disease components and yield traits) and 516 markers available in bi allelic form (0/1) for each genotype over different chromosomes were used.

- Provided data advisory service to Dr. Santosh, H.B., Scientist (Plant Breeding), Division of Crop Improvement, ICAR - Central Institute for Cotton Research (CICR), Nagpur. GGE biplot analysis was carried out for 6 different traits corresponding to 10 genotypes of chickpea grown in 9 different environments with 3 replications. The analysis was performed by using GGEBiplotGUI package of R-software.

Sh. Samarendra Das

- Provided analytical help to Dr. Shanaz, Asst. Professor, SKUAST-K and analysed her research data related to "Marker-Trait Association".

- Provided analytical help to Dr. S. B. Chaudhury, Scientist, CRIJAFT and analysed the data related to "Genetic Diversity Analysis".

Dr. Prakash Kumar

- Provided advisory to analysis of 19 guava genotype survey by Dr. Adhubala, scientist, Horticulture, IARI, New Delhi.

- Provided advisory to analyze the fractional factorial designed data of gladiolus crop of Ms. Laxmi Durga, Ph.D. Student, Horticulture, IARI, New Delhi.

- Provided advisory to analyze the data of seed development research of cauliflower and radish provided by Sanjay Kumar, M. Sc. Student, Division of Seed Science and Technology, PG School, IARI, New Delhi.

- Provided advisory to analyze allicin and allyl thiosulphinates data of different Germplasm of garlic provided by Dr. Preeti Singh, Scientist, Section of Medicinal & Aromatic Crops, ICAR-IIHR, Bangaluru.

- Provided advisory to analyze the data of different level of treatment of different quantitative value of variables of horticultural crop consulted by Nikita Sharma, Horticulture IARI Ph.D. Student.

- Provided advisory to analyze the data of different level of treatment of different quantitative value of variables of horticultural crop consulted by Nikita Sharma, Horticulture IARI Ph.D. Student.

- Provided advisory to analyze the data on study of broccoli irrigation water productivity with crop water productivity of horticultural crop consulted by Jitendra Kumar, Ph.D. Student IARI New Delhi.

- Provided advisory to analyze the data on study of Gene expression and resistance of a plant to disease provided by Dr. Arvind Konda, Scientist ICAR-IIPR, Kanpur.

- Provided advisory to analyze the data on Triple Test Cross and develop excel program to analyze triple test cross data provided by Ph.D. student Geeta Devi, CCSHAU Hissar.

- Provided advisory to analyze PCA and correlation study of data provided by Ph.D. student Samadhan Bagul, Microbiology, IARI, New Delhi.

- Provided advisory to analyze Multifactor response surface design of data provided by Ph.D. student Manjit Lad, PHT, IARI, New Delhi.

- Provided advisory to Statistical analysis of nitrogenase activity of plant data provided by Ph.D. student Anupama Priyadarshini Biotechnology, BHU, Varanasi.

- Provided advisory to estimates genetic parameters of data provided by Dr. Muraleedhar S. Aski, Scientist, Division of Genetics, Indian Institute of Agricultural Research (IARI).

Dr. Neeraj Budhlakoti

- Provided advisory to Anurag Mishra, M.Sc. Student from Department of Ag. Biotechnology, S.V.P.U.A. &.T Modipuram, Meerut. (U.P.) was advised on the procedure of analysis of an experiment conducted for 35 genotype for 54 SSR markers. The number of genotype were compared and diversity analysis has been done using DARwin software.

- Provided advisory to Shruti Sinha, Ph.D. student from Department of Biotechnology, IARI, New Delhi has been advised on the procedure gene enrichment analysis, Gene Ontology annotation and regarding combining p-Value, in case pooling of data from various experiments.

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RAC, Management Committee and IRC

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 to review the progress of on-going research projects periodically. It also monitors the follow up action on the recommendations of the Quinquennial Review Team (QRT), 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 entire year, 20 new research projects were approved and progress of 125 on-going research projects was reviewed and 17 research projects were declared complete and 01 project was declared as closed.

Two meetings (85th and 86th) of the IRC were held during October 05-06, 2016 and April 01-03, 2017 respectively.

- In the 85th meeting, 09 new research projects (03 Institute funded, 01 in collaboration with other Institutes, 03 outside funded and 02 Extramural funded) were approved and progress of 60 on-going research projects (28 Institute funded, 02 in collaboration with other Institutes and 30 outside funded) were discussed and 03 research projects were declared as completeand 01 project was declared as closed.

- In the 86th meeting, 11 new research projects (06 Institute funded, 04 outside funded and 01 Extramural funded) were approved and progress of 65 on-going research projects (25 Institute funded, 05 in collaboration with other Institute and 35 outside funded) was reviewed and 14 research projects were declared as complete.

Research Advisory Committee (RAC)

Research Advisory Committee (RAC), to review the research and teaching activities of ICAR-Indian Agricultural Statistics Research Institute for a period of three years with effect from 23-01-2017, was constituted vide Council's Office Orders No. F.No.A.Engg./5/4/2012/IA-II(AE) dated 02-02-2017 and F.N.Ag.Edn.14/3/2017-A&P dated 20-03-2017(for re-nomination of one member). The composition of the RAC is

Professor R.B. Singh Chancellor, CAU, Imphal Ex-Chairman, ASRB & Ex-Director, IARI	Chairman
Dr. (Mrs.) Sangeeta Verma Principal Economic Advisor, Ministry of Commerce and Industry	Member
Dr. A.K. Nigam Consultant Advisor, IASDS, Begaluru	Member
Dr. Alok Bhattacharya Professor, School of Life Sciences, JNU, New Delhi	Member
Dr. SD Sharma Former Vice Chancellor, DSVV, Haridwar and Former Director, IASRI	Member
Dr. V.K.Gupta Former National Professor (ICAR)	Member

Institute Management Committee (IMC)

संस्थान प्रबन्धन समिति की 65वीं बैठक दिनांक 02.11. 2016 को संस्थान में सम्पन्न हुई। बैठक में निम्नलिखित सदस्य एवं विशेष आमंत्रित सदस्य उपस्थित हुए

1 डॉ.यू.सी.सूद,   अध्यक्ष
   निदेशक, भा.कृ.सां.अ.सं.

2 डॉ. कंचन सिंह,   सदस्य
   सहायक महानिदेशक, (फार्म इंजिनियरिंग),
   भा.कृ.अ.प.

3 डॉ. टी.आर. शर्मा,   सदस्य
   परियोजना निदेशक, एन.आर.सी.पी.बी.,
   नई दिल्ली

4 डॉ. सी.आर. मेहता,   सदस्य
   प्रोजेक्ट कॉर्डिनेटर, ए.आई.सी.आर.पी.
   ऑन एफ.आई.एम., भोपाल

5 डॉ. देवेन्द्र ढींगरा,   सदस्य
   प्रधान वैज्ञानिक, कृषि अभियांत्रिकी प्रभाग,
   कैब-II, नयी दिल्ली

6 श्री नरेश अरोड़ा,   सदस्य
   व.वि.एवं ले. अधिकारी (श्रीमती रश्मिराव,
   उपनिदेशक, वित्त) के नामित

7 श्री एस.के. गजमोती,   सदस्य सचिव
   कार्यालय प्रधान, भा.कृ.सां.अ.सं.,
   नई दिल्ली

At the outset, Dr. U.C. Sud, Director, IASRI, New Delhi and the Chairman of the Management Committee welcomed all the distinguished members and special invitees present in the meeting. Thereafter, the agenda items were taken up for discussion.

The proceedings of Institute Management Committee held on 01.08.2015 were approved by the Council vide its letter A.Engg.5/3/2010-IA-II (AE) dated 10th September,2015& 9/14th October, 2015. Members considered the proceedings and approval of Council and on the basis of the approval from the Council, proceedings were confirmed by IMC members.

The action taken report on the recommendations of 64th Management Committee meeting held on 01.08.2015 was presented before the Committee. The members noted the review of action taken by the Institute on the recommendations with satisfaction.

Action taken on proceedings of 64th Meeting regarding Research Programmes and Research Projects of the Institute was discussed and the members were satisfied with the action taken and applauded the same.

Significant Research Achievements and Research Programmes/ Research Projects discussed in Institute Research Committee: The presentation was made by Dr. Ajit, Incharge (PME). He presented Research Achievements on the completed research projects and ongoing projects at IASRI. The house was satisfied with the research work done under various projects going on at IASRI. All the members appreciated the presentation.

Significant Teaching & Training Achievements: The presentation was made by Dr.(Smt.) Seema Jaggi, Incharge, Training & Administration Cell on Teaching and Training Activities of the Institute. The house was satisfied with the teaching and training activities going on at IASRI. All the members appreciated the presentation.

The list of equipment's to be procured for the financial year 2016-17 of XII Plan (Equipment's) with tentative cost and justification was discussed and considered for approval of the members and the same was approved by the members.

The statement of actual expenditure incurred up to 31.03.2016 in respect of Plan/ Non-Plan of the Institute was presented before the management committee. The members expressed their satisfaction over the utilization of funds.

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Papers Presented and Participation of the Institute at the Conferences/Workshops etc.

PAPER PRESENTED

- College of Fisheries, OUAT, Rangeilunda,11-12 March, 2017
  - ➢ Rao, AR. Recent Advances in Bioinformatics Priorities in Fisheries and Aquaculture (PFA).
- ICAR-IARI, New Delhi, 7th March 2017.
  - ➢ Rao, AR. Recent Advances in Bioinformatics Application of Bioinformatics tools in agriculture.
- 18th NCARS Conference on National Priorities in Agricultural Statistics and Informatics, IIFSR-Modipuram, 16-17 December, 2017.
  - ➢ Rao, AR. Data Science & Bioinformatics: Ways to promote Indian Agriculture.
- 18th NCARS conference on National Priorities in Agricultural Statistics and Informatics, IIFSR-Modipuram, 16th -17th December, 2017.
  - ➢ Rao, AR. *Current Status and Future Challenges in Research in Bioinformatic.*
- India Altair Technology Conference, ATXs Hyper Works Conference, New Delhi, July 29, 2016
  - ➢ Chaturvedi, KK, Rai, A, Lal, SB, Angadi, UB, Bhagwan, J. CABGRID: Interactive Job Submission and Management Portal for Indian Agriculture.
- 18th National Conference of Agricultural Research Statisticians, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (UP), 16-17 December, 2016
  - ➢ Mishra, DC, Srivastava, S, Lal, SB, Angadi, UB, Chaturvedi, KK, Rai, A. Protein Structure Comparison: Past to Current Scenario.
- Altair Technology Conference ATCx 2016, Le Meridien, New Delhi, 29 July-2016.

- ➢ Chaturvedi, KK, Rai, A, Lal, S.B., Angadi, UB, Bhagwan, J. ASHOKA: Analytical Study of Computing Resources.
- 19th Annual National Conference of Society of Statistics, Computer and Applications on Statistics and Informatics in Agricultural and Allied Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (J&K), 06-08 March, 2017.
  - ➢ Chaturvedi, KK, Rai, A, Farooqi, MS, Lal, SB, Sharm, A, Angadi, UB, Bhagwan, J. Application and Issues of Fog Computing in Agriculture.
  - ➢ Angadi, UB and Chaturvedi, KK. Computational Perspectives of Bioinformatics in Agriculture.
  - ➢ Budhlakoti, N and Rai, A. Classification of proteins related to different stress using machine learning techniques.
- 70th annual Conference of ISAS on Statistics and Big Data Bioinformatics in Agricultural Research ICRISAT, Hyderabad, 21-23 November, 2016.
  - ➢ Budhlakoti, N, Rai A. Microarray data expression study for better identification of differentially expressed genes.
- International Conference on Innovative Research in Biomedical Engineering, Cancer Biology, Stem Cells, Bioinformatics and Applied Biotechnology (BECBAB-2016), Jawaharlal Nehru University, New Delhi, 30 October, 2016.
  - ➢ Verma, SK, Jasrotia, RS, Sarika, Iquebal, MA, Rai and Kumar, D. Candidate genes discovery of coconut root wilt disease and development of its transcriptomic database (CnTDB).

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research at ICRISAT, Hyderabad during November 21-23, 2016.
  - ➢ Roy, HS, Paul, RK and Bhar, LM Detection of outliers in INAR(1) models.
  - ➢ Ghosh, H. and Pal, S. Nonparametric time-series regression modeling and forecasting under correlated errors using simple data-driven bandwidth.
  - ➢ Paul, RK and Anjoy, P. Wavelet Methodology for capturing volatility in agricultural commodity prices.
  - ➢ Kumar, P. Rank Based Simultaneous Index for Assessing Stable Crop Varieties with High Yield.
  - ➢ Dash, S and Kumar, P. Role of Big Data in Agriculture; A statistical perceptive.
- 70th ISAS annual International Conference on Statistics & Big Data Bioinformatics held at ICRISAT, Hyderabad during Nov 21-23, 2016.
  - ➢ Gurung, B. An insight into technology diffusion of tractor through Weibull growth model.
  - ➢ Rathod, S. Space Time Autoregressive Moving Average (STARMA) Model for Modelling and Forecasting Spatio-Temporal Time Series Data.
- 18th National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country organized at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP) during December 16-17, 2016.
  - ➢ Gurung, B. Modelling the diffusion of tractor technology through growth models.
  - ➢ Shekhawat, RS. Study of Rapeseed & Mustard and Gram Production in Rajasthan through Decomposition Analysis.
  - ➢ Kumar, RR. Co-integration approach for examining the co-movement between energy and agricultural commodity prices in India.
- International conference on 'Innovative Approach in Applied Physical, Mathematical/ Statistical, Chemical Sciences and Emerging Energy Technology for Sustainable Development (APMSCSET) on January 15, 2017 at Jawahar Lal Nehru University, New Delhi.
  - ➢ Alam, W. "Long Term Forecast of Crop Yield using Hybrid Linear time series Approach.

- ➢ Alam, W. Modified Simple Exponential Smoothing Approach for time series forecasting of crop yield.
- 70th ISAS annual International Conference on Statistics & Big Data Bioinformatics held at ICRISAT, Hyderabad during Nov 21-23, 2016.
  - ➢ Alam, W. Transfer Function Model for Crop Yield Forecast using Weather Variables.
  - ➢ Arya, P. An improved method of estimation of hedge ratio using kalman filter.
  - ➢ Mrinmoy, R. Nonparametric bootstrap approach for constructing prediction intervals of VAR model.
  - ➢ Shekhawat, RS. Decomposition Analysis of Agricultural Production in Rajasthan
  - ➢ Kumar, RR. Energy-growth linkage in Indian agriculture: A comprehensive analysis using panel co-integration.
- 30th National conference on Agricultural Marketing at IAS, BHU during October 20-22, 2016.
  - ➢ Shekhawat, RS. Potentials of Agro-Processing and Agri-business in Uttar Pradesh.
  - ➢ Das, S. Statistical approach for Gene Set Analysis with QTL.
- GR Seth Young Scientist Award session at ISAS Conference at ICRISAT, Huydrabad during 21-23 November, 2016.
  - ➢ Meher, PK. A non-parametric regression based computational approach for prediction of donor splice site.
- Global Strategy Outreach Workshop on Agricultural Statistics held at FAO Headquarters, Rome, Italy during 24-25 October 2016.
  - ➢ Ahmad, T, Sud, UC, Rai, A, Sahoo, PM, Jha, SN and Vishwarma, RK. Sampling methodology for estimation of harvest and post harvest losses of major crops and commodities.
- The Seventh International Conference on Agricultural Statistics (ICAS VII), Rome, Italy during 26-28 October, 2016.
  - ➢ Ahmad, T, Sud, UC, Rai, A, Sahoo, PM, Jha, SN and Vishwakarma, RK. Sampling methodology for estimation of harvest and post harvest losses of major crops and commodities. Presented in the session on "Post Harvest Losses" in Pre-Conference workshop organized by FAO, Rome, Italy on October 25, 2016 (Invited Speaker).

- Chandra, H, Salvati, N, Chambers, R and Sud, UC. A Spatially Non-stationary Fay-Herriot Model for Small Area Estimation – An Application to Crop Yield Estimation. (Invited talk).
- Sud, UC, Ahmad, Tauqueer, Rai, A and Sahoo, PM. "An alternative methodology for estimation of cotton yield using double sampling approach. (Invited talk).
- Sud, UC, Ahmad, T, Rai, A and Sahoo, PM. Sampling methodology for estimation of average yield of cotton using double sampling approach.

- 70th annual Conference of Indian Society of Agricultural Statistics entitled "International conference on statistics and big data bioinformatics in Agricultural research" organized by ICRISAT, Patacheru, Telangana during 21-23 November, 2016.

  - Ahmad, T, Sahoo, PM and Krishna, G. (2016). Comparative evaluation of advanced classifiers for delineation of area under agroforestry from space-borne multispectral data". (Invited Speaker)
  - Basak, P (2016). Calibration Estimation of Finite Population Regression Coefficient involving Two-stage Sampling Design.
  - Chandra, H, Kumar, S, Sud, UC and Aditya, K (2016). Small Area Estimation of Proportions by Combining Survey Data with Different Levels of Auxiliary Data.
  - Kumar, R and Bhar, LM (2016). Identification of Outliers in incomplete Multi-Response Experiments.
  - Singh, D (2016). Trade, market and market intelligence with relation to pulses in major Pulse-hub region (Bundhelkhand) of India.
  - Tyagi, KK, Rao, GM, Aditya, K, Chandra, H and Sud, UC (2016). Pilot Study for Developing State Level Estimates of Crop Area and Production on the Basis of Sample Size Recommended by Prof. Vaidyanathan Committee-Observations on Field Data Collection Work.

- 18th National Conference of Agricultural Research Statisticians entitled "National Priorities in Agricultural Statistics and Informatics" organised jointly by ICAR-IASRI and ICAR-IIFSR Modipuram, Meerut, Uttar Pradesh during 16-17 December, 2016

  - Aditya, K, Chandra, H, and Sud, UC (2016). MAPI Software for Data Collection using Smart Phones –A Way Forward for Fast, Cost Effective and Quality Data. (Invited talk).
  - Biswas, A, Sahoo, RN and Krishna, G (2016). Discrimination of Wheat Varieties using Hyperspectral data. (Invited talk).
  - Sahoo, PM, Ahmad, T and Rai, A (2016) Generation of Agricultural Statistics using Remote Sensing and GIS: Current Status and Future Challenges. (Invited talk).

- The 25th International Conference of the Forum for Interdisciplinary Mathematics Statistics and Computational Techniques at Jaipur during 22-24 December, 2016.

  - Chandra, H, Kumar, S, Sud, UC and Aditya, K (2016). Small Area Estimation of Proportions by Combining Survey Data with Different Levels of Auxiliary Data. (Invited talk).

- 104th Indian Science Congress held at Sri Venkateswara University, Tirupati during 03-07 January, 2017.

  - Sahoo, PM, Ahmad, T and Rai, A (2017). Sampling Methodology for Crop Acreage and Production Estimation in Hilly Regions using Geospatial technology.

- National Workshop on Improvement of Agricultural Statistics" organized by Directorate of Economics & Statistics, MoAFW, Govt. of India during 04-05 January, 2017 at Symposium Hall, Pusa Complex, New Delhi

  - Ahmad, T, Sud, UC, Biswas, A and Sahoo, PM (2017). Alternative sampling methodology for estimation of area and production of horticultural crops under ICAR-IASRI component of CHAMAN. (Invited talk).
  - Chandra, H, Aditya, K and Sud, UC (2017). MAPI Software for Data Collection using Smart Phones –A Way Forward for Fast, Cost Effective and Quality Data. (Invited talk).

- The International Conference on Computational Mathematics & Statistics 2017, Banasthali University, Rajasthan, January 24-25, 2017.

  - Chandra, H, Kumar, S and Aditya, K (2017). Estimation of Small Area Proportions using Survey Data and Different Levels of Covariates. (Invited talk).

- Workshop under 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" at ICAR-IASRI during 17-18 March, 2017.

- ➢ Aditya, K (2017). Schedules for Data Collection, Data Entry Software and MAPI Software" (Invited talk).
- Workshop on Standardization of Sampling Methodology for Crop Yield Estimation at Lower Level in the Context of Crop Insurance, ICAR-IASRI, New Delhi, 27 March, 2017.
  - ➢ Chandra, H and Sud, UC (2017). Disaggregate Level Crop Yield Estimation Using Small Area Estimation Techniques. (Invited talk).
  - ➢ Ahmad, T (2017). Use of Remote Sensing Technology for crop yield estimation in the context of Crop Insurance. (Invited talk).
- 70th Annual Conference of Indian Society of Agricultural Statistics- An International Conference on Statistics & Big Data Bioinformatics in Agricultural Research, ICRISAT Hyderabad, India during 21-23 November, 2016.
  - ➢ Dr Tauqueer Ahmad delivered an invited talk and convened the session on "Geostatistics & Remote Sensing" as Co-Convener.
  - ➢ Dr. Tauqueer Ahmad, Dr. Hukum Chandra, Sh. Deepak Kumar, Sh. Raju Kumar and Sh. Pradeep Basak attended the conference.
- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research' during 21st to 23rdNovember, 2016 at ICRISAT, Hyderabad.
  - ➢ Dr.A.K.Choubey was Co-Convener of Data Science Teaching & Communication session
  - ➢ Dr. S.Marwaha and Dr.S.Pal were Co-Convener of Data Management Session.
- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research' during 21st to 23rdNovember, 2016 held at ICRISAT, Hyderabad.
  - ➢ Dr. Soumen Pal presented a contributory research paper entitled "KVK Knowledge Network: Data Management of Krishi Vigyan Kendras in India".
- XVIII National Conference of Agricultural Research Statisticians held at IIFSR, Modipuram during 16th to 17thDecember, 2016.
  - ➢ Dr. Soumen Pal presented an invited talk in the on "Krishi Vigyan Kendra Knowledge Network: A Management System for Agriculture Extension Services in Indian NARES".

- XVIII National Conference of Agricultural Research Statisticians held at IIFSR, Modipuram during 16th-17th December, 2016.
  - ➢ Dr. Mukesh Kumar delivered the talk on KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture
- 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu during 6th -8thMarch, 2017.
  - ➢ Dr. Soumen Pal presented two invited talks

LECTURE DELIVERED

Dr. L.M. Bhar

- "Some challenges on statistical genetics and genomics" in the eighteenth National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP) during December 16-17, 2016.

Dr. R.K. Paul

- "Statistical models for forecasting rainfall in different agro-climatic zones of India" in the eighteenth National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP) during December 16-17, 2016.
- "Time-Series Analysis" on July 22, 2016 in the FDP on Application of Statistical Tools and Data Analysis in Research at Jagannath International Management School (JIMS) Vasant Kunj, New Delhi.
- "Market Intelligence" in the 5th Review Workshop of the Network Project held on 16-18 May, 2016, at NIAP, New Delhi on ARIMA, ARIMAX, SARIMA, ARCH, GARCH, and Hybrid Models.
- "Advances in time series modelling" in the review workshop of Network Project on Market Intelligence on 7 February, 2017 at ICAR- NIAP, New Delhi.

Dr. P.K. Meher

- "Supervised learning techniques using R" in a "National workshop in big data analytics and visualization" which was organised by Jaypee Institute of Information Technology, Noida, UP, during on 06 Sept., 2016.

Dr. Rajender Parsad

- One lecture on Statistical Concepts, Web Resources and Indian NARS Statistical Computing Portal to the students of Ph.D. (Agricultural Engineering) at CIAE, Bhopal. (lecture delivered on April 12, 2016).

- One lecture on Fundamental of Design of Experiments and Web Resources to the participants of Workshop cum training programme on Yield Enhancement in Maize through Breeding and Design of Newly Developed Genotypes in All India Coordinated Research organized by ICAR- IIMR, New Delhi during June 01-03, 2016. (lecture delivered on June 02, 2016).

- 04 lectures on (i) SPSS: An Overview; (ii) Practical exercise on Central Tendency using SPSS; (iii) Practical exercise on Correlation and Regression Using SPSS and (iv) Practical exercise on analysis of qualitative data using SPSS to the participants of the Training Programme on Thematic Research on Border Issues organized at Institute for Border Management and Strategic Studies, New Delhi during July 04-August 26, 2016 (lectures delivered on July 13, 2016).

- 04 lectures on (i) Correlation and Regression Analysis; (ii) Non-parametric tests and (iii) Web Resources on Statistical Techniques (2 lectures) to the participants of the Training Programme on FDP on Application of Statistical Tools and Data Analysis in Research organized at Jagannath International Management School, Vasant Kunj, New Delhi during July 18-22, 2016 (lectures delivered on July 20, 2016).

- 02 lectures on (i) Basic Principles of Design of Experiments and (ii) Indian NARS Statistical Computing Portal to the participants of the Training Programme on "Statistical Tools used in IPM" organized at NCIPM, New Delhi during August 09-August 11, 2016 (lectures delivered on August 09, 2016).

- 14 Lectures (11 Theory and 03 practical) on (i) Statistics: Introduction and Concepts; (ii) Classification, tabulation and graphical representation of data and levels of Measurement; (iii) Estimation of Parameters; (iv) Testing of hypothesis; (v) Correlation and Regression: correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation; (vi) Correlation and Regression: Simple and multiple linear regression model, coefficient of determination; (vii) Web Resources on Design of Experiments; (viii) Planning of an Experiment and Basic Principles of Design of Experiments; (ix) Response Surface designs and Experiments with Mixtures; (x) Multivariate Analysis: An Overview; (xi) Data Analysis Techniques: A Review; (xii) Practical Exercise using Web Resources on Design of Experiments; (xiii) Practical Exercise on Correlation and (xiv) Practical Exercise on Regression Analysis to the Participants of 2nd Batch of Afghanistan National Agricultural Sciences and Technology University under International M.Sc. Programme for Afghan Nationals on Teaching of Post-Graduate courses in Agronomy from July 30 to August 25, 2016 at IASRI, New Delhi.

- 04 lectures on (i) SPSS: An Overview; (ii) Practical exercise on Central Tendency using SPSS; (iii) Practical exercise on Correlation and Regression Using SPSS and (iv) Practical exercise on analysis of qualitative data using SPSS to the participants of the Training Programme on Thematic Research on Border Issues organized at Institute for Border Management and Strategic Studies Building, Hq 25 Bn BSF, Chhawla, New Delhi during October 03- November 16, 2016 (lectures delivered on October 14, 2016).

- 02 lectures on SAS: An Overview to the participants of the training programme on Impact Assessment of Agricultural Technology organized under the aegis of CAFT by Division of Agricultural Economics, ICAR-IARI, New Delhi during December 14, 2016 -January 03, 2017. (Lectures delivered on December 19, 2016)

- 04 Lectures on (i) Designing Lab and Field Experiments (02 lectures) and (ii) Design Resources Server (2L) to the participants of 10 Weeks Induction Training for Scientists and Research Officers of ICFRE organized at

FRI (Deemed University), Dehradun (lectures delivered on January 09, 2017).

- One invited talk on Web Resources and SAS: An Overview during the Workshop on Data Analysis Using SAS and SPSS held organized in 19th Annual Conference of Society of Statistics, Computer and Application organized during March 06-08, 2017 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu on March 08, 2017.

- One Lecture on Principle of Field Experimental Designs to the participants of the ICAR sponsored training programme on Layout and Maintenance of Field Experiments and Recording Observations at Division of Agronomy, ICAR-IARI, New Delhi-110012. (lecture delivered on March 18, 2017).

- 02 invited talks on (i) Web Resources on Statistical Techniques and (ii) Correlation and Regression to the participants of National Workshop on Bio-Statistics organized at Zakir Husain Delhi College, University of Delhi, Delhi during March 09-10, 2017. (lectures delivered on March 10, 2017).

- One Lecture on Genesis, Progress and Future Course of Action on ICAR Research Data Repository for Knowledge Management to the participants of the Experts' Workshop on Geo-Portal organized at ICAR-NBSS&LUP, Nagpur on March 27, 2017.

Dr. Mukesh Kumar

- Talk delivered on "Online Module for Technology Repository" in Technical Session IV, Second Workshop of Nodal Officers on ICAR Research Data Repository for Knowledge Management (KRISHI) held during 24th-25th January, 2017 at NASC Complex, New Delhi.

- Talk delivered on "Workflows for Central Data Repository, Single Sign on through Unified Communication System and accessibility with ICAR Data Centre" in Technical Session VI, Second Workshop of Nodal Officers on ICAR Research Data Repository for Knowledge Management (KRISHI) held during 24th-25th January, 2017 at NASC Complex, New Delhi.

Dr. Soumen Pal

- "KVK Mobile App: An ICT Tool to Empower Indian Farmers from Hill Area with Knowledge Produced at Krishi Vigyan Kendra" in the Technical Session II on 'Synthesis of Statistics and Informatics in Relation to Hill Ecosystem' in 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu during 6th -8thMarch, 2017.

- "KVK Portal and KVK Mobile Application" in the Technical Session III on 'Informatics on Protection of Plant Varieties and Farmer's Rights' in 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu during 6th-8th March, 2017.

PARTICIPATION

Conferences/Workshops/Trainings/Seminars/Symposia

- Workshop of Network Project on Market Intelligence during 7-8 February, 2017 at ICAR-NIAP, New Delhi. (Dr. RK Paul)

- Workshop of the Network Project on Market Intelligence held during 16-18 May, 2016, at NIAP, New Delhi. (Dr. RK Paul)

- Workshop of the project Impact of ICT in Agricultural education during 21-23 March, 2017 held at KAB-II, New Delhi. (Dr. RK Paul)

- Workshop on Onion at Lasalgaon, Maharashtra on 20th September, 2016 conducted under the project network project on Market Intelligence. (Dr. RK Paul)

- Workshop of the project on "Network Project on Impact Assessment of Agricultural Research and Development" held on 15th March, 2017 at ICAR-NIAP, New Delhi. (Dr. RK Paul)

- 70th Annual "International Conference on Statistics & Big Data Bioinformatics in Agricultural Research at ICRISAT, Patancheru, Telangana under annual conference of Indian Society of Agricultural Statistics (ISAS) during 21-23 November 2016. (Dr. LM Bhar, Dr. AK Paul, Dr. Himadri Ghosh, Dr. RK Paul, Dr. PK Mehar and Dr. Prakash Kumar)

- Eighteenth National Conference of Agricultural Research Statisticians of ICAR   Institutes, Project Directorates and Agricultural Universities of the country held at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP) during December 16-17, 2016.(Dr. LM Bhar, Dr. RK Paul, Dr. UK Pradhan and Dr. Prakash Kumar)

- 19th Annual Conference of Society of Statistics, Computer and Applications held during 06-08 March, 2017 at SKUAST-Jammu, Jammu and Kashmir. (Dr. PK Meher and and Dr. Samarendra Das)

- Zonal Workshop-cum-Interaction Meet on ICAR-NAIF-Innovation & Incubation Projects for SMD-Engineering Institute of ICAR organized at ICAR-CIAE, Bhopal during April 11-12, 2016.(Dr. Rajendra Parsad)

- XXXIV Annual Group Meeting of AICRP on Vegetable Crops held at Division of Vegetable Science, IARI, New Delhi during May 11-13, 2016. (Dr. Rajendra Parsad)

- National Symposium on Statistics for Sustainable Agricultural Development organized to commemorate the Birth Centenary of Late Professor P.K. Bose by Indian Association for productivity, quality and reliability in collaboration with ICAR-National Bureau of Soil Survey and Land Use planning and International Plant Nutrition Institute, South Asia Programme, Gurgoan at ICAR-NBSS&LUP, Regional Centre, Kolkata during June 17-18, 2016. (Dr. Rajender Parsad)

- "Communication technology Mediated Agricultural Extension" under the aegis of CAFT at Division of Agricultural Extension, ICAR-IARI, Pusa, New Delhi during 02-22 August, 2016. (Dr. Arpan Bhowmik)

- "Professional Attachment Training" (PAT) at Department of Statistics, Viswa Bharati University under the guidance of Prof. Kashinath Chatterjee. Worked on the topic "A Study on Fractional Factorial Designs" during the period under attachment training. This study included Split-plot designs with factorial treatment structure and Latin Hypercube designs. Also prepared a report on this study during the training period. Attended Second Lecture Series on "Recent Developments in Statistics" organized by Department of Statistics, Viswa-Bharati. (Dr. Anindita Datta)

- "Professional Attachment Training" (PAT) at Department of Statistics, Viswa Bharati University under the guidance of Prof. Kashinath Chatterjee. Worked on the topic "A Study on Fractional Factorial Designs" during the period under attachment training. This study included Split-plot designs with factorial treatment structure and Latin Hypercube designs. Also prepared a report on this study during the training period. Attended Second Lecture Series on "Recent Developments in Statistics" organized by Department of Statistics, Viswa-Bharati. (Mohd. Harun)

- Workshop on Linear Mixed Model in Practice: An AS REML-Oriented Approach at CIFE, Mumbai organized by Indian Fisheries Association and CIFE, Mumbai during October 13-15, 2016. (Dr. Susheel Kumar Sarkar and Dr. Sukanta Dash)

- "Advances in Experimental Data Analysis" under CAFT, in Frontier and Specialized Areas of Agriculture and allied sciences organized during 06-26 October, 2016 at ICAR-IASRI. (Mohd. Harun)

- International Conference on Statistics and Big Data Bioinformatics in Agricultural Research (70th Annual Conference of Indian Society of Agricultural Research) organized at ICRISAT, Hyderabad during November 21-24, 2016. (Dr. Rajender Parsad, Dr. Susheel Kumar Sarkar, Dr. B.N. Mandal, Dr. Eldho Varghese, Dr. Sukanta Dash, Dr. Arpan Bhowmik, Mr. Sunil Kumar Yadav, Dr. Anindita Datta and Mohd. Harun)

- 4th International Agronomy Congress w.e.f. 22-26, November, 2016 at IARI, New Delhi-110012. (Dr. Anil Kumar)

- "Digitalization of Breeding Database through Breeding Management System software of Integrated Breeding Platform" during November 14-18, 2016 at ICRISAT, Hyderabad. (Dr. Susheel Kumar Sarkar)

- 18th NCARS held at ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram, Meerut during December 16-17, 2016. (Dr. Seema Jaggi, Dr. Rajender Parsad, Dr. Cini Varghese, Dr. Anil Kumar, Dr. Susheel Kumar Sarkar Dr. Eldho Varghese, Dr. Sukanta Dash and Dr. Arpan Bhowmik)

- 8th International Symposium on Statistics and Optimization in conjuction with 36th Annual Convention of Indian Society of Probability and Statistics organized at Department of Statistics and Operations Research, Aligarh Muslim University, Aligarh during December 17-19, 2016 (participated on December 18, 2016). (Dr. Rajender Parsad)

- Steering Committee Meeting of KRISHI to review the progress made and discuss the way forward for implementation of ICAR Research Data Repository for Knowledge Management, held at ICAR-IASRI, New Delhi on December 23, 2016. (Dr. Rajender Parsad, Dr. Anil Kumar and Dr. Susheel Kumar Sarkar)

- Biennial Workshop of AICRP on IFS at SKUAST, Jammu during December 20-21, 2016 and made a presentation on "Progress and methodology for statistical analysis of on-farm farming system experiments. (Dr. Cini Varghese)

- Biennial workshop of AICRP on IFS held at SKUAS&T, Jammu during 20-23, December, 2016. Presentation is also made on " Progress on statistical analysis techniques for On-station experiments of cropping and farming systems" in Technical session-I. (Dr. Anil Kumar)

- "Massive Open Online Course" (MOOC) on Competency Enhancement for Effective Teaching during November 18–December 15, 2016 organized by NAARM Hyderabad. (Dr. Eldho Varghese)

- "Massive Open Online Course" (MOOC) on Basics of Entrepreneurship Development in Agriculture during 18th January, 2017 - 19th March, 2017 jointly offered by Indian Institute of Technology Kanpur (IITK) and Commonwealth of Learning (COL), Canada. (Dr. Eldho Varghese)

- Second Workshop of Nodal Officers of KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) at NASC and ICAR-IASRI during 24-25 January, 2017. (Dr. Seema Jaggi, Dr. Rajender Parsad, Dr. Anil Kumar, Dr. Susheel Kumar Sarkar, Dr. Arpan Bhowmik)

- Advanced Level Workshop on IP Management jointly organized by TIFAC and DRDO at NASC Complex, ICAR, New Delhi during January 12-14, 2017. (Dr. Rajender Parsad)

- Attended XIII Agricultural Science Congress 2017 organized at University of Agricultural Sciences, Bengaluru during February 21-24, 2017. (Dr. Rajender Parsad)

- "STAT-QUEST-2017 Workshop" organized by the Department of Statistics, University of Calcutta, Kolkata on March 21, 2017 for Post Graduate students of Statistics. (Dr. Seema Jaggi)

- 19th Annual Conference of Society of Statistics, Computer and Application organized during March 06-08, 2017 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu. (Dr. Rajender Parsad and Dr. Sukanta Dash)

- Workshop for UNIT LEVEL DATA REPOSITORY under KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) at ICAR-IASRI during 28 February-01March, 2017. (Dr. Rajender Parsad, Dr. Seema Jaggi, Dr. Susheel Kumar Sarkar, Dr.Sukanta dash and Dr. Arpan Bhowmik)

- Training Programme on Unit Level Data from Researchers Perspective under KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) at ICAR-IASRI during 24-25 March, 2017. (Dr. Rajender Parsad, Dr. Seema Jaggi, Dr. Susheel Kumar Sarkar, Dr. Sukanta dash and Dr. Arpan Bhowmik)

- ICAR KRISHI Geoportal Workshop- Experts at ICAR-NBSS&LUP, Nagpur during March 27, 2017. (Dr. Susheel Kumar Sarkar)

- Agri-entrepreneurs workshop organized at KVK, Sikohpur on 27.03.2017 and interacted with agri-entrepreneurs. (Dr. Eldho Varghese and Dr. Arpan Bhowmik)

- Workshop on "Preparing Strategic Plan for Agricultural and Rural Statistics (SPARS)" in Sri Lanka under the Global Strategy for Improving Agricultural and Rural Statistics in the country, Colombo, Sri Lanka on 29 April, 2016. (Dr Hukum Chandra)

- Workshop, on usage of Landscape-scale Crop Assessment Tool (LCAT) the LCAT during 02–03 May, 2016 at Hotel Pride Plaza, Aerocity, New Delhi, India organized by Oak Ridge National

Laboratory (ORNL, USA), the International Maize and Wheat Improvement Center (CIMMYT) and Cereal Systems Initiative for South Asia (CSISA) and the organizing committee of LCAT. (Dr. Prachi Misra Sahoo)

- Workshop on statistical techniques in biometrics during 31 May to 02 June, 2016 at ICAR-IASRI, New Delhi. (Sh Deepak Kumar)

- Workshop on "Statistical Computing using R", Department of Financial Studies, University of Delhi, South Campus, Delhi on 11 June, 2016. (Dr Hukum Chandra)

- 9th Agriculture Leadership Summit 2016 held in New Delhi during 08-09 September, 2016.(Dr. Hukum Chandra)

- Workshop on "Advancement in Computing", Banasthali, Rajasthan on 10 September, 2016. (Dr Hukum Chandra)

- Workshop organized by Population Research Centre, Kerala under the Ministry of Health & Family Welfare, Govt of India, Trivandrum, Kerala during 06-07 October, 2016. (Dr. Hukum Chandra)

- Global Strategy Outreach Workshop on Agricultural Statistics organized by FAO at FAO Headquarters, Rome, Italy during 24-25 October 2016. (Dr Tauqueer Ahmad)

- Seventh International Conference organized by FAO on Agricultural Statistics (ICAS VII) held at FAO Headquarters, Rome, Italy during 26-28 October, 2016. (Dr. Tauqueer Ahmad and Dr. Hukum Chandra)

- 18th National Conference of Agricultural Research Statisticians, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, India during 16-17 December, 2016. Dr. Tauqueer Ahmad convened the session on "Current Status and Future Challenges in Space Technology based tools in Agriculture research (Applications of Remote Sensing and Geographic Information System)" as Convener. (Dr. Tauqueer Ahmad, Dr. Hukum Chandra, Dr. Kaustav Aditya and Sh Raju Kumar)

- All India Training Workshop for Nodal Officers of 20th Livestock Census 2017 organized by Dept. of Animal Husbandry, Dairying and Fisheries, Ministry of Agricultural and Farmers Welfare, Vigyan Bhawan, Delhi during 19-21 December, 2016. (Dr. Tauqueer Ahmad and Dr. Hukum Chandra)

- 25th International conference of the forum for interdisciplinary Mathematics Statistics and Computational Techniques, Jaipur during 22-24 December, 2016. (Dr. Hukum Chandra)

- 104th Indian Science Congress held at Sri Venkateswara University, Tirupati during 03-07 January, 2017. (Dr. Prachi Misra Sahoo)

- National workshop on Improvement of Agricultural Statistics organized by Directorate of Economics & Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India during 04-05 January, 2017. (Dr. Hukum Chandra and Dr. Kaustav Aditya)

- International Conference on Computational Mathematics & Statistics 2017, Department of Mathematics & Statistics, Banasthali University, Rajasthan, India during 24-25 January, 2017. (Dr. Hukum Chandra)

- Workshop on "Pilot studies on use of technology for Crop Insurance", NASC Complex, New Delhi on 28 February, 2017. (Dr. Hukum Chandra)

- 19th Annual Conference of Society of Statistics, Computer & Application, Sher-e-Kashmir University of Agricultural Sciences- Jammu during 06-08 March, 2017. (Dr. Hukum Chandra)

- Workshop pertaining to 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 at the Institute during March 17-18, 2017. (Scientists and Technical Officers of the SSM Division)

- Workshop on Statistical Computing software R, Department of Mathematics, Keshav Mahavidyalaya, University of Delhi, Delhi on 24 March, 2017. (Dr. Hukum Chandra)

- Workshop on Standardization of sampling methodology for crop yield estimation at lower level in the context of Crop Insurance under the Chairmanship of Secretary, Department of Agricultural Research & Education (DARE) and Director General, ICAR at ICAR-IASRI, New Delhi on 27 March, 2017. (Scientists and Technical Officers of the SSM Division)

- Fourth Annual Review Workshop of National Agricultural Science Fund during May 28-29, 2015 at NASC Complex, PUSA, New Delhi 110012. (Dr. A.R.Rao)

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- Strategy workshop on 'Towards achieving self-sufficiency of pulses in India' was organized at NASC, New Delhi under the auspices of National Academy of Agricultural Sciences (NAAS) on 7-8 April 2016. (Dr. Dinesh Kumar)

- Strategy workshop on 'Towards achieving self-sufficiency of pulses in India' was organized at NASC, New Delhi under the auspices of National Academy of Agricultural Sciences (NAAS) on 7-8 April 2016. (Dr. M. A. Iquebal)

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research (70th Annual Conference of ISAS) ICRISAT, Hyderabad, 21-23 November, 2016. (Dr. Anil Rai)

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research (70th Annual Conference of ISAS) ICRISAT, Hyderabad, 21-23 November, 2016. (Dr. Dinesh Kumar)

- XVIII National Conference of Agricultural Research Statisticians at ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut from December 16-17, 2016. (Dr. Dinesh Kumar)

- National Seminar on Priorities in Fisheries and Aquaculture (PFA) – 2017 at College of Fisheries, Rangeilunda, OUAT, 21-23 November, 2016. (Dr. A.R. Rao)

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research, ICRISAT, Hyderabad, 21-23 November, 2016. (Dr. A.R. Ra.)

- 18th NCARS conference on National Priorities in Agricultural Statistics and Informatics, IIFSR-Modipuram. (Dr. A.R. Rao)

- Altair Technology Conference organized by Altair on High Performance Computing Simplified, New Delhi, July 29, 2016. (Dr.U.B.Angadi)

- XVIII National Conference of Agricultural Research Statisticians, ICAR- IIFSR Modipuram, Meerut. 16 December 2016. (Dr. K.K. Chaturvedi)

- 19th Annual National Conference of Society of Statistics, Computer and Applications on Statistics and Informatics in Agricultural and Allied Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu

(J&K), 06 March to 08 March 2017. (Dr. K.K. Chaturvedi)

- ATCx 2016 conference on "High Performance Computing Simplified", New Delhi, 29 July 2016. (Dr. K.K. Chaturvedi)

- 5th International Conference on Reliability, Infocomm and Technology Optimization (ICRITO 2016), Amity University, Noida (UP), 09 September 2016. (Dr. K.K. Chaturvedi)

- XVIII National Conference of Agricultural Research Statisticians, ICAR- IIFSR Modipuram, Meerut, 16 December 2016. (Ms. Anu Sharma)

- International Conference on Innovative Research in Biomedical Engineering, Cancer Biology, Stem Cells, Bioinformatics and Applied Biotechnology (BECBAB-2016), Jawahar Lal Nehru University, New Delhi, 30 October, 2016. (Dr. Sarika)

- International Conference on Green Technology for Health and Environment: Implementations and Policies. Ramanashree Resort, Bangalore, December 15-16, 2016. (Dr. M.A. Iquebal)

- XVIII National Conference of Agricultural Research Statisticians, ICAR-Indian Institute of Farming Systems Research, Modipuram, Modipuram, Meerut (UP), December 16, 2016. (Dr. D.C. Mishra)

- 19th Annual National Conference of Society of Statistics, Computer and Applications on Statistics and Informatics in Agricultural and Allied Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K), 06 March to 08 March 2017. (Dr. D.C. Mishra)

- 19th Annual National Conference of Society of Statistics, Computer and Applications on Statistics and Informatics in Agricultural and Allied Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K), 06 March to 08 March 2017. (Dr. SB Lal)

- International Conference on Computational Mathematics & Statistics, Department of Mathematics & Statistics Banasthali University, Rajasthan, India. January 24-26, 2017. (Dr. SB Lal)

- Altair Technology Conference organized by Altair on High Performance Computing Simplified,

ShangriLa's Eros Hotel, Ashoka Road, New Delhi, July 29, 2016. (Dr. SB Lal)

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research, ICRISAT, Hyderabad, 21-23 November, 2016 Dr. A.R. Rao. (Mr. Neeraj Budhlakoti)

- XVIII National Conference of Agricultural Research Statisticians at ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut from December 16-17, 2016. (Mr. Neeraj Budhlakoti)

- 19th Annual National Conference of Society of Statistics, Computer and Applications on Statistics and Informatics in Agricultural and Allied Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K), 06 March to 08 March 2017. (Mr. Neeraj Budhlakoti)

- XVIII National Conference of Agricultural Research Statisticians at ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut from December 16-17, 2016. (Md. Samir Farooqi)

- Workshop on RTIMIS for RTI Nodal Officer on 21st October, 2016 at NASC Complex. This workshop was organized by ICAR HQ with DoPT Personnel. (Dr. Mukesh Kumar)

- Consultation Workshop on Mobile Seva on 21st November, 2016 at CGO Complex, New Delhi. (Dr. Mukesh Kumar)

- Workshop on Breeding Data Management & Analysis on 24th November, 2016 at ICRISAT Hyderabad. (Dr. A.K.Choubey)

- International Conference CAF 16 in New Delhi organized by Ag. Engineering Division of ICAR. (Dr. Sudeep)

- XVIII National Conference of Agricultural Research Statisticians held at IIFSR, Modipuram during 16-17 December, 2016. (Dr. A. K. Choubey, Dr. Mukesh Kumar, Dr. Soumen Pal and Sh. Pal Singh)

- International Conference on Statistics & Big Data Bioinformatics in Agricultural Research at ICRISAT, Patancheru, India 21-23 November 2016 and Co-convened the session "Theme: Data Science Teaching & Scientific Communication" : Co-Convener on 23-11-2016. (Dr. A.K. Choubey)

- XVIII National Conference of Agricultural Research Statisticians of ICAR Institutes, Project Directorates and Agricultural Universities of the country organized at Indian Institute of Farming Systems Research (IIFSR), Modipuram (UP) during December 16-17, 2016. Convened the Technical Session VI: Access to technology information for end users with specific reference to Development of Expert/Decision Support/ Knowledge Management Systems and Mobile Applications in Agricultural Research and Extension. (Dr. A.K. Choubey)

- 19th Annual National Conference of Society of Statistics, Computers and Applications held at SKUAST, Jammu during 6th -8thMarch, 2017. (Dr. Mukesh Kumar and Dr. Soumen Pal)

- National Level Review-cum-Sensitization Workshop of Management and Impact Assessment of Farmer First Projects during 18th-19th March, 2017at NAARM, Hyderabad under 'Farmer First' Programme (FFP) Component of KVK Scheme. (Dr. Mukesh Kumar, Dr. Anshu Bharadwaj and Dr. Soumen Pal)

- Workshop on KVK Portal and Mobile App organized at ICAR-IASRI on 9th March, 2017. (Dr. Alka Arora)

- Workshop for Unit Level Data Repository on 1st March, 2017. (Dr. Anshu Bharadwaj)

Visit Abroad

Dr. UC Sud

- Rome, Italy during 07-08 September, 2016 for participation in the Validation meeting on "Improving methods for estimation crop area, yield and production under mixed, repeated and continuous cropping" and brief session on "Measuring vegetable production" at FAO Head quarters.

- Thimphu, Bhutan during 14-25 September, 2016 to provide consultancy services to develop improved sampling design/methodology for crop yield estimation in the country for paddy and Maize.

- Thimphu, Bhutan from 23-28 January, 2017 to provide consultancy services for Bhutan Living Standard Survey (BLSS) to finalize sampling

design for Living Standard Measurement Survey as a Sampling Expert.

- Chiba, Japan during 21-24 March, 2017 for Regional workshop on Training of Trainers for Official Statistics.

Dr. Tauqueer Ahmad

- Rome, Italy during 07-08 September, 2016 for attending Validation meeting organized by Food and Agriculture Organization of the United Nations (FAO) on "improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" and brief session on "Measuring vegetable production" held at FAO Headquarters, Rome.

- Rome, Italy during 24-28 October, 2016 for attending and presenting research papers in Global Strategy Outreach Workshop on Agricultural Statistics during 24-25 October, 2016 and Seventh International Conference on Agricultural Statistics (ICAS VII) during 26-28 October, 2016 organized by Food and Agriculture Organization of the United Nations (FAO) held at FAO Headquarter, Rome.

Dr. Hukum Chandra

- Sri Lanka as International Consultant for the Food and Agriculture Organization of United Nations under Global Strategy to Improve Agricultural and Rural Statistics in Sri Lanka during 25 April - 06 May, 2016 and during 12-23 September, 2016.

- Rome, Italy to attend the Seventh International Conference on Agricultural Statistics and to present paper, Rome, Italy. Funded by Food

and Agriculture Organization of United Nations, Rome, Italy during 25-29 October, 2016.

- Addis Ababa, Ethiopia as Expert Member to attend the experts meeting on Ethiopia Statistics from Space project of the Food and Agriculture Organization of United Nations, Addis Ababa, Ethiopia during 04-08 December, 2016.

Dr. Kaustav Aditya

- National Institute of Statistics of Rwanda, Kigali, Rwanda to impart training on Computer Assisted Personal Interviewing (CAPI) software during 25-30 April, 2016.

- Musanze District in Rwanda where the field data collection work under the project "Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" was undertaken, for verification of data on 29 April, 2016.

Dr. Ankur Biswas

- National Institute of Statistics of Rwanda, Kigali, Rwanda as a Resource Person to impart training on CAPI software during 25-30 April, 2016 under the project "Research on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" funded by FAO of United Nations, Rome.

- Jamaica as a Resource Person in order to supervise data collection work during 13-17 June, 2016 under the project entitled "Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping" funded by FAO of United Nations, Rome.

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Conferences, Workshops, Meetings, Seminars and Annual Day Organized

Dr. Ajit

- As Organizing Secretary organized the Eighteenth National Conference of Agricultural Research Statisticians at ICAR-Indian Institute of Farming Systems Research, Modipuram (UP) during December 16-17, 2016.

Dr. Seema Jaggi

- Systematized the visit of NAAC Peer Team to ICAR-IASRI on 10-08-2016 during their visit to IARI (August 8 - 11, 2016) for accreditation of IARI.

Dr. Rajender Parsad, Dr. Eldho Varghese and Dr. Sukanta Dash

- Modular Course on Basic Statistical Methods for the Participants of 2nd 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 July 30 to August 25, 2016 at IASRI, New Delhi (the complete programme was coordinated by Professor Anupam Verma and organized at IARI, New Delhi).

Dr. Cini Varghese and Dr. B.N. Mandal

- Training programme on "Experimental Data Analysis" for technical personnel of ICAR was organized during 24th August - 06th September, 2016 by the Division of Design of Experiments, ICAR – IASRI, New Delhi.

Dr. Anil Kumar and Dr. Sukanta Dash

- Winter School on "Designing and Analysis of Cropping System Experiments" during September 07-27, 2016 under the aegis of Education Division, ICAR, New Delhi.

Dr. Eldho Varghese and Dr. Arpan Bhowmik

- Training programme on "Advances in Experimental Data Analysis" organized as Course Coordinator during 06-26 October, 2016 under the aegis of CAFT at IASRI.

- Agri-entrepreneurs workshop in collaboration with IARI and KVK, Sikohpur on 27 March, 2017.

Dr. Seema Jaggi and Dr. Arpan Bhowmik

- Training programme on Statistical Techniques for Agricultural Data Analysis organized as Course Coordinator during 02-11 November, 2016 for the technical personnel of ICAR-IASRI at IASRI.

- Technical Session on Current Status and Future Challenges in Teaching and Human Resource Development in Agricultural Statistics and Informatics as Convener in the XVIII National Conference of Agricultural Research Statisticians (NCARS) held at ICAR-IIFSR, Modipuram, Meerut during December 16-17, 2016.

- A one day training programme organized on 28 December, 2016 at IASRI on functions and activities of IASRI for the participants of five weeks training programme on Official Statistics and Related Methodology for the participants of International Statistical Education Centre (ISEC) Kolkata conducted by National Statistical System Training Academy (NSSTA).

Dr. Susheel Kumar Sarkar

- Organized 70th Annual Conference of ISAS as International Conference on Statistics and Big Data Analytics in Agricultural Research during November 21-23, 2016 at ICRISAT, Hyderabad.

Dr. Rajender Parsad

- Technical Session on Current Status and Future Challenges in Research in Agricultural Statistics in the XVIII National Conference of Agricultural Research Statisticians organized at ICAR-Indian Institute of Farming Systems Research, Modipuram during December 16-17, 2016 (The session was held on 16.12.2016).

- Second Workshop of Nodal Officers of KRISHI: Knowledge based Resources Information Systems Hub for Innovations in Agriculture (ICAR Research Data Repository for Knowledge Management) at NASC and ICAR-IASRI during 24-25 January, 2017.

- Technical Session on Significance of Experimental Designs in Agricultural Sciences during 19th Annual Conference of Society of Statistics, Computer and Application organized during March 06-08, 2017 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu (Session was held on March 07, 2017).

Dr. Susheel Kumar Sarkar, Dr. Anindita Datta and Mohd. Harun

- Hindi workshop on Basic Statistical Techniques using SAS during 12-15 December, 2016.

Dr. Rajender Parsad, Dr. Anil Kumar, Dr. Susheel Kumar Sarkar and Dr. Arpan Bhowmik

- Workshop on Unit Level Data Repository organized during February 28-March 01, 2017.

- Training programme on Unit Level Data from Researchers Perspective planned during March 24-25, 2017 at ICAR-IASRI, New Delhi. An Experts Workshop on Geo-Portal planned at ICAR-NBSSLUP, Nagpur on March 27, 2017 and Another Experts Workshop organized at ICAR-NAARM, Hyderabad on March 24, 2017.

Dr. Prakash Kumar

- Workshop in hindi on Statistical Techniques in Biometrics from May 31, 2016 to June 2, 2016.

- Study tour for the student of Agricultural Statistics, Computer Applications and Bioinformatics to Dehradun during 18.02.2017 to 21.02.2017 under institute building activity.

Dr. L.M. Bhar and Dr. Samarendra Das

- Training programme on "Recent Analytical Techniques in Statistical Genetics and Genomics" under CAFT at IASRI (17 January - 06 February, 2017).

Dr. A.K. Paul and Dr. Samarendra Das

- Winter School Training programme "Advanced Statistical Techniques in Genetics and Genomics" during 02 - 22 March, 2017 at IASRI.

Dr. A.K. Paul and Dr. R.K. Paul

- Study tour for B.Tech. (Agricultural Information Technology) students from TNAU on 5th December 2016.

Dr. Kaustav Aditya

- Project Management Committee (PMC) meetings 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" as a member secretary of the Project Management Committee on 07 April, 2016, 25 October, 2016 and 03 January, 2017.

- Experts' 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" as a member secretary of the organizing Committee on 06 May, 2016.

- Trainings for Scientists, Technical Officers and Research Associates of the Division on Crop Cutting Experiments (CCE) techniques for major crops and horticultural crops and filling up the schedules under the project "Study to test the developed alternative methodology for estimation of area and production of horticultural crops: IASRI Component of CHAMAN Programme under MIDH" during 10-11 May, 2016 and on 04 July, 2016.

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- Training of the Field Investigators 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" of ICAR-IASRI at AERC, Gujarat Centre on 19-22 September, 2016 and imparted them a training on collection of data on crop area, yield and conducting crop cutting experiments in the field on 20 and 21 September, 2016 respectively. Also imparted a training on data collection using MAPI software on 22 September 2016.

- Field visit in village Bardoli-bariya of Dehgam taluka Gandhinagar District of Gujarat on 23 January 2017 to validate the data collected by the staff of AERC Gujarat under 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" of ICAR-IASRI. A field Demonstration and Training of Crop Cutting Experiment was imparted to the Field investigators. A demonstration of data collection using MAPI software was also imparted was also conducted. Field visit on 24 January in village Sondarda of district Junagarh and village Sunderpura of District Gir Somnath of Gujarat in which training was imparted to the field investigators regarding the data collection technique for crop area enumeration.

Dr. Ankur Biswas

- Assisted Michael Rahija, Research Officer, Global Strategy to Improve Agricultural and Rural Statistics, Food and Agriculture Organization to provide the hands-on exercises in the Workshop - cum - Training on the on Survey Solutions-Computer-Assisted Personal Interviewing (CAPI) under the AMIS project during 11-15 July, 2016 at ICAR-IASRI, New Delhi.

- Co-trainer in collaboration with FAO India, organized an advanced level training on CAPI software for collection of wholesale prices for the officials of Market Intelligence Units (MIU) of DES on 13 February, 2017 at ICAR-IASRI, New Delhi.

- Workshop organized under 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" at ICAR-IASRI during 17-18 March 2017 for reviewing the progress of the project and to get feedback from States on various problems/issues experienced in data collection and data entry work.

- Workshop on "Standardization of sampling methodology for crop yield estimation at lower level in the context of crop insurance" was organized at ICAR-IASRI on 27 March 2017.

Dr. Hukum Chandra

- *Invited Technical Session* on "Open Sources Statistical Computing" in the 70th Annual Conference of Indian Society of Agricultural Statistics, an International Conference on Statistics & Big Data Bioinformatics in Agricultural Research, held at ICRISAT Hyderabad, during 21-23 November, 2016.

- *Invited Technical Session* on "Current Status and Future Challenges in Space Technology based tools in Agriculture research (Applications of Remote Sensing and Geographic Information System)" in the 18th National Conference of Agricultural Research Statisticians, Modipuram, Uttar Pradesh, during 16-17 December, 2016

- Symposium on "Recent Developments in Sample Surveys" in the 25th International conference of the forum for interdisciplinary Mathematics Statistics and Computational Techniques, Jaipur, Rajasthan, during 22-24 December, 2016.

- *Invited Technical Session* "Sample Survey and Statistical Quality Data" in the 19th Annual Conference of Society of Statistics, Computer & Application held at Sher-e-Kashmir University of Agricultural Sciences-Jammu, Jammu, during 06-08 March, 2017.

Dr. A.K. Paul and Samarendra Das

- Winter School Training programme "Advanced Statistical Techniques in Genetics and Genomics" during 02 - 22 March, 2017 at ICAR-IASRI.

Dr. A.K. Paul and Dr. R.K. Paul

- Study tour for B.Tech. (Agricultural Information Technology) students from TNAU on 5th December 2016.

Dr. M.A. Iquebal and Dr. Sarika

- Training on Computational Approaches for NGS Data Analysis and Genomic Selection during 13-18 October, 2016 under CABin scheme at ICAR-Indian Institute of Wheat and Barley Research, Karnal.

- Training under CAFT "Computational Approaches for Next Generation Sequencing (NGS) Data Analysis in Agriculture", at ICAR-IASRI, New Delhi during February 08- 28, 2017 sponsored by the Agricultural Education Division, ICAR, New Delhi.

- Training on Analysis of Biological data Using Computational tools, under CABin scheme during 8-18 January 2016 at ICAR-Central Institute of Freshwater Aquaculture, Bhubaneshwar.

Dr. S.B. Lal and Dr. K.K. Chaturvedi

- Training under CAFT "Advance Computational and Statistical Tools for Omics Data Analysis" during 01-21 December 2016, sponsored by the Agricultural Education Division, ICAR, New Delhi.

Dr. Dinesh Kumar

- Training on Bioinformatics Tools and Techniques in Agriculture, jointly organized by ICAR-NAARM & ICAR-IASRI during 01-10 November 2016.

Dr. M. Grover

- Taining on Introduction to Bioinformatics sponsored by ICAR at ICAR-IASRI, New Delhi during 08-21 November 2016.

Dr. Alka Arora and Dr. Mukesh Kumar

- Knowledge Enhancement Training on HRMS and Payroll module under ICAR-ERP was organized during 18 to 19 April 2016.

Dr. Mukesh Kumar and Dr. N. Srinivasa Rao

- Knowledge Enhancement Training on HRMS and Payroll module under ICAR-ERP organized during 02-03 May, 06-07 May and 23-24 May, 2016.

Dr. Mukesh Kumar

- Knowledge Enhancement Training programme on Supply Chain Managment (SCM) module under ICAR-ERP during 6-7 June and 16-17 June, 2016.

Dr. N. Srinivasa Rao & Dr. Anshu Bharadwaj

- Training on "Computer Applications" during 18-23 July, 2016 for technical personnel of ICAR.

Mr. S.N. Islam and Dr. Soumen Pal

- Training on "Networking: Basics and Management" for technical personnel of ICAR during 25-30 July, 2016.

Dr. Anshu Bharadwaj and Dr. Soumen Pal

- CAFT training on "Machine Learning Tools and Techniques for Agricultural Datasets for Knowledge Discovery" during 3-23 August, 2016.

Dr. Mukesh Kumar and Dr. Sudeep

- Training on "Cyber Security" for ICAR Technical Personnel during 28 September – 5 October, 2016.

- Brain Storming Session organized on 27 December 2016 at ICAR-IASRI for the development of Portal and Mobile Applications for the Division of Agricultural Engineering.

Dr. Mukesh Kumar and Dr. Anshu Bharadwaj

- Workshop of Nodal Officers on ICAR Research Data Repository for Knowledge Management (KRISHI) organized during 24-25 January, 2017 at NASC Complex, New Delhi.

- Training on "ICAR-ERP" for ICAR Technical Personnel during 20- 25 March, 2017.

Mr. Pal Singh and Dr. Sudeep

- Training on "Web-designing, Development and Maintenance using Open Source Software" for ICAR Technical Personnel during 18-27 February, 2017.

**Dr. Soumen Pal, Dr. A.K. Choubey,
Dr. Sudeep, Dr. Mukesh Kumar and
Dr. Anshu Bharadwaj**

- Workshop on KVK Portal and KVK Mobile App at ICAR-IASRI, New Delhi on 9 March, 2017.

Dr. Anshu Bharadwaj

- Workshop for the officials of Directorate of Statistics, Ministry of Agriculture and Farmers Welfare, and State Government Officials of various states on 17-18 March 2017 under the project "Pilot Study for developing States-level estimates as per methodology recommended by Prof. Vaidyanathan Committee Report".

National Conference of Agricultural Research Statisticians

Eighteenth National Conference of Agricultural Research Statisticians was organized by ICAR-IASRI, New Delhi at ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (UP) during December 16-17, 2016. The theme of the conference was National Priorities in Agricultural Statistics and Informatics. Dr. Ajit, Principal Scientist and Incharge-PME-cell, ICAR-IASRI, New Delhi was the Organizing Secretary and Dr. N. Ravishankar, Principal Scientist, ICAR-IIFSR, Modipuram was the Local Organizing Secretary. Six Technical Sessions were conducted during the Conference as listed below (in addition to the two sessions on Action Taken on last conference and Plenary session to finalize the recommedations).

Technical Session I: *Current Status and Future Challenges in Research in Agricultural Statistics*

Technical Session II: *Current Status and Future Challenges in Research in Bioinformatics*

Technical Session III: *Current Status and Future Challenges in Teaching and Human Resource Development in Agricultural Statistics and Informatics*

Technical Session IV: *Current Status and Future Challenges in Space Technology based tools in Agriculture research (Applications of Remote Sensing and Geographic Information System).*

Technical Session V: *Statistical Applications and Modelling with specific reference to Natural Resources Management and Agricultural Engineering*

Technical Session VI: *Access to technology information for end users with specific reference to Development of Expert/Decision Support/Knowledge Management Systems and Mobile Applications in Agricultural Research and Extension.*

Special Session: *Statistical tools for farming systems data analysis*:

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संस्थान में हिन्दी के प्रगामी प्रयोग की रिपोर्ट

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में वर्ष–दर–वर्ष हिन्दी के प्रगामी प्रयोग में अभिवृद्धि हो रही 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 इस संस्थान में लगभग पूरा कर लिया गया है। संस्थान द्वारा समस्त प्रशासनिक कार्य शत–प्रतिशत हिन्दी में और यथाआवश्यक द्विभाषी हो रहा है।

भारत सरकार, राजभाषा विभाग की नगर राजभाषा कार्यान्वयन समिति (उत्तरी दिल्ली) की 30 नवम्बर 2016 को हुई सदस्य कार्यालयों की तीसरी बैठक में वर्ष 2015–16 में राजभाषा कार्यान्वयन कार्य में उत्कृष्ट निष्पादन हेतु बड़े कार्यालयों के वर्ग में भारतीय कृषि सांख्यिकी अनुसंधान संस्थान को तृतीय पुरस्कार प्रदान किया गया।

उक्त समिति द्वारा ही संस्थान में हिन्दी के प्रगामी प्रयोग से सम्बन्धित सितम्बर 2016 को समाप्त छःमाही रिपोर्ट के आधार पर संस्थान को ''उत्कृष्ट श्रेणी'' में वर्गीकृत किया गया है।

संस्थान में प्रशासनिक कार्य के अतिरिक्त वैज्ञानिक प्रकृति के कार्यों में भी हिन्दी के उपयोग को प्रोत्साहित किया जाता है। साथ ही, हिन्दी के प्रयोग में गुणवत्ता की ओर भी ध्यान दिया जा रहा है। संस्थान के वैज्ञानिकों द्वारा अपनी परियोजना रिपोर्टों के कवर पेज, आमुख, प्राक्कथन एवं सारांश द्विभाषी रूप में प्रस्तुत किये गये तथा कुछ वैज्ञानिकों द्वारा अपनी परियोजना रिपोर्टों में विषय–सूची एवं तालिकाएँ भी द्विभाषी रूप में प्रस्तुत की गयीं। वैज्ञानिक प्रभागों द्वारा आयोजित प्रशिक्षण कार्यक्रमों की संदर्भ पुस्तिकाओं में

आमुख, प्राक्कथन एवं कवर पेज द्विभाषी रूप में प्रस्तुत किये। 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 द्विभाषी रूप में सार प्रस्तुत किये गये। वैज्ञानिकों एवं तकनीकी कर्मियों द्वारा शोध–पत्र हिन्दी में प्रकाशित किये गये।

प्रतिवेदनाधीन अवधि के दौरान संस्थान के विभिन्न वर्गों के कर्मियों के लिए चार हिन्दी कार्यशालाएँ आयोजित की गयीं। पहली कार्यशाला अप्रैल–जून 2016 तिमाही में 31 मई से 02 जून 2016 के दौरान संस्थान के सांख्यिकी आनुवंशिकी प्रभाग के वैज्ञानिक, श्री प्रकाश कुमार एवं डॉ. रंजीत कुमार पॉल द्वारा **''जैवमिति में सांख्यिकी तकनीकें''** विषय पर आयोजित की गयी। इस कार्यशाला में इन वैज्ञानिकों के अतिरिक्त संस्थान के अन्य 09 वैज्ञानिकों द्वारा विषय से सम्बन्धित विभिन्न उप–विषयों पर हिन्दी भाषा में 13 व्याख्यान दिये गये। कार्यशाला में वक्ताओं द्वारा प्रतिभागियों को व्याख्यान की सामग्री हिन्दी भाषा में उपलब्ध करायी गयी। दूसरी कार्यशाला जुलाई–सितम्बर 2016 तिमाही के दौरान 21 सितम्बर, 2016 को **''हिन्दी तिमाही प्रगति रिपोर्ट का प्रप्त्र भरने और प्रेषण तथा हिन्दी एवं अंग्रेजी के आवती रजिस्टरों का रखरखाव''** विषय पर आयोजित की गयी। इस कार्यशाला में हिन्दी एकक की वरिष्ठ तकनीकी अधिकारी, सुश्री ऊषा जैन द्वारा प्रतिभागियों को विषय के सम्बन्ध में व्यावहारिक जानकारी उपलब्ध करायी गयी। तीसरी कार्यशाला अक्टूबर–दिसम्बर 2016 तिमाही में 13 से 15 दिसम्बर 2016 के दौरान संस्थान के परीक्षण अभिकल्पना प्रभाग के वैज्ञानिक, श्री सुशील कुमार सरकार,

डा. मोहम्मद हारुन एवं डॉ. अनिंदिता दास द्वारा ''एस.ए. एस द्वारा मौलिक सांख्यिकी तकनीकें'' जैसे तकनीकी विषय पर आयोजित की गयी जिसमें आयोजक वैज्ञानिकों के साथ–साथ परीक्षण अभिकल्पना प्रभाग के अन्य 08 वैज्ञानिकों द्वारा विषय से सम्बन्धित विभिन्न उप–विषयों पर हिन्दी भाषा में 11 व्याख्यान दिये गये। कार्यशाला में वक्ताओं द्वारा प्रतिभागियों को व्याख्यान की सामग्री हिन्दी भाषा में उपलब्ध करायी गयी। चौथी कार्यशाला जनवरी–मार्च 2017 तिमाही में संस्थान के पूर्वानुमान एवं कृषि प्रणाली मॉडलिंग प्रभाग के वैज्ञानिक, श्री राजीव रंजन कुमार, श्री संतोष राठोड़ एवं श्री रवीन्द्र सिंह शेखावत द्वारा 09 से 14 फरवरी 2017 के दौरान ''कृषि आँकड़ों की मॉडलिंग एवं पूर्वानुमान के लिए सांख्यिकीय तकनीकें'' विषय पर आयोजित की गयी। इस कार्यशाला में आयोजक वैज्ञानिकों के अतिरिक्त पूर्वानुमान एवं कृषि प्रणाली मॉडलिंग प्रभाग के अन्य 05 वैज्ञानिकों द्वारा विषय से सम्बन्धित विभिन्न उप–विषयों पर हिन्दी भाषा में 16 व्याख्यान दिये गये। कार्यशाला में वक्ताओं द्वारा प्रतिभागियों को व्याख्यान की सामग्री हिन्दी भाषा में उपलब्ध करायी गयी। यहाँ यह उल्लेखनीय है कि तकनीकी विषयों पर आयोजित विभिन्न कार्यशालाओं के कई आयोजक/वक्ता वैज्ञानिक हिन्दीतर हैं और उनके द्वारा बड़ी निपुणता से हिन्दी में व्याख्यान दिये गये।

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।

प्रतिवेदनाधीन अवधि में संस्थान में राजभाषा कार्यान्वयन समिति की बैठकें 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।

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 हिन्दी आशुलिपि एवं हिन्दी टंकण के प्रशिक्षण का लक्ष्य भी संस्थान द्वारा पूरा कर लिया गया है। 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 केन्द्रीय हिन्दी प्रशिक्षण संस्थान से हिन्दी टंकण का प्रशिक्षण दिलवाया जा चुका है। परीक्षा में अनुत्तीर्ण/पूरक परिणाम प्राप्त 05 कर्मियों द्वारा पुनः टंकण/पूरक परीक्षा दी जानी हैं।

संस्थान की वेबसाइट द्विभाषी है जिसको समय–समय पर अद्यतन किया गया। संस्थान की वेबसाइट पर उपलब्ध 'हिन्दी सेवा लिंक' में 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। अपना दैनिक कार्य हिन्दी में सरलता से करने के लिए संस्थान के कर्मियों द्वारा इस सेवा का उपयोग किया जाता है।

संस्थान द्वारा प्रकाशित हिन्दी पत्रिका, 'सांख्यिकी–विमर्श' के बारहवें अंक का प्रकाशन मार्च 2017 में किया गया। इस पत्रिका में संस्थान के कीर्तिस्तम्भ, 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 जाता है। पाठकों के हिन्दी ज्ञानवर्धन के लिए दैनिक स्मरणीय शब्द–शतक हिन्दी व अँग्रेजी में दिया जाता है।

संस्थान में 01 से 14 सितम्बर 2016 के दौरान हिन्दी पखवाड़े का आयोजन किया गया। दिनांक 01 सितम्बर 2016 को हिन्दी पखवाड़े का उद्घाटन संस्थान के निदेशक, डॉ. उमेश चन्दर सूद जी द्वारा किया गया। हिन्दी उद्घाटन के तत्पश्चात काव्य–पाठ का आयोजन किया गया। हिन्दी पखवाड़े के दौरान 'डॉ. दरोगा सिंह स्मृति व्याख्यान' के साथ–साथ वैज्ञानिक प्रभागों में हिन्दी में सर्वाधिक वैज्ञानिक कार्य करने के लिए प्रभागीय चल–शील्ड तथा काव्य–पाठ, वाद–विवाद, प्रश्न–मंच, अन्ताक्षरी, हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता आयोजित

की गयी। प्रश्न–मंच एवं अन्ताक्षरी प्रतियोगिता के संचालकों द्वारा 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 वर्गों के कर्मियों ने बढ़–चढ़कर हिस्सा लिया। संस्थान में प्रत्येक वर्ष हिन्दी दिवस के अवसर पर डॉ. दरोगा सिंह स्मृति व्याख्यान का आयोजन किया जाता है। इस वर्ष इस कड़ी का पच्चीसवाँ व्याख्यान हरियाणा कृषि विश्वविद्यालय के पूर्व अपर निदेशक (अनुसंधान), डॉ. एफ.एस. चौधरी जी द्वारा दिया गया और इस कार्यक्रम की अध्यक्षता आई.सी.एम.आर. के पूर्व अपर महानिदेशक एवं राष्ट्रीय सांख्यिकीय आयोग के सदस्य, डॉ. पदम सिंह जी द्वारा की गयी। दिनांक 14

सितम्बर 2016 को हिन्दी पखवाड़े के समापन समारोह के अवसर पर इस दौरान आयोजित प्रतियोगिताओं के सफल प्रतियोगियों को पुरस्कृत करने के साथ–साथ वर्ष 2015–16 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 2015 से जून 2016 तक की अवधि के दौरान संस्थान में अयोजित हिन्दी कार्यशालाओं के वक्ताओं को भी सम्मानित करने के साथ–साथ संस्थान द्वारा प्रकाशित हिन्दी पत्रिकाः सांख्यिकी विमर्श 2015–16 के सम्पादक मंडल के सदस्यों को भी प्रशस्ति–पत्र प्रदान किये गये।

राजभाषा सम्मान

भारत सरकार, राजभाषा विभाग की नगर राजभाषा कार्यान्वयन समिति (उत्तरी दिल्ली) द्वारा वर्ष 2015–16 में राजभाषा कार्यान्वयन कार्य में उत्कृष्ट निष्पादन हेतु बड़े कार्यालय वर्ग में भारतीय कृषि सांख्यिकी अनुसंधान संस्थान को तृतीय पुरस्कार प्रदान किया गया। इसके लिए संस्थान को एक ट्रॉफी एवं प्रशस्ति–पत्र प्रदान किया गया।

वर्ष 2015–16 में राजभाषा कार्यान्वयन कार्य में उत्कृष्ट निष्पादन हेतु बड़े कार्यालयों के वर्ग में भारत सरकार, राजभाषा विभाग की नगरकास (उत्तरी दिल्ली) द्वारा संस्थान को प्राप्त तृतीय पुरस्कार

LIST OF RESEARCH PROJECTS

DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEMS RESEARCH

On-going

Institute Funded

1. Minimal response surface designs for resource optimization in agricultural experiments. (AGENIASRISIL201401500034) Eldho Varghese, Arpan Bhowmik, Seema Jaggi and Cini Varghese: 04.09.2014-03.09.2017

2. A optimal block designs for comparing test treatments with control treatment(s)-an algorithmic approach. (AGENIASRISIL201500200039) BN Mandal, Rajender Parsad, VK Gupta (till 16.03.2016) and Sukanta Dash: 18.02.2015-17.02.2018

3. Some investigations on trend resistant row-column designs. (AGENIASRISIL201502900066) Arpan Bhowmik, Seema Jaggi, Eldho Varghese and Sunil Kumar Yadav: 24.09.2015-31.03.2018

4. On construction of orthogonal and nested orthogonal Latin hypercube designs. (AGENIASRISIL201503200069) Sukanta Dash, Rajender Parsad, BN Mandal and Susheel Kumar Sarkar: 16.11.2015-15.11.2018

Outside Funded

5. Information system for planning and analysis of experiments on All-India Coordinated Research Project on Vegetable Crops. Funded by AICRP (VC), IIVR, Varanasi. (AGENIASRICOL201400200021)

   IASRI: Rajender Parsad and Sukanta Dash; NAARM, Hyderabad: A Dhandapani; IIVR, Varanasi: B Singh, PM Singh (January 2015-10.12.2015), Satyandra Singh (October 2014 15.05.2015), Major Singh (since 11.12.2015) and T Choubey: 05.02.2014-31.03.2017

6. ICAR Research Data Repository for Knowledge Management as KRISHI: Knowledge based Resources Information System Hub for Innovations in Agriculture. Funded by ICAR Headquarter Plan Scheme under XII Plan period (2012-2017). (AGENIASRICOL201503100068)

   IASRI: Rajender Parsad, AK Choubey, Anil Kumar, Mukesh Kumar, Anshu Bharadwaj, Susheel Sarkar, Arpan Bhowmik, Raju Kumar and Vandita Kumari Choudhary (on leave); NAARM, Hyderabad: A Dhandapani; NBSS&LUP, Nagpur: GP Obi Reddy, Nirmal Kumar and Sudipto Chattaraj; IARI, New Delhi: Vinay Kumar Seghal and Joydeep Mukerjee; DKMA, New Delhi: Mitali Ghosh Roy; CMFRI, Kochi: J Jayasankar; CRIDA, Hyderabad: NS Raju: 24.07.2015-31.03.2017

Completed

Institute Funded

7. Factorial experiments with minimum level changes in run sequences. (AGENIASRISIL201301200013)

   Arpan Bhowmik, Eldho Varghese, Cini Varghese and Seema Jaggi: 16.08.2013-04.04.2016

8. Planning, designing and analysis of data relating to experiments for AICRP on long-term fertilizer experiments. (SIX1206)

   Krishan Lal (till 31.03.2014), BN Mandal (from 01.10.2012 to 21.09.2013 and 22.10.2014 onwards) and LM Bhar (from 01.10.2013 to 30.10.2014): 01.04.2012–31.03.2017

9. Planning, designing and analysis of 'On Farm' research experiments planned for AICRP on IFS. (SIX1207)

   NK Sharma (till 30.09.2014), Cini Varghese (from 01.10.2014), Sukanta Dash (from 01.10.2012) and Arpan Bhowmik (from 01.10.2014): 01.04.2012–31.03.2017

10. Information system for designed experiments. (SIX1208)

    OP Khanduri (till 13.11.2014), DK Sehgal (till 31.08.2012), Soumen Pal (till 30.09.2012), Susheel Kumar Sarkar (since 01.10.2012) and Shashi Dahiya (on study leave from 03.07.2014): 01.04.2012–31.03.2017

11. Planning, designing and analysis of experiments planned 'On Stations' under the AICRP on IFS. (SIX1209)

    Anil Kumar and Eldho Varghese (since 01.10.2012): 01.04.2012–31.03.2017

New Initiated
Institute Funded

12. Development of varietal and hybrid technologies of pearl millet [Pennisetum glaucum (L). R. Br.] For higher yield and nutritional improvement. (Collaboration with ICAR-IARI) (AGENIASRICIP201601200081)

    IARI: C Tara Satyavathi, SP Singh, Mukesh Sankar, MB Arun Kumar, RS Banna, Sudhir Kumar, N Srinivasa, Dabas, Gynander Singh, Anil Dahuja; RS Dharwar: Jayant Bhat; RS Karnal: Raj Kumar; NRCPB: Jasdeep Chatrath Padaria; FS&PHT: SK Jha; SSA&C: MC Meena; IASRI: Eldho Varghese: 26.09.2016-31.03.2019

13. Design involving multi-way genetic crosses for agricultural and animal breeding programmes. (AGENIASRISIL201700300089)

    Harun, Anindita Datta, Cini Varghese and Seema Jaggi: 09.03.2017-08.03.2020

14. Generalized row-column designs for crop and animal experiments. (AGENIASRISIL201700400090)

    Anindita Datta, Harun, Seema Jaggi and Cini Varghese: 31.03.2017-30.03.2020

Outside Funded

15. Incomplete split-plot designs: construction and analysis. Funded by SERB. (AGENIASRISOL201601000079)

    BN Mandal, Sukanta Dash, Rajender Parsad and VK Gupta (till March 16, 2016): 16.08.2016-15.08.2019

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

On-going
Institute Funded

16. A Study on price efficiency in agricultural commodity market.(AGENIASRISIL201500700044)

    SP Bhardwaj, Bishal Gurung and Kanchan Sinha: 13.05.2015-12.05.2017

17. Forecasting of spatio-temporal time series data using Space Time Autoregressive Moving Average (STARMA) model. (AGENIASRISIL201502300060)

    Santosha Rathod, Mrinmoy Ray, Ajit, KN Singh and Bishal Gurung (from 20.09.2015): 20.08.2015-19.02.2018

18. Nonparametric bootstrap approach for constructing prediction intervals for non-linear and bivariate time series models. (AGENIASRISIL201502200059)

    Mrinmoy Ray, Santosha Rathod, Wasi Alam and KN Singh: 19.08.2015-18.08.2017

19. Development of hybrid time series models using machine learning techniques for forecasting crop yield with covariates. (AGENIASRISIL201502000057)

    Wasi Alam, Kanchan Sinha (till 22.08.2016), Mrinmoy Ray, Santosha Rathod, KN Singh and Rajeev Ranjan Kumar (since 23.08.2016): 14.07.2015-13.01.2018

Completed

Institute Funded

20. Estimation of heritability under correlated errors. (AGENIASRISIL201400100020)

    Amrit Kumar Paul and SD Wahi: 04.01.2014-03.05.2016

21. Study on volatility spillover of agricultural commodity prices. (AGENIASRISIL201401000029)

    Kanchan Sinha, Wasi Alam, Sanjeev Panwar and Bishal Gurung: 12.05.2014-11.05.2016

Outside Funded

22. Network project on market intelligence. Funded by ICAR, DARE, Ministry of Agriculture, New Delhi (AGENIASRICOP201400300022)

    NIAP: Raka Saxena; IASRI: Ranjit Kumar Paul: 13.02.2014-31.03.2017

23. Network project on impact assessment of agricultural research and development. Funded by ICAR. (AGENIASRICOP201500100038)

    NIAP: PS Birthal (till 26.01.2016), Shiv Kumar (since 27.01.2016), Jaya Jumrani, Kingsly IT and SK Srivastava;

    IASRI: Ranjit Kumar Paul: 01.01.2015-31.03.2017 (Association of IASRI w.e.f. 12.01.2015)

New Initiated

Institute Funded

24. Smallholder's productivity and agricultural growth through technology, sustainable intensification and ecosystem services. (AGENIASRICIP201600800077)

    IARI, New Delhi: Girish Jha; IASRI, New Delhi: Prawin Arya: 13.04.2016- 31.03.2019

25. Future perspective of Bt technology in Indian agriculture. (AGENIASRISIL201601700086)

    Mrinmoy Ray, Santosh Rathod, Bishal Gurung, KN Singh and Ravindra Shekhawat (since 15.12.2016): 01.12.2016-30.11.2018

Outside Funded

26. Forecasting agricultural output using Space Agrometeorology and Land based Observations (FASAL). Funded by IMD, New Delhi. (AGENIASRICOP201600700076)

    IMD: KK Singh; IASRI: KN Singh, Bishal Gurung: 13.04.2016-31.03.2017.

27. Doubling farmers' income in India by 2021-22: Estimating farm income and facilitating the implementation of strategic framework. (AGENIASRICOP201700600092)

    NIAP: Director, Raka Saxena, Naveen P Singh, Usha R Ahuja; IASRI: Ranjit Kumar Paul: 31.03.2017-31.03.2022

DEVELOPMENT OF TECHNIQUES FOR PLANNING AND EXECUTION OF SURVEYS AND STATISTICAL APPLICATIONS OF GIS AND REMOTE SENSING IN AGRICULTURAL SYSTEMS

On-going

Outside Funded

28. 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)

    UC Sud, Tauqueer Ahmad, Prachi Misra Sahoo, Kaustava Aditya, AK Gupta (till 31.07.2016) and Ankur Biswas: 16.09.2014- 15.06.2017

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. Funded by Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi. (AGENIASRISOL201500300040)

    UC Sud, Kaustava Aditya, Hukum Chandra, AK Gupta (till 31.07.2016), Ankur Biswas, Vandita Kumari, Raju Kumar, Anshu Bhardwaj, Anil Kumar and Ajit: 16.02.2015- 31.08.2017

30. 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, Tauqueer Ahmad, Ajit, Kaustav Aditya and Ankur Biswas: 01.09.2015-31.08.2017

Completed
Institute Funded

31. Calibration estimators under two stage sampling design when study variable is inversely related to auxiliary variable. (AGENIASRISIL201400800027)

    Ankur Biswas, Kaustav Aditya and UC Sud: 01.05.2014-26.09.2016

Outside Funded

32. Development of innovative approches for small area estimation of crop yield, socio-economic and food insecurity parameters-under ICAR's Lal Bahadur Shastri Young Scientist award- 2012. (AGENIASRISOL201301800019)

    Hukum Chandra and Kaustav Aditya: 09.12.2013-31.03.2017

New Initiated
Institute Funded

33. Assessment of post harvest losses in fruits and vegetables and strategies for their reduction in Andman and Nicobar Islands. (AGENIASRICIP201601400083)

    CIARI: Sachidananda Swain, SK Zamir Ahmad, LB Singh, Chandrika Ram, Manoj Kumar; IASRI: Prachi Mishra Sahoo, Tauqueer Ahmad: 01.06.2015-31.05.2017 (Association of IASRI w.e.f. 03.10.2016)

34. A study on calibration estimators under adoptive cluster sampling. (AGENIASRISIL201601500084)

    Raju Kumar, Ankur Biswas, Deepak Singh: 25.10.2016-24.10.2018

DEVELOPMENT OF STATISTICAL TECHNIQUES FOR GENETICS/ COMPUTATIONAL BIOLOGY AND APPLICATIONS OF BIOINFORMATICS IN AGRICULTURAL RESEARCH

On-going
Institute Funded

35. Development of a tool for comparison of protein 3D structure using graph theoretic approach. (AGENIASRISIL201400500024)

    UB Angadi, KK Chaturvedi, Monendra Grover and Sudhir Srivastava (till 01.08.2015): 18.03.2014-15.04.2017

36. Multilevel functional classification of abiotic stress related proteins in poaceae. (AGENIASRISIL201400600025)

    Monendra Grover, UB Angadi and Sudhir Srivastava (till 01.08.2015): 20.03.2014-30.04.2017

37. Development of methodology for nonparametric modelling of time-series data and its application in agriculture. (AGENIASRISIL201500800045)

    Himadri Ghosh and Soumen Pal (since October, 2015): 06.06.2015-05.12.2017

38. Development of rank based stability measures for selecting genotypes.(AGENIASRISIL201502500062) Prakash Kumar, Amrit Kumar Paul, Samrendra Das and LM Bhar: 10.09.2015-31.08.2017

39. Gene Selection for Classification of Crop Gene Expression Data. (AGENIASRISIL201503000067) Samarendra Das, PK Meher, RK Paul and UK Pradhan (till 10.01.2017): 20.10.2015-19.09.2018

40. A study on sequence encoding based approaches for splice site prediction in agricultural species. (AGENIASRISIL201600100070)

    Prabina Kumar Meher, UK Pradhan (till 10.01.2017), SD Wahi (till 31.08.2016) and AR Rao: 01.01.2016-31.12.2017

Outside Funded

41. Whole genome sequencing and development of allied genomic research in two commercially important Fish-Labeorohita and Clarias batrachus. Funded by DBT (AGENIASRISOL201301400015)

    IASRI: Dinesh Kumar, Sarika (since 28.01.2014) and Mir Asif Iquebal (since 28.01.2014); NBFGR: NS Nagpure (till 07.12.2015), Basdeo Kushwaha and Ravindra Kumar; CIFA: Paramananda Das, P Jayasankar and L Sahoo; Anand Agricultural University: Chaitanya G Joshi, PG Koringa: 10.09.2013-09.09.2017

42. Whole genome based SNP mining and development of breed signatures for dairy and dual-purpose indigenous cattle. Funded by DBT. (AGENIASRICOL201401600035)

    NBAGR, Karnal: Satpal Dixit, Jaya Kumar S; NDRI, Karnal: Ajay Kumar Dang, Avtar Singh; IASRI: Mir Asif Iquebal, Dinesh Kumar: 09.07.2014-08.07.2017

43. ICAR Network Project on Transgenics in Crops (NPTC).

    (AGENIASRICOP201500400041)

    NRCPB: NK Singh (till 11.05.2015), TR Sharma (since 12.05.2015); IASRI: MA Iquebal, Sarika, Dinesh Kumar, Anil Rai: 27.01.2015-31.03.2017

44. Computational identification and modelling of genetic variation in relation to performance traits in buffaloes. Funded by CABin. (AGENIASRICOP201500900046)

    CIRB, Hisar: Punam Sikka, KP Singh, SS Paul, A Jerome, S Balhara and Varij Nayan; IASRI, New Delhi: Dwijesh Chandra Mishra, AR Rao and KK Chaturvedi: 06.06.2015-31.03.2017

45. Genomic data analysis for identification of economically important markers and viral diagnostics in pulses. Funded by CABin. (AGENIASRICOP201501000047)

    IIPR, Kanpur: Abhishek Bohra, Khela Ram Soren and Akram; IASRI, New Delhi: MA Iquebal, Dinesh Kumar, Sarika and UB Angadi: 06.06.2015-31.03.2017

46. Computational approach for harnessing genome information and its integration with wheat phenome for efficient varietal development. Funded by CABin. (AGENIASRICOP201501200049)

    IIWBR, Karnal: Ratan Tiwari, Pradeep Sharma, Rajender Singh and Sonia Sheoran; IASRI, New Delhi: Dinesh Kumar, MA Iquebal, Sarika and UB Angadi: 15.06.2015-31.03.2017

47. Mining and validation of candidate gene markers and screening on antimicrobial peptides of black pepper and small cardamom. Funded by CABin. (AGENIASRICOP201501100048)

    IISR, Kozhikode, Kerala: Johnson K Greorge, P Umadevi, KV Saji and Sharon Aravind; IASRI, New Delhi: UB Angadi, Dinesh Kumar, MA Iquebal and Sarika: 15.06.2015-31.03.2017

48. Bioinformatic analysis of sequence data of brinjal and bitter gourd for identification of functional and regulatory genes for traits of economic importance. Funded by CABin. (AGENIASRICOP201501300050)

    NBPGR: KV Bhat, Soma S Marla, AB Gaikwad, S Archak and DP Wankhede; IASRI: Monendra Grover and SB Lal: 16.06.2015-31.03.2017

49. Molecular and computational approach to delineate metabolic pathways for better carbohydrate utilization in Labeo spp. Funded by CABin. (AGENIASRICOP201501400051)

    CIFA, Bhubaneshwar: JK Sundaray, S Nandi, PK Maher, L Sahoo, KD Rasal, P Nandanpawar and UK Udit; IASRI, New Delhi: Sarika, Dinesh Kumar, MA Iquebal and UB Angadi: 16.06.2015-31.03.2017

50. Elucidating the mechanism of Pashmina fibre development: An OMICS approach. Funded by National Agricultural Science Fund (NASF) (AGENIASRICOP201501500052)

    SKUAST-K: Nazir : A Ganai; IASRI, New Delhi: AR Rao and PK Meher; NDRI, Karnal: Jai K Kaushik: 01.07.2015-30.06.2018

51. Microbial domain research projects on computational aspects. Funded by CABin. (AGENIASRICOP201501600053)

    NBAIM, Mau: DP Singh, Renu and Lalan Sharma; IASRI, New Delhi: Sanjeev Kumar, KK Chaturvedi, Samir Farooqi: 03.07.2015-31.03.2017

52. Development of database repertoire for Clostridium perfiringens strains prevalent in causing Enterotoxaemia in goats. Funded by CABin. (AGENIASRICOP201501700054)

    CIRG, Makhdoom: RVS, Pawaiya; IASRI: AR Rao: 04.07.2015-31.03.2017

53. Development of database on SNPs associated with economically important traits of Indian goats. Funded by CABin. (AGENIASRICOP201501800055)

    CIRG, Makhdoom: RVS Pawaiya; IASRI: AR Rao: 04.07.2015-31.03.2017

54. RiceMetaSys: Understanding rice gene network for blast resistance and drought tolerance through system biology approach. Funded by CABin. (AGENIASRICOP201501900056)

    NRCPB: Amol Kumar U Solanke, TR Sharma, Amitha SV Mithra and Ramawatar; IASRI: Dwijesh Chandra Mishra, KK Chaturvedi: 08.07.2015-31.03.2017

55. Identification of genetic polymorphisms for pathogenicity in Vibrio sp. Funded by CABin. (AGENIASRICOP201502100058)

    CIBA, Chennai: Ashok Kumar Jangam, SV Alavandi, K Vinaya Kumar, B Sivamani and Satheesha Avunje; IASRI: Monendra Grover: 19.08.2015-31.03.2017

56. 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, Dwijesh Chandra Mishra:04.09.2015-31.03.2020

57. Metagenomic applications and transcriptomes profiling for inland aquatic environmental health surveillance. Funded by CABin. (AGENIASRICOP201502700064)

    CIFRI, Barrackpore : BK Behera; IASRI: AR Rao: 01.09.2015-31.03.2017

58. 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; IASRI: Himadri Ghosh, Lal Mohan Bhar: 06.11.2015-05.11.2018

59. Network project on computational biology and agricultural bioinformatics under two sub-projects: Funded by CABin. (AGENIASRICOP201600300072): 26.11.2015-31.03.2017

    Sub-project 1:

    Gene regulatory networks modeling for heat stress responses of source and sink for development of climate smart Wheat.

    IARI: C Viswanathan, RR Kumar, Suneha Goswami, GP Singh, PK Singh, Neelu Jain and Puja Rai; IASRI: DC Mishra, M Grover, Sanjeev Kumar and KK Chaturvedi

    Sub-project 2:

    Studying drought-responsive genes in subtropical maize germplasm and their utility in development of tolerant maize hybrids.

    IARI: T Nepolean, MG Mallikarjuna and Shailendra K Jha; IASRI: AR Rao and PK Meher

Completed
Institute Funded

60. Modelling and construction of transcriptional regulatory network using time-series gene expression data. (AGENIASRISIL201401100030)

    Samrendra Das, Bishal Gurung, Sanjeev Kumar and SD Wahi (till 31.08.2016): 22.05.2014 – 05.01.2017

61. Estimation of breeding value using longitudinal data. (AGENIASRISIL201400700026)

    Upendra Kumar Pradhan, Prabina Kumar Meher, AR Rao and AK Paul: 23.04.2014-31.12.2016

Outside Funded

62. Modelling network of gene responses to abiotic stress in rice. Funded by NFBSFARA, ICAR. (AGENIASRICOL201300500006)

    IASRI: Sanjeev Kumar, Dinesh Kumar, Anil Rai, SB Lal and DC Mishra; NRCPB: Kishore Gaikwad, NK Singhand Vandana Rai; DRR: D Subramanyam, P Senguttuvel; DKMA: Himanshu; CDAC: Rajendra Joshi: 01.04.2013-31.03.2017

New Initiated
Institute Funded

63. Platform for integrated genomics warehouse. (AGENIASRISIL201600900078)

    KK Chaturvedi, MS Farooqi, SB Lal, DC Mishra, Sanjeev Kumar: 10.06.2016-09.06.2019

64. Development of an improved hybrid De-novo whole genome assembler. (AGENIASRISIL201700100087)

    SB Lal, Anu Sharma, Sanjeev Kumar, DC Mishra, Neeraj Budhlakoti: 04.01.2017-03.01.2019

65. Non-linear modeling for genomic predictions based on multiple traits. (AGENIASRISIL201700500091)

    Neeraj Budhlakoti, DC MIshra, SB Lal: 31.03.2017-30.03.2019

Outside Funded

66. In silico analysis of data for identification of functional alleles for stress tolerance and quality traits using bioinformatics in Potato. (AGENIASRICOL201601300082)

    IASRI: Anil Rai, AR Rao, Sanjeev Kumar, DC Mishra; CPRI: Shashi Rawat, Sanjeev Sharma, Vinay Bhardwaj, Som Dutt, Jagesh Tiwari, Sundresha, Sridhar, VU Patil: 12.09.2016-31.03.2017

67. Creating a fully characterized genetic resource pipeline for mustard improvement programme in India. Funded by National Agricultural Science Fund (NASF). (AGENIASRICOP201700800094)

    PAU: SS Banga; IARI: DK Yadav; Directorate of Rapeseed-Mustard Research, Bharatpur: KH Singh; GBPUAT: Ram Bhajan; IASRI: AR Rao, Cini Varghese, PK Meher: 01.01.2017-31.12.2019

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going
Institute Funded

68. Management system for post graduate education - II. (SIX1218)

    Sudeep, PK Malhotra (till 30.09.2014), RC Goyal (till 30.06.2013), Yogesh Gautam (till 15.08.2014) and Pal Singh (since 01.10.2013): 01.04.2012– 31.03.2018

69. National Information System on Agricultural Education Network in India. (NISAGENET-IV). (SIX1217)

    RC Goyal (till 30.06.2013), Sudeep, Alka Arora, Pal Singh, Shashi Dahiya and Soumen Pal (till 30.09.2012) and Anshu Bhardwaj (since 01.10.2014): 01.04.2012–30.06.2017

70. Development of 16s rRNArumen specific microbes database. (Collaboration with NIANP, Bangalore) (AGENIASRICIP201401400033)

    NIANP, Bangalore: M Bagath and AP Kolte; IASRI: UB Angadi and Monendra Grover (since 21.11.2014): 23.07.2014-30.04.2017

71. Tobacco Agridaksh: An online expert system. (AGENIASRICIP201401800037)

    CTRI, Rajahmundry: H Ravisankar, D Damodar Reddy, U Sreedhar, K Sivaraju, K Sarala, S Kasturi Krishna and M Anuradha; IASRI: N Srinivasa Rao (till 24.09.2016) and Sudeep: 20.10.2014-20.10.2017

72. Implementation of ICAR-ERP, unified communication and web hosting solution. (AGENIASRISIL201500600043)

    AK Choubey, Alka Arora, Sudeep, N Srinivasa Rao (till 24.09.2016), Mukesh Kumar, SN Islam, Anshu Bhardwaj and Sangeeta Ahuja: 10.04.2015-09.04.2018

Completed
Institute Funded

73. Developing a comprehensive web based system for agriculturally important microbes. Collaboration with NBAIM, Mau. (AGENIASRICIP201500500042)

SN Islam, Anshu Bhardwaj and N Srinivasa Rao: 01.04.2015-31.03.2017

*As per the decision of IRC held on April 05-06, 2016 the project was abandoned as per the request of PI.

74. Cluster ensemble algorithms for germplasms evaluation on Chickpea. (AGENIASRISIL201502600063) IASRI: Sangeeta Ahuja and AK Choubey; NCIPM: OP Sharma NBPGR: HL Raiger: 18.09.2015-17.09.2016

*As per the decision of special IRC held on November 02, 2016 the project was declared as CLOSED due to repeated non-presentation/unsatisfactory progress.

75. Results framework document management system in ICAR (RFD-MS). (AGENIASRISIL201400900028)

N Srinivasa Rao (till 24.09.2016), Mukesh Kumar and AK Choubey: 09.05.2014-21.02.2017

New Initiated
Outside Funded

76. Management and impact assessment of farmer first project. Funded by ICAR farmer first programme under KVK scheme (ATARI-I) (AGENIASRICOP201700200088)

NIAP: Shiv Kumar, Rajni Jain, Vinayak R Nikam, Kinsly IT, Abhimanyu Jhajhria; NAARM: P Venkatesan, Bharat S Sontakki, N Sivaramane; IASRI: Mukesh Kumar, Anshu Bhardwaj, Soumen Pal; DKMA: Aruna T Kumar, Mitali Ghosh Rai: 14.02.2017-31.03.2018

77. Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in Rice and Wheat – Phase II. Funded by National Agricultural Science Fund (NASF). (AGENIASRICOP201700700093) IARI: Viswanathan Chinnusamy; IASRI: Anil Rai, AR Rao, Sudeep, Sanjeev Kumar; Indian Institute of Technology, New Delhi: Brejesh Lall; National Rice Research Institute, Cuttack: Padmini Swain: 01.01.2017-31.03.2018

Extramural Projects
On-going

78. Transcriptome and proteome analysis for identification of candidate genes responsible for pistillate nature in castor. Funded by Extramural funded under Crop Sciences Division. (AGENIASRICOP201600400073)

IIOR: M Sujatha; IASRI: MA Iquebal: 21.01.2016-31.03.2017

Completed

79. Knowledge management system for agriculture extension services in Indian NARES. Funded by ICAR Extra Mural Research Projects-Agricultural Extension Division. (AGENIASRICOL201600500074)

IASRI: Alka Arora, AK Choubey, NS Rao (till 24.09.2016), SN Islam, Soumen Pal and Sudeep; ICAR: P Adiguru: 04.03.2016-31.03.2017

80. Impact of ICT in Agricultural Education in India. Funded by ICAR Extra Mural Research Projects-Agricultural Extension Division. (AGENIASRICOP201600600075)

NIAP: Rajni Jain, Pavithra S; IASRI: Anshu Bhardwaj, Ranjit Kumar Paul: 08.04.2016-31.03.2017

81. Creating awareness for efficient use of ICT and MOOCs in agriculture education. Funded by Extramural (AGENIASRISOL201601600085)

Anil Kumar, Sukanta Dash: 01.11.2016-31.03.2017

82. Standardization and validation of scales for measuring socio-psychological constructs related to risk adjustment and entrepreneurship behaviours of farmers. Funded by ICAR Extra Mural Research Project (Under Agricultural Extension division). (AGENIASRICOP201601100080)

IARI: RN Padaria, RR Burman, Rashmi Singh, Sujit Sarkar, V Lenin, Reshma Gills; IASRI: Arpan Bhowmik, Eldho Varghese: 05.09.2016-31.03.2017

Consultancy Projects

83. Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping. Funded by the Food and Agriculture Organization (FAO) of United Nations.

    UC Sud, Tauqueer Ahmad, Hukum Chandra, Prachi Misra Sahoo, Kaustav Aditya, Ankur Biswas, Man Singh, GM Pathak and Neelam Chandra: 18.12.2014-17.10.2016

84. 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, Prachi Misra Sahoo, Anil Rai, Kaustav Aditya, Raju Kumar, Man Singh, GM Pathak and Neelam Chandra: 01.06.2015-28.02.2018

85. 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, Prachi Misra Sahoo, Anil Rai, Ankur Biswas, Vandita Kumari, Man Singh, GM Pathak and Neelam Chandra :06.08.2015-05.05.2018

National Fellow Scheme

86. 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

ICAR-IASRI PERSONNEL

Director
Dr. UC Sud

Incharge, Prioritization, Monitoring & Evaluation Cell
Dr. Ajit

Head, Division of Design of Experiments
Dr. Seema Jaggi

Head, Division of Sample Surveys
Dr. Tauqueer Ahmad

Head, Division of Statistical Genetics
Dr. LM Bhar

Head Division of Forecasting & Agricultural Systems Modeling
Dr. KN Singh

Head, Division of Computer Application
Dr. AK Chaubey

Head, Centre for Agricultural Bioinformatics
Dr. Anil Rai

Professor (Agricultural Statistics)
Dr. Seema Jaggi

Professor (Computer Application)
Dr. Seema Jaggi (till 14.07.2016)
Dr. Sudeep Marwaha (from 22.07.2016)

Professor (Bioinformatics)
Dr. Anil Rai (till 21.10.2016)
Dr. AR Rao (from 22.10.2016)

HRD Nodal Officer
Dr. Seema Jaggi

Warden, Sukhatme Hostel
Dr. AK Chaubey

Vigilance Officer
Dr. LM Bhar

Transparency Officer & Nodal Officer, RTI
Sh. SD Wahi (till 31.08.2016)
Dr. Mukesh Kumar (from 27.09.2016)

Welfare Officer
Dr. SP Bhardwaj

Incharge, National Agricultural Science Museum
Sh. Pal Singh

Senior Administrative Officer & Head of Office
Sh. Suresh Kumar Gajmoti

Sr. Finance and Account Officer
Sh. Arvind

Library
Dr. Anil Rai, Incharge
Sh. SPS Hans, Librarian (till 31.12.2016)
Sh. Lakhmi Chand, Librarian (from 01.01.2017)

Public Information Officer
Sh. Chander Vallabh

Various ICAR-IASRI Committees

Consultancy Processing Cell (CPC)

1.	Dr. Rajender Parsad, Principal Scientist	Chairman
2.	Dr. Seema Jaggi, Principal Scientist and Head, DE	Member
3.	Dr. Anil Kumar, Principal Scientist	Member
4.	Dr. Tauqueer Ahmad, Principal Scientist and Head, SS	Member
5.	Dr. Ajit, Principal Scientist and Incharge, PME	Member
6.	Senior Finance and Accounts Officer (Ex-Officio)	Member
7.	Head of Office (Ex-Officio)	Member
8.	Sh. PP. Singh, CTO	Member-Secretary (till 30-11-2016)
9.	Sh. Naresh Kumar, CTO	Member-Secretary (since 13-01-2017)

Institute Technology Management Committee (ITMC)

1.	Dr. UC Sud, Director	Chairman
2.	Dr. Anil Rai, Head, CABin	Member
3.	Dr. LM Bhar, Head, Statistical Genetics	Member
4.	Dr. KS Rana, Professor and Head Division of Agronomy	Member
5.	Dr. Seema Jaggi, Principal Scientist and Head, DE	Member
6.	Dr. Rajender Parsad, Principal Scientist & Incharge, ITMU	Member-Secretary

Institute Technology Management Unit (ITMU)

1.	Dr. Rajender Parsad, Principal Scientist	Office Incharge
2.	Dr. Tauqueer Ahmad, Principal Scientist and Head, SS	Member
3.	Sh. PP. Singh, CTO	Member Secretary (till 30-11-2016)
4.	Sh. Naresh Kumar, CTO	Member Secretary (since 19-01-2017)

Institute Deputation Committee

1.	Director	Chairman
2.	All Heads of Divisions	Member
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	Member
3.	Incharge-PME Cell	Member Secretary

Institute Joint Staff Council

Official Side Members

1.	Dr. U.C. Sud (Director)	Chairman
2.	Dr. S.P. Bhardwaj	Member
3.	Dr. Anil Kumar	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Sh. S.K. Gajmoti, Head of Office	Member
6.	Dr. Tauqueer Ahmed	Member
7.	Dr. Alka Arora	Member
8.	Dr. A.K. Paul	Member Secretary

Staff Side Members

1.	Sh. K.B. Sharma, Assistant	Secretary
2.	Sh. Dharmendra, UDC	Member
3.	Sh. Mohan Singh, Technical Officer	Member
4.	Sh. Hari Singh, Driver	Member
5.	Sh. Ashok Kumar, SSS	Member
6.	Sh. Janak Kumar, SSS	Member

Grievance Committee

Official Side Members

1.	Dr. U.C. Sud (Director)	Chairman
2.	Dr. A.K. Chaubey, Head, CA	Member
3.	Sh. S.K. Gajmoti, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Assistant Administrative Officer (Admn. II)	Member Secretary

Staff Side Members

1.	Sh. Pal Singh, Scientist	Member, Scientific Group
2.	Sh. Satya Pal Singh, Sr. Technical Officer	Member, Technical Group
3.	Sh. Basant Kumar, Assistant	Member, Administrative Group
4.	Sh. Viveka Nand, SSS	Member, Skilled Supporting Staff Group

ICAR Staff Welfare Fund Scheme

1.	Dr. U.C. Sud (Director)	Chairman
2.	Dr. S.P. Bhardwaj	Welfare Officer
3.	Sh. S.K. Gajmoti, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Dr. Seema Jaggi, Principal Scientist	Female Member
6.	Sh. K.B. Sharma, Secretary, IJSC(SS)	Member
7.	Sh. Mahender Pandit, Member IGC	Member
8.	AAO, Admn-II	Member Secretary

Women Cell

1.	Dr. Seema Jaggi, Principal Scientist	Chairperson
2.	Dr. Cini Varghese, Principal Scientist	Member
3.	Ms. Vijay Bindal, CTO (till 31.05.2016)	Member
4.	Smt. Savita Wadhwa, CTO (from 01.06.2016)	Member
5.	Smt. Suman Khanna, Stenographer	Member
6.	Smt. Poonam Singh, Administrative Officer	Convener

International Training Hostel (ITH) and Guest House

1.	Dr. Anil Kumar, Principal Scientist	Coordinator
2.	Sh. Dilip Khapekar, AAO	Officer Incharge
3.	Sh. Diwan Singh	Care Taker

Hostel Executive Committee

1.	Warden	Dr. A. K. Chaubey
2.	Prefect	Amit Kairi
3.	Mess Secretary cum Assitant Prefect	Md Asif Khan
4.	Cashier	Nalini Kant Chaudhary
5.	Maintainance Sectretary	Tanuj Mishra, Gopal Saha, Dilip Kumar
6.	Sports Secretary	Mohd Yeasin, Akhilesh Jha Nitin Varshney (Mentor)
7.	Cultural Secretary	Amit Saha, Dilip Kumar Arpan Majhi, Rahul Banerjee (Mentor)
8.	Gym Secretary	Aamir Khan, Ronit Jaiswal
9.	Health Secretary	Nobin Chandra Pal, Dipankar Mitra
10.	Magazine Secretary	Rajeev Kumar, Himanshu
11.	Commom Room Secretary	Asit Kr. Pradhan, Ramesh Prajapati
12.	Communication Secretary	Samir Burman, Aashish Udgata
13.	Auditors	Pramod Maurya, Sadikul Islam Rajeev Kumar, Md Ashraful Haque Subrajit Sathpaty
14.	Food Committee	Chandan Kr. Deb, Sreekumar Biswas Pramod Kr. Maurya
15.	Panse Guest House Representative	Bulbul Ahmed
16.	Warden's Nominee	Saurav Guha
17.	Coffee/Tea Machine Incharge	Anubhav Roy, Sandeep Verma Md Ashraful Haque
18.	Girl's Representative	Shabana Begum

Institute Recreation Club

1.	Dr. U.C. Sud (Director)	President
2.	Dr. K.N. Singh, Head of Division	Vice President
3.	Sh. S.K. Gajmoti, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Sh. Raj Kumar Verma, Assistant	Member
6.	Sh. Mayank Pundeer, Assistant	Secretary
7.	Sh. Dharmendra Tanwar, LDC	Treasurer
8.	Smt. Vijay Laxmi Murthy, PA	Lady Member

Institute Sports Committee

1.	Dr. U.C. Sud (Director)	President
2.	Dr. K.N. Singh, Head of Division	Vice President
3.	Sh. S.K. Gajmoti, Head of Office	Member
4.	Sh. Arvind, Sr. F&AO	Member
5.	Dr. Sushil Kumar Sarkar, Scientist	Member
6.	Sh. RS Tomar, Assistant Chief Technical Officer	Member
7.	Sh. Dilip Khapekar, AAO	Member
8.	Sh. KB Sharma, Assistant & Secretary, IJSC	Member
9.	Smt. Vijay Laxmi Murthy, PA	Lady Member

IASRI Employees Co-operative Thrift and Credit Society Limited

1.	Dr. U.C. Sud (Director)	Patron
2.	Sh. Ram Naresh	President
3.	Sh. BJ Gahlot	Vice-President
4.	Sh. SP Singh	Secretary
5.	Sh. Sunil Bhatia	Treasurer
6.	Sh. VP Singh	Member
7.	Sh. Ashok Kumar	Member
8.	Sh. Sukanta Dash	Member
9.	Sh. Dinesh Kumar Rai	Member
10.	Sh. MM Mourya	Member
11.	Dr. Sarika	Member
12.	Dr. Anshu Bhardwaj	Member

National Agricultural Science Museum (NASM)

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.The responsibility of up-keep and maintenance of NASM rests with ICAR-Indian Agricultural Statistics Research Institute, Pusa, New Delhi-110012. NASM is situated at NASC Complex,DPS Marg, Opposite Dasghara village, Pusa campus, New Delhi-110012

The Management Committee of National Agricultural Science Museum for modernization/Strengthening of NASM under XII five year plan has been reconstituted consisting of the following chairman//Members:

Dr. Alagusundaram, DDG (Engg)	Chairman
Dr. K.K. Singh, ADG (Engg)	Member
Dr. A.K. Vasisht, ADG (PIM&ESM), ICAR	Member
Dr. Rameshwar Singh, PD, DKMA	Member
Sh. Devendra Kumar, Director (Finance), ICAR	Member
Dr. U.C. Sud, Director, IASRI	Member & Nodal Officer, NASM
Sh. Kulshreshtha, DS (GAC), ICAR	Member
Sh. V.P. Kotyal, Director (Works), ICAR	Member
Sh. S.K. Singh, CTO, IASRI	Member Secretary

Under the guidance of above committees, the activities of the museum relating to up-keep and maintenance are looked after by Sh. Pal Singh, Scientist & Incharge, NASM with Technical Officers and administrative staff of ICAR-IASRI. 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. General Information about museum is available at http://www.icar.org.in/en/node/306 and virtual tour of museum is also available at http://www.icar.org.in/en/node/2095 .

Annual Visitors Information

During the year 2016-17 (April 2016 to March 2017) 1,27,507 (One lakh twenty seven thousand five hundred seven) visitors visited NASM and 2607 tickets were sold. Students from 276 Schools of Delhi/NCR, Students from Universities of 18 States and farmers from 10 States of India visited the NASM. Trainees of different training programmes conducted by ICAR institutes and many important delegates visited NASM.

Krishi Unnati Mela, 2017: National Agricultural Science Museum (NASM) participated in the Pusa Krishi Unnati mela held at ICAR-IARI, New Delhi during 15-17 March, 2017. Documentary films on Green Revolution, Agricultural festival of India & Indigo Cultivation of India were shown through plasma. Posters of NASM exihibits and India's position in the world of different commodities were also demonstrated to the general visitors, researchers, students and farmers to give them adequate knowledge about NASM. 735 visitors including students, farmers Govt. and non Govt. agencies visited NASM Stall. NASM also received a participation certificate from Krishi Unnati Mela, 2017 Organizing Committee of ICAR-IARI, Pusa, New Delhi.

Combating the Challenges

At ICAR-IASRI, we are attempting to respond the challenges for supporting the agriculture research and development in the country in the changing global scenario. We have seeded several initiatives and projects that have started fruiting. An ongoing focus on continuous improvement is helping us innovate to achieve even greater efficiencies.

The Challenge

- Developing statistical techniques for emerging issues in agriculture research
- e-Governance implementation
- Strengthening agriculture research and development
- Human Resource Development
- Access to technology information for end user

ICAR-IASRI-Initiatives and Way Forward

- ICAR Data Centre established
- ICAR-ERP (MIS&FMS) implemented
- Unified Messaging & Web Hosting solutions initiated

Advancement/Standardizing of Statistical
- Designs both in terms of cost and precision for agricultural systems research
- Methodology for estimation of important agricultural parameters and GIS/Remote Sensing applications
- Forecasting and forewarning models
- Estimation of genetic parameters
- Web resources and repository on advances in statistical techniques with emphasis on design of experiments and sample surveys

- Capacity building through National and International training programmes
- Post Graduate degree courses in agricultural statistics and informatics

- Supporting agricultural biotechnological research by providing computational platform-ASHOKA (Advanced Supercomputing Hub for OMICS Knowledge in Agriculture)
- Supporting Statistical computing through service oriented and customized computing modules

Promoting agricultural informatics through research & application
- Expert/Decision Support/ Knowledge Management Systems
- Mobile Applications

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch