

ICAR-IASRI ANNUAL REPORT 2014-15



ICAR-INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
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Contents

Preface

Milestones

Vision, Mission and Mandate

1.	Executive Summary	1
2.	Introduction	9
3.	Research Achievements	17
4.	Education and Training	53
5.	Awards and Recognitions	71
6.	Linkages and Collaborations in India and Abroad including Outside Funded Projects	75
7.	List of Publications	79
8.	Consultancy and Advisory Services	93
9.	RAC, Management Committee and IRC	97
10.	Papers Presented and Participation of the Institute at the Conferences/ Workshops, etc.	103
11.	Conferences, Workshops, Meetings, Seminars and Annual Day Organized	115
12.	Distinguished Visitors	121

Annexures

I.	List of Research Projects	125
II.	IASRI Personnel	131
III.	Various Committees	132
IV.	National Agricultural Science Museum (NASM)	137
V.	Results-Framework Document (RFD) for Indian Agricultural Statistics Research Institute (2013-2014)	139
VI.	Annual (April 1, 2013 to March 31, 2014) Performance Evaluation Report in respect of RFD 2013-2014 of RSCs i.e. Institutes	145

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

Preface



It is a matter of immense pleasure and great satisfaction to present the Annual Report 2014-15 of ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI). ICAR-IASRI is an ISO 9001:2008 certified Institute of Indian Council of Agricultural Research (ICAR) with glorious tradition of carrying out research, teaching and training in the area

of Agricultural Statistics and Informatics.

During the year, the Institute has made some outstanding and useful contributions to research in the field of Design of Experiments, Sample Surveys, Statistical Genetics, Bioinformatics, Forecasting Techniques, Statistical Modelling, Computer Application and Software Development. The Institute has conducted basic and original research on many topics of interest. The Institute has also been providing education/training in Agricultural Statistics and Informatics to develop trained manpower in the country. 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.

Research activities in the Institute were strengthened through in house and externally funded projects, network and inter-institutional collaborative projects and capacity building. During the year, research was carried out under 57 research projects (33 Institute funded, 22 externally funded, 1 National Professor Scheme and 1 Consultancy Project) in various thrust areas. Out of these 21 projects were in collaboration with other institutes, 11 projects were completed and 17 new projects were initiated.

A landmark for the institute this year was a study awarded 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. The networking services at IASRI have been further strengthened and the entire campus is Wi-Fi enabled with a high speed internet connection. ICAR Data Centre (Tier-III) has been established at IASRI to provide Unified Mail Messaging and Web Hosting solution in ICAR.

The Institute has made its presence felt in the National Agricultural Research and Education System (NARES) through its research and human resource development programmes. The institute has contributed significantly by providing excellent human resource to NARES in the disciplines of Agricultural Statistics and Informatics. During the year, 25 training programmes (Six 21 days under Centre of Advanced Faculty Training, Thirteen under National Agricultural Innovation Projects, Four Resource Generation and Two other training programmes sponsored by ICAR for Technical Personnels of ICAR) were organized in which 636 participants were imparted training. This year, a total

of 18 students {5 Ph.D. (Agricultural Statistics), 6 M.Sc. (Agricultural Statistics), 2 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics)} completed their degrees. A Senior Certificate Course in Agricultural Statistics and Computing was also organized. The Institute organized the 68th Annual Conference of the Indian Society of Agricultural Statistics during January 29-31, 2015. During this Conference, a workshop on methodology for estimating crop area and yield under mixed and continuous cropping was also organized.

The Institute has made important contributions in strengthening National Agricultural Statistics System (NASS), which has a direct impact on the national policies.

The Institute has published 128 research papers in National and International refereed Journals along with 24 popular articles/short communications, 1 book, 9 book chapters, 4 papers in conference proceedings and 58 project reports/technical bulletins/ monograph/reference manuals/ brochures. Besides, 57 e-manuals/e-resources/ macros were also developed.

I am extremely happy to share that some of our colleagues received academic distinctions during the year. **Dr. Seema Jaggi received the Bharat Ratna Dr. C. Subramaniam Award for Outstanding Teachers-2013 of ICAR** for excellent teaching in the field of Social Sciences, **Dr. Hukum Chandra was awarded ICAR-National Fellow and also received Professor PV Sukhatme Gold Medal Award 2014 by the Indian Society of Agricultural Statistics (ISAS)**. Dr. Alka Arora received the Best Paper Award published in the journal of ISAS. The scientists of the Institute were deputed in various national/international conferences. This year, five scientists were deputed on different assignments to Bangladesh, Italy, Japan, USA, Ethiopia and Spain.

I would like to express my gratitude to Hon'ble Secretary, Department of Agricultural Research & Education (DARE) and Director General, ICAR Hon'ble Dr. S Ayyappan, for his invaluable guidance, encouragement and support. I am grateful to DDG (Engg.), ICAR, New Delhi for his constant direction, inspiration and backing. My sincere appreciation to all Heads of Divisions, scientists and other staff of the Institute for their devotion, whole-hearted support and cooperation in carrying out various functions and activities of the Institute. The services of the PME Cell in compiling and timely publication of the report are highly appreciated. I wish to express my sincere thanks to all my colleagues in PME Cell, in particular the in-charge, Dr. Seema Jaggi, for all the efforts and coordinating various activities.

I am hopeful that the scientists in NARES 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

- 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	<ul style="list-style-type: none"> • Development of PIMSNET (Project Information Management System on Internet) for NATP
2003	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • National Information System on Agricultural Education (NISAGENET) Project launched • Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited • E-Library Services initiated
2005	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Organisation of International Conference on Statistics and Informatics in Agricultural Research
2007	<ul style="list-style-type: none"> • Establishment of Agricultural Bioinformatics Laboratory (ABL)
2008	<ul style="list-style-type: none"> • Software for Survey Data Analysis (SSDA) 1.0 released
2009	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Maize AgriDaksh and Expert System on Seed Spices launched • Indian NARS Statistical Computing Portal initiated • M.Sc. degree in Bioinformatics initiated
2012	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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

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

- To undertake basic, applied, adaptive, strategic and anticipatory research in Agricultural Statistics
- To conduct Post-Graduate teaching and in-service, customized and sponsored training courses in Agricultural Statistics, Computer Applications and Bioinformatics at National and International level
- To lead in development of Agricultural Knowledge Management and Information System for National Agricultural Research System
- To provide advisory and consultancy services for strengthening the National Agricultural Research System
- To provide methodological support in strengthening National Agricultural Statistics System



Executive Summary

ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI) is mainly responsible for conducting research and education in Agricultural Statistics and Informatics to bridge the gaps in the existing knowledge. The Institute has used the power of Statistics blended judiciously with Informatics and has contributed significantly in improving the quality of Agricultural Research. The Institute 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. A landmark for the institute this year was a study awarded 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. The networking services at IASRI have been further strengthened. The entire 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. ICAR Data Centre (Tier-III) has been established at the Institute to provide Unified Mail Messaging and Web Hosting solution in ICAR.

The Institute has made some outstanding and useful contributions to the research in Agricultural Statistics and Informatics. A number of research projects were undertaken in the Institute during this year. Research was carried out under 57 research projects (33 Institute funded, 22 externally funded, 1 National Professor Scheme and 1 Consultancy Project) in various thrust areas. Out of these 21 projects were in collaboration with other institutes,

11 projects were completed and 17 new projects were initiated.

Some salient research achievements are as follows:

- A method to generate minimally changed run sequences for fitting second order response surfaces was developed by rearranging the run orders of the central composite designs. The general expression for minimum number of changes in run sequences of these designs was obtained. A SAS macro for the generation of central composite design with minimum level changes in the run sequences was developed. A catalogue consisting of number of input factors, total number of runs, total number of changes in run sequences along with layout of designs for input factors upto 10 is also prepared.
- Universal optimality of block design with spatial indirect effect from neighbouring units under a general non-additive model has been established in the presence of interactions among the treatments applied in the adjacent plots as these effects contribute significantly to the response.
- A webpage of All India Coordinated Research Project on Vegetable Crops (www.iasri.res.in/aicrpvc) has been developed. Experiment creation module, Data upload and scrutiny module, Management module and Administrator module have been developed. β -version of the Information System was released. Database for updating attribute tables is being finalized. The line entries of various crops for Initial evaluation trials, Advanced varietal trial-I and Advanced varietal trial-II are being updated in the corresponding database tables.

- A general method for obtaining s^k factorial with minimum level changes in the run sequences has been developed. The general expression for factor wise number of level changes has been obtained. A SAS macro for the generation of s^k factorial with minimum level changes in the run sequences has been developed and made available at <http://www.iasri.res.in/sscnars/sftsmcrs.aspx>.
- Polycross nursery is a specific type of field design commonly used in the breeding of wind pollinated species where each genotype gets equal chance of being pollinated by any of the others. Series of polycross designs have been obtained for different experimental situations and an online solution WebPD has been developed for generation of these designs.
- A web application has also been developed for online generation of row-column designs for factorial experiments in two rows with unequal replication of treatment combinations for orthogonal estimation of main effects and two factor interactions.
- Forecasting agricultural commodity prices using time series data was undertaken to forecast prices of onion, wheat, mustard seeds, lentil and gram. The GARCH model was found to be a better model than ARIMA in forecasting spot price of gram and onion. For forecasting wheat, mustard and lentil prices, Vector Auto Regressive (VAR) model gave better results than ARIMA in most of the forecast days.
- Optimal one-step and two-step ahead forecast of Exponential Smooth Transition Autoregressive (ESTAR) family of nonlinear time-series model has been derived and applied to forecast oil sardine landings in Kerala.
- Monthly wholesale prices of onion crop for Mumbai, Nasik and Delhi markets have been analysed. Parametric and semiparametric multivariate GARCH model established the presence of volatility spillovers between onion market prices under consideration.
- Long memory property has been found to be highly significant in the squared return series (which is considered to be a good proxy of volatility) of gram in Delhi market. Accordingly, Fractionally Integrated Generalized Autoregressive Conditional Heteroscedastic (FIGARCH) model which allows for long memory behaviour and slow decay of the impact of volatility shock, revealed to be appropriate in modelling as well as forecasting the series.
- Small area estimation (SAE) has been used to provide estimates for those districts where there is no sample information under Improvement of Crop Statistics Scheme (ICS) and so direct estimates cannot be computed. Further, estimates generated by using SAE approach have smaller values of per cent coefficient of variation (CV) as compared to direct estimates. This clearly indicates that the SAE technique can be satisfactorily applied to produce reliable district level estimates of crop yield using Crop Cutting Experiments (CCE) supervised under ICS scheme.
- The SAE techniques for semicontinuous variables under a two part random effects model that allows for the presence of excess zeros as well as the skewed nature of the non-zero values of the response variable is studied. Empirical results suggest that the proposed method lead to efficient small area estimates for semicontinuous data of this type. A parametric bootstrap method is proposed to estimate the MSE of the proposed small area estimator. These bootstrap estimates of the MSE are compared to the true MSE in a simulation study.
- For skewed data, the commonly used small area methods, the model-based direct estimation (MBDE) and the synthetic type estimation (SYN) provide efficient estimates as compared to the linear mixed model based empirical best linear unbiased prediction. The MBDE is a direct estimator and unbiased in the presence of between area heterogeneity but can yield unstable estimates if sample sizes are too small and the synthetic type of empirical predictor only accounts for between area variability. An empirical best predictor (EBP) for small area means has been developed which addresses both of these issues simultaneously. The empirical results showed that the EBP for skewed data is efficient than the existing methods (MBDE and SYN).
- A quantitative assessment of harvest and post-harvest losses for 45 major agricultural crops / commodities in 120 districts of the country was made using stratified multistage random sampling design. A comparison of losses between 2013-14 *vis-à-vis* 2005-07 was made for various food grains, oilseeds, fruits and vegetables.
- For the situation when population level complete auxiliary information is available at the fsu level,

population level complete auxiliary information is available at the ssu level for all the fsu and population level auxiliary information is available only for the selected fsu, design weights under two stage sampling designs were calibrated using available auxiliary information at different stages. Further, the approximate variance and the Yates-Grundy form of estimate of variance of all the proposed calibration based product type estimators were also obtained.

- An attempt is being made to customize “Survey Solutions: CAPI (Computer Assisted Personal Interviewing) Software” developed by World Bank team in collaboration with Food and Agriculture Organization of United Nations, with the help of World Bank officials and configure an in-house server for the CAPI software so that the data from the field can be uploaded by the Field Investigators to IASRI server.
- Under the study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping by Food and Agriculture Organization (FAO) under the Global Strategy to Improve Agricultural and Rural Statistics program, two technical reports on “Synthesis of literature and framework” and “Gap analysis and proposed methodologies for estimation of crop area and crop yield under mixed and continuous cropping” were submitted to the FAO. The methodology for estimating crop area, yield and production under mixed, repeated and continuous cropping has been developed. Country schedule for obtaining information about the Agricultural Statistics System of the field testing countries and Work Plan for the field testing countries have been prepared and sent to two field testing countries i.e. Indonesia and Rwanda.
- The splice site sequence data were encoded using an approach based on the difference between the observed and estimated values of nucleotides. The observed values were taken based on occurrence and non-occurrence of nucleotides and the estimated values were computed on the basis of conditional dependencies between di-nucleotides at donor splice site motifs. Based on the proposed approach, a web application was developed to predict the donor splice sites in vertebrates and is available at <http://cabgrid.res.in:8080/sspred/>
- SAS codes for data generation as well as heritability estimation for different correlation structure of errors [AR(1) and AR(2)] in case of half sib and full sib models have been developed. Estimates of heritability and means square error (MSE) are obtained for heritabilities (0.1, 0.25 and 0.5), for different sample sizes and different correlation values. It has been observed that if correlation increase from -1 to 0 by 0.1 interval, the MSE decrease but if correlation increase from 0 to +1 by 0.1 interval, the MSE are increasing.
- An attempt has been made to derive the joint and conditional distributions of response variable and sire effects under correlated sire and error structures. The log likelihood function based on the observed data and the latent data has been derived theoretically and then, a theoretical expression for the Q-function which is the conditional expectation of the complete data likelihood function given the observed data and the current estimate has been derived.
- The raw micro-array data for rice and soybean under different abiotic stress conditions were pre-processed by using RMA algorithm implemented in R software. The probes which are expected to have some role in stress were identified by using a three stage filtering process from the pool of probes. Then the selected probe ids were matched to the respective gene id by using available database. Further, the modeling of transcriptional regulatory networks was done by directly taking micro-array values as gene expression values. The regulatory networks were constructed by using value of the regulatory strengths and the obtained results were validated by using published literature and available database. For time-series gene expression experiment, a feature (gene) selection criteria was developed by using support vector machine and mutual information based algorithms.
- Under National Agricultural Bioinformatics Grid (NABG) established in ICAR, a number of databases and tools have been developed and number of training programs/ workshops/ meetings of different domains were organized to sensitize and train researchers in the field of computational biology and agricultural bioinformatics.
- In the halophile proteins database available at <http://webapp.cabgrid.res.in/protein/>, various physicochemical properties have been listed, that are helpful in identifying the protein structure, bonding pattern and function of the

specific proteins.

- Artificial Neural Network approach has been used for breed identification with locus minimization resulting in reduction in cost of genotyping and is applied in breed identification server for goat available at <http://nabg.iasri.res.in/bisgoat>.
- The sugarbeet whole genome marker discovery and database SBMDb (<http://webapp.cabgrid.res.in/sbmdb/>) has been developed.
- FMD virus VP1 protein and integrin protein sequences of Bos, Gallus and Canis from PDB were retrieved and used for homology modelling. *silico* site directed mutation of the FMDV VP1 protein RGD domain amino acids to KGD resulted in loss of interaction between FMDV VP1 protein and bos integrin. FMDV tropism in susceptible and resistant species and the importance of RGD domains for virus recognition and entry was deciphered through docking and interaction analysis *in silico*.
- A databank on “Resources Augmented and Knowledge Generated” has been developed and available at <http://bioinformatics.iasri.res.in/NAIP4BSR/naipc4/>. This covers the information on sub-projects, products, publications, patents, protocols developed etc., which could be of long term use to post-graduate students, researchers, research managers, regulatory bodies, policy administrators and agri-input industry.
- Anti Microbial Peptides (AMPs) are considered as alternative to chemical antibiotics. Artificial Neural Networks (ANNs) and Support Vector Machines (SVMs) have been applied to predict AMPs in cattle. SVMs with different kernels have exhibited high accuracy of prediction and were implemented on a web server available in public domain for classification/prediction of novel AMPs of cattle.
- An approach based on RF methodology was proposed (combined Random Forest) for the prediction of disease risk from imbalanced case-control data. The proposed approach was compared with the existing methods meant for imbalanced data, namely, Balanced Random Forest (BRF) and Weighted Random Forest (WRF) based on performance metrics, viz., sensitivity, specificity, classification accuracy, and precision. The proposed approach was illustrated using a case-control data set of Rheumatoid arthritis and found to perform better in terms of prediction accuracy over the existing BRF and WRF. Besides, SNPs associated with ulcerative colitis and rheumatoid arthritis diseases were identified at whole genome level by employing Least Absolute Shrinkage and Selection Operator (LASSO), a penalized regression technique.
- Identification of genes and transcription factors, which are co-expressed in multiple stress response, are important for understanding the underlying gene regulatory network. Meta-analysis of five abiotic stresses response in rice was performed by analyzing microarray samples. MCL clustering identified multiple modules that show high co-expression and further gene ontology enrichment analysis showed the stress specific modules and hub genes with high connectivity. Pathway analysis showed the involvement of genes in sucrose, carbohydrate, transport metabolism and Metabolism of terpenoids and polyketides.
- Tissue regulatory gene networks (TRGNs) with respect to salt and drought were reconstructed and investigated in rice under combined effect of salt and drought stress. It was suggested that the tissue regulatory network has a property of “small niche”; and there is substantial coordination between these niches mediated by common transcription factors. Pathway analysis of these subset of dynamic target genes were found to be involved with the processes such as stomatal closures, photosynthesis, root elongation and wax biosynthesis suggesting their probable role in providing stress tolerance in rice.
- Transcription factors (TF) knock-down approach has been used for *in silico* validation of developed network that mimics *in-vitro* knockdown experiment, which indicated that the constructed network had correctly identified the effected target genes governed by each of the TF's with an accuracy of 70%.
- Web based tool for modeling Gene Regulatory Network (GRN) facilitates pre-processing Next Generation Sequencing (NGS)/ microarray data, constructing GRN via different modeling formalisms and visualization of network. A pipeline for pre-processing NGS data with the available tools has been developed and five methods of modeling regulatory network have been integrated.
- MicroRNAs (miRNAs) are the key modulators of target gene regulation involved in different metabolism. Bread wheat (*Triticum aestivum*) is a hexaploid species with A, B, and D ancestral

- genomes. Gene ontology (GO) analysis of the target genes showed enriched activity related to nitrogen, starch, sucrose, glucan and fructan biosynthesis process. Two novel miRNA's were verified by stem loop pulsed RT-PCR for their expression in root and leaf tissue under nitrogen starvation.
- Abiotic stress, especially during seedling and flowering stage, is one of the major factors responsible for huge yield losses in *Brassica juncea*. MicroRNA plays a key role in adaptive responses of the plants towards abiotic stress conditions through post transcriptional gene regulation. One of the miR-SNP (C/T) was found on the mature region of miR2926 which led to the distorted and unstable hairpin structure of miR2926 consequently there was complete loss of its function.
 - Epigenetics refers to the changes in gene expression that do not involve changes in the DNA sequence. This concept implies that a new genetic state can be stably propagated through mitosis or meiosis independently of the inducible signal, yet can still revert to its original state. A web-based "Livestock Epigenetic Information System" has been developed (<http://bioinformatics.iasri.res.in/edil/>) to analyse pigenetic information required for improvement in production traits and controlling diseases in livestock.
 - A web based software (WP3) has been developed for carrying out phylogenetic analysis, simple sequence repeat (SSR) to primer design and expressed sequence tag (EST) to gene prediction. A separate library has been developed for connectivity to the ASHOKA supercomputing platform and the computations thereon.
 - Protein structure comparison (PSC) is an important task for understanding the evolutionary relationships among proteins, predicting structure and function of proteins. Various technologies like Scoring algorithm, Software for protein structure comparison have been developed, each method optimizing its own scoring scheme. A web-based Software for protein structure comparison has also been developed for PSC for performing the protein structural analysis.
 - Whole genome sequence data of Mangur fish (*Clarias batrachus*) were generated from Roche 454 and Ion Torrent sequencing platforms. The phylogenetic analysis of coding DNA sequences (CDS) and tRNA supports the monophyly of catfishes.
 - For *multilabel functional classification of abiotic stress related proteins in Poaceae*, Post translational modification patterns such as Palmitoylation, KEN and D box, Calpain Cleavage sites, Polo like Kinase sites, Pupylation sites, S-Nitrosylation sites, Nitration Sites and Sumoylation were analysed. The physico-chemical properties of these proteins were also deduced and analyzed.
 - Graph partitions obtained by spectral clusters shows significant improved result to decipher secondary structure segments and folding information than Markov CLustering (MCL). MATLAB codes for cluster analysis have been developed for further analysis and comparing 3D structures.
 - Indian NARS Statistical Computing Portal (<http://stat.iasri.res.in/sscnarsportal>) has been strengthened by adding macros for customized analysis of data from split factorial (Main AxB, Sub C) designs and strip-split plot designs. Design Resources Server (www.iasri.res.in/design) was further strengthened by adding new link on response surface designs at http://www.iasri.res.in/design/Response%20Surface/RS_Home.html.
 - Results Framework Document (RFD) is an instrument that helps prioritizing and measuring the performance of any department/organization. Results Framework Document Management System (RFD-MS) was initiated to manage RFD activities in ICAR. The RFD-MS facilitates institutes to prepare, submit and report RFDs targets and achievements online and provide access to officials authorized by the Institutes, respective SMDs and RFD coordination unit in ICAR. It also facilitates generation of consolidated reports. RFD-MS has been designed and developed in 3-tier architecture on the .NET platform. The system has a user interface for online data entry, updation and modification of various sections of RFD document. The interface for report and queries as per the requirement has been designed and developed. The consolidated reports of RFD with print option have been designed.
 - Development of web based expert system on Tobacco using Agridaksh tool was initiated with Central Tobacco Research Institute, Rajahmundry to provide knowledge based system on various aspects of tobacco crop. The system aims to design and develop various modules on tobacco such as insect pests and

diseases, abiotic stresses, varieties, soil types and nutrient disorders, weed management and world tobacco scenario. The customization, designing and development of tobacco expert system was done using the Agridaksh tool.

- ICAR-ERP system is available for access at <http://icarerp.iasri.res.in>. Following Modular approach, the system has been implemented in 108 ICAR institutions. Data digitization work was carried out in all ICAR institutions. Data was loaded in the system using scripts. More than 20000 users have been created in the system. Finance module is completely operational in all the institutes. Almost 3 lakh transactions have been recorded in different modules till March 2015.
- ICAR Data Centre (Tier-III) has been established at IASRI to provide Unified Mail Messaging and Web Hosting solution in ICAR. Domain name "icar.gov.in" has been registered and the Unified Communication and Web Hosting Services have been made operational. Digital certificates of servers were procured and installed SSL to provide the services of different applications through <http://icar.gov.in> domain. Coordination has been made with NIC to strengthen the existing NKN connectivity to newly created Data Centre (Dual link has been established). Unified messaging solution (email with chat features) has been implemented (<https://mail.icar.gov.in>). Email ids are being created for ICAR employees after verification of data from institutes. KRISHI Portal, Agroweb, NAIP and other application running from IASRI server (HYPM, NISAGENET) have been migrated into Data center environment.
- Developed a phenome data management system with several analysis modules meant for estimation of physical and biochemical traits of rice under moisture deficit and low temperature stress tolerance. Regression methodology was applied for estimation of leaf area and chlorophyll content of rice seedlings under pot culture conditions through image analysis. An online software "Leaf Area Estimator" has been developed and deployed on the production server for ready use by the experimental biologists.
- Dog Health Management Trainer (DHMT) was designed and developed to provide the detailed stepwise information to dog owners. DHMT serves as an expert for training of the dog owners who are beginners and are

keen to know the scientifically correct methods of dog rearing.

- The software Expert System for Farm Power and Machinery Selection has been developed. DLL (Dynamic Link Libraries) and API (Application Programming Interface) have been developed for each module used in this software. It is a complete web based solution or web based expert system for farm power and machinery selection for rice-wheat crops.

The Institute organized the 68th Annual Conference of the Indian Society of Agricultural Statistics during January 29-31, 2015. During the Conference, a Workshop on "Methodology for Estimating Crop Area and Yield under Mixed and Continuous Cropping" was also organized. 9 students (6 Agricultural Statistics, 2 Computer Application and 1 Bioinformatics) received Appreciation Certificates for the excellent presentation of their papers in the respective sessions. The Institute has regularly organized the meetings of Research Advisory Committee (RAC), Institute Management Committee (IMC) and Institute Research Committee (IRC). Results Framework Document, 2014-15 was submitted to the Council.

Scientists of the Institute have published 128 research papers in National and International refereed Journals along with 24 popular articles/short communications, 1 book, 9 book chapters, 4 papers in conference proceedings and 58 project reports/technical bulletins/ monograph/reference manuals/brochures. Besides this, 57 e-manuals/ e-resources/ macros were also developed.

During the year, 25 training programmes were organized in which 636 participants were imparted training

- Six 21 days training programme under Centre of Advanced Faculty Training on Forecast Modelling Analytics in Crops, Agricultural Web Applications Development using Content Management Tools, Recent Advances in Survey Design and Analysis of Survey Data using Statistical Software, Advances in Omics Data Analysis: Learning by Examples, Advanced Statistical Techniques in Horticulture Science Research and Recent Advances in Statistical Genetics were organized.
- Thirteen training programmes were conducted under National Agricultural Innovation Projects: Basic Training on Discovery Studio, High Performance Computing, Oracle Database 11g: Administration Workshop, Six Different modules

of SAS software: SAS Data Integration Studio, Fast Track, Data Flux Data Management Studio, Text Analytics Using SAS Text Miner, Managing SAS Analytical Models Using SAS Model Manager, Grid Computing (SAS Enterprise Scheduling with Platform Suite for SAS and SAS Content Categorization Studio: Building Models, Advance Training on Discovery Studio Software, Training for Post ICAR-ERP implementation, Knowledge Enhancement Session on MIS/FMS Solution by IBM and Post Go-Live Knowledge Enhancement Sessions for MIS/FMS Solution.

- Four Resource Generation training programmes were conducted on Data Analysis and Interpretation for ISS Probationers of XXXV Batch sponsored by CSO, Ministry of Statistics and Programme Implementation, Refresher Training Programme on Statistical Techniques sponsored by Livestock Department, Government of Chhattisgarh, International training programme on Importance of Statistical and Experimental Designs, Data Analysis and Biometrical Techniques in Agriculture Research sponsored by Ministry of Agriculture, Irrigation and livestock (MAIL), Afghanistan and International training programme on Applications of Remote Sensing and GIS Development in Agricultural Surveys sponsored by African-Asian Rural Development Organization.
- Two other training programmes sponsored by ICAR on Office Automation using Oracle ERP for Technical Personnels of ICAR were organized.

The activities relating to Post Graduate teaching programmes of the Institute were undertaken in collaboration with PG School, IARI. During the year, a total of 18 students {5 Ph.D. (Agricultural Statistics), 6 M.Sc. (Agricultural Statistics), 2 M.Sc. (Computer Application) and 5 M.Sc. (Bioinformatics)} completed their degrees. 32 new students {6 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 7 M.Sc. (Computer Application), 6 Ph.D. (Bioinformatics) and 5 M.Sc. (Bioinformatics)} were admitted. A Senior Certificate Course in Agricultural Statistics and Computing was also organized.

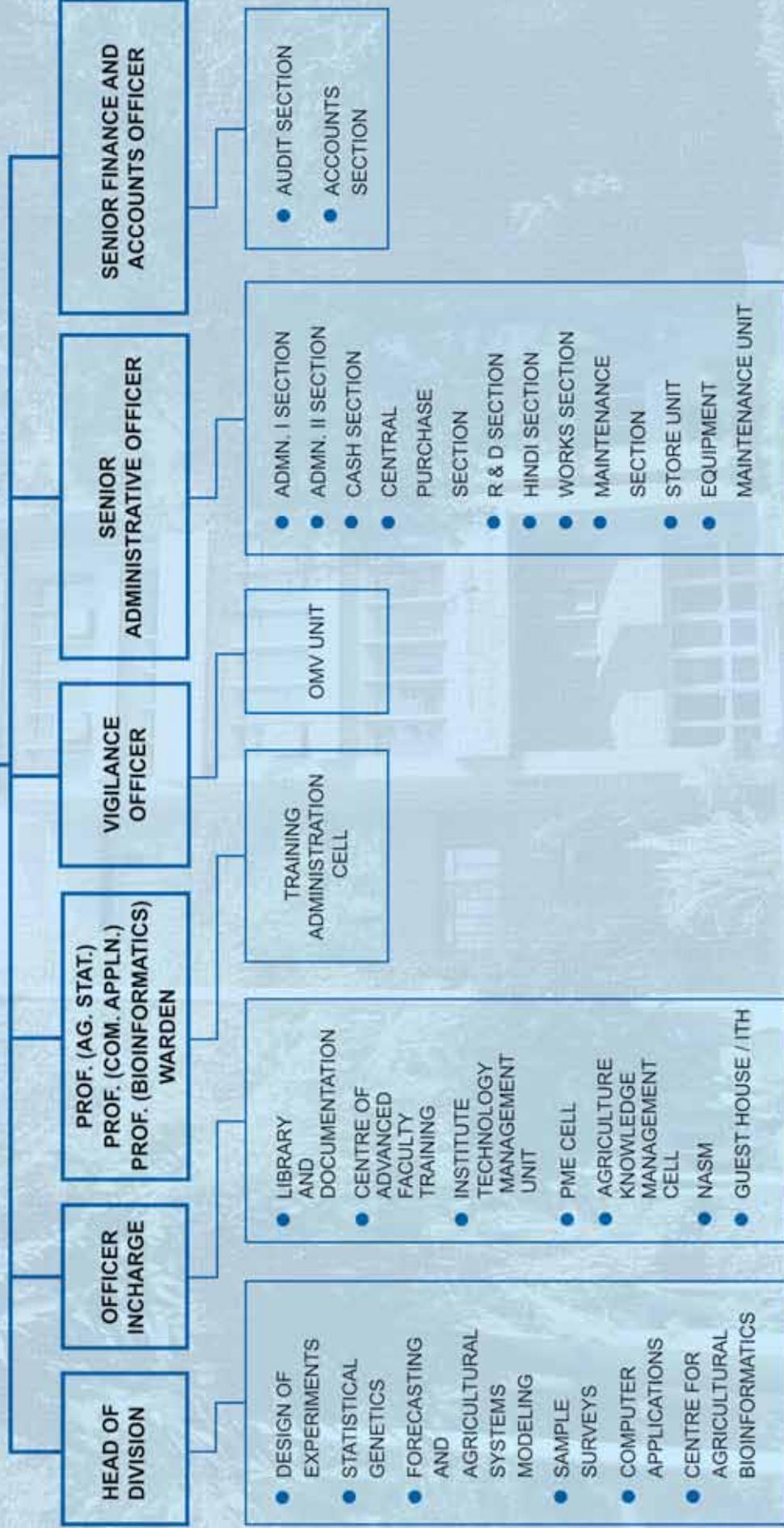
Dr. UC Sud visited Bangladesh to participate in the Workshop on Harmonization and Dissemination

of Unified Agricultural Production Statistics in Bangladesh. Dr. Hukum Chandra Visited Italy to attend the collaborative training programme on Small Area Estimation under Generalized Linear Mixed Model at Department of Economics and Management, University of Pisa, Italy. He also visited Tsukuba, Japan to participate in Sixth Workshop on Forging Partnerships in Statistical Training in Asia and the Pacific: Networking for Agricultural and Rural Statistics, attended experts meeting on Skills Framework and Training Needs Assessment Tools for Agricultural and Rural Statistics and visited Chiba, Japan to attend the training programme at United Nations Statistical Institute for Asia and the Pacific on Assessing Training Needs of the Statistical Workforce in Agricultural Statistics. Sh. KK Chaturvedi attended training on Bioinformatics at Cornell University, Ithaca, USA sponsored by NAIP (ICAR). Dr. Sanjeev Panwar visited Addis Ababa, Ethiopia as a resource person in the training course on Advanced Experimental Designs, Data Analysis and Management for Breeding Trials. Dr. Susheel Kumar Sarkar visited Spain to attend training on Integrated Breeding Multi-Year Course (IB-MYC) Year 3 under Generation Challenge Programme - Integrated Breeding Platform (GCP-IBP) at Mediterranean Agronomic Institute of Zaragoza (IAMZ) in Zaragoza, Spain.

Scientists of the Institute have brought laurels to the Institute by receiving awards from different agencies. Dr. Seema Jaggi received the Bharat Ratna Dr. C. Subramaniam Award for Outstanding Teachers-2013 of ICAR for excellent teaching in the field of Social Sciences during the 86th ICAR Foundation Day and Award Ceremony held at NASC Complex, New Delhi on July 29, 2014. Dr. Hukum Chandra was awarded ICAR-National Fellow and also received Professor PV Sukhatme Gold Medal Award 2014 by the Indian Society of Agricultural Statistics during 68th Annual Conference of ISAS (29-31 January 2015) for his outstanding contribution in the field of Agricultural Statistics. Dr. Alka Arora received the Best Paper Award published in the journal of ISAS and Sh. KK Chaturvedi received Fellowship Award from Society for Scientific Development in Agriculture and Technology, Meerut.

ORGANOGRAM

RESEARCH ADVISORY COMMITTEE ↔ **DIRECTOR** ↔ INSTITUTE MANAGEMENT COMMITTEE





Introduction

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. 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.

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). Besides, the ICAR-ERP solution for Financial, Project, Material, Human Resource Management and Payroll at ICAR has been developed and implemented. 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 Correlation (STCR); (iv) Rapeseed and Mustard; (v) Sorghum; (vi) Wheat and Barley and (vii) Vegetable Crops.

Sample Surveys

The subject of sampling techniques helps in providing the methodology for obtaining precise estimates 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.
- The 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 very 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 $G \times E$ 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 can 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

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 from April 2012 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.
- Realizing the need of integration of databases to prepare a comprehensive knowledge warehouse that can provide desired information in time to the planners, decision makers and developmental agencies, Integrated National Agricultural Resources Information System (INARIS) has been developed. The data warehouse comprises of databases on agricultural technologies of different sectors of agriculture and related agricultural statistics at district/state/national levels, population census including village level population data as well as tehsil level household assets and livestock census. Subject-wise data marts have been designed, multi-dimensional data cubes developed and published in the form of on-line decision support system. It is being developed as knowledge data warehouse through the development of Knowledge Management for Agricultural Research and Technologies (KMART). The system also provides facility of spatial analysis of the data through web using functionalities of Geographic Information System (GIS).
- 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, M.Sc. and Ph.D. in Computer Application and M.Sc. in Bioinformatics in collaboration with Indian Agricultural Research Institute (IARI), New Delhi. Ph.D. degree in Bioinformatics has also been initiated from academic session 2014-15. The Institute has so far produced 188 Ph.D. and 328 M.Sc. students in Agricultural Statistics, 112 M.Sc. students in Computer Application and 6 M.Sc. students in Bioinformatics.
- 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. So far, 62 training programmes have been organized under the aegis of CAS/CAFT and in all a total of 1076 participants have been benefited.
- 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. In all 88 participants have completed both the modules, 39 have completed module-I and 22 have completed module-II since 1997.
- 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 the agro-based private sector. One such training programme

was organized for research personnel of E.I. DuPont Pvt. Ltd. The Institute has also conducted training programmes for the scientists/research personnel of CGIAR organizations such as ICARDA and Rice-Wheat Consortium for Indo-Gangetic plains.

Infrastructural Development

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

Keeping pace with the emerging technologies in the area of Information Technology (IT), the computing infrastructure have been constantly upgraded/replaced with newer platforms and versions. The computing environment in the Institute has latest computing and audio visual equipments i.e. High Performance Computing having 144 cores Intel HPC cluster, rack mount & redundant SMPS servers, workstations, desktops, laptops, netbooks, documents printing & scanning, DVD duplicator, visualiser and wireless multimedia projectors etc. The Institute is also well equipped with 100 MBps bandwidth fiber optics backbone wired and wireless networking campus.

The first supercomputing hub for Indian Agriculture ASHOKA (Advanced Super-computing Hub for OMICS Knowledge in Agriculture) established at IASRI, was dedicated to the Nation on 15 January 2014. In order to provide access to this advanced computing facility to researchers, a National Bio-Computing Portal has been launched through which authenticated users will be able to perform their biological data analysis. This portal consists of number of computational biology and agricultural bioinformatics software/workflow/pipelines which will be able to automate routine biological analytics in seamless manner. This super-computing hub consists of hybrid architecture with high performance computing having (i) 256 nodes Linux cluster with two

masters, 3072 cores and 38 Tera Flops computing, (ii) 16 nodes windows cluster with one master, (iii) 16 nodes GPU cluster with one master with 192 CPUs + 8192 GPUs and (iv) SMP based machine with 1.5 TB RAM. Also, this hub has approximately 1.5 Peta Byte storage divided into three different types of storage architecture i.e. Network Attached Storage (NAS), Parallel File System (PFS) and Archival. This hub also consists of super-computing systems (16 node Linux cluster with one master and 40 TB storage) at National Bureau of Plant Genetic Resources (NBPGR) New Delhi, National Bureau of Animal Genetic Resources (NBAGR) Karnal, National Bureau of Fish Genetic Resources (NBFGR) Lucknow, National Bureau of Agriculturally Important Microbes (NBAIM) Mau and National Bureau 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 332 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.

The Library of 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 house keeping 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. Pansa 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

- Prioritisation, 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 (2014-15) Institute Plan & Non-Plan

Head of Account Plan	(Rs. In Lakhs)			
	Allocation		Expenditure	
	Non-Plan	Plan	Non-Plan	Plan
Pay & Allowances + Pension & other retirement benefits	0.00	2984.96	0.00	2984.74
TA	12.50	5.00	12.32	4.99
OTA	0.00	0.50	0.00	0.25
HRD	3.75	7.60	3.70	7.51
Fellowship	0.00	46.00	0.00	45.42
Research & Operational	7.17	7.00	5.62	1.74
Equipments	97.00	8.00	92.00	7.93
Information Tech.	0.00	0.00	0.00	0.00
Furniture	7.50	2.00	3.56	0.00
Works	54.25	0.00	46.36	0.00
Library	40.00	0.00	39.99	0.00
Loan & Advances	0.00	6.00	0.00	4.78
Administrative Exp.	102.58	472.50	95.91	432.59
Guest House Maintenance	3.25	0.44	1.75	0.42
Other Miscellaneous	334.00	0.00	334.00	0.00
Total	662.00	3540.00	635.22	3490.38

Staff Position (as on 31 March 2015)

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	1
Scientific	130	62
Technical	215	69
Administrative	84	71
Canteen	14	8
Skilled Supporting Staff	78	46
Total	522	257

3 Technical Officials and 2 Skilled Supporting Staff who are having disabilities are being paid double amount of Transport Allowance and they are also being allowed additional rebate in Income tax as per rules.



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

Minimal response surface designs for resource optimization in agricultural experiments

Randomization of the run sequences is a technique commonly employed in response surface methodology (RSM) to avoid influence of unknown factors that could have an influence on the response

which may lead to misinterpretation of the results. Randomizing the run sequences does not always achieve the desired effect of neutralizing the influence of unknown factors. In addition, randomization can induce a big number of changes in factor level and thus make experimentation expensive, time-consuming and difficult. The number of level changes is of serious concern to experimenters in many agricultural, post-harvest and processing, engineering and industrial experiments as in such experiments one may come across some situations where it is physically very difficult to change levels of some factors.

A method to generate minimally changed run sequences for fitting second order response surfaces was developed by rearranging the run orders of the central composite designs. The general expression for minimum number of changes in run sequences of these designs was obtained. A SAS macro for the generation of central composite design with minimum level changes in the run sequences was developed.

The SAS System

Minimally changed run sequences for Central Composite Design

Minimal_CCD		
-1	-1	-1
-1	-1	1
-1	1	1
-1	1	-1
1	1	-1
1	1	1
1	-1	1
1	-1	-1
1.6817928	0	0
-1.681793	0	0
0	1.6817928	0
0	-1.681793	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	1.6817928
0	0	-1.681793

Factor-wise number of changes in the run sequence

Factor_Change		
4	6	7

Total number of changes in the run sequence

Total_Change	
17	

A catalogue consisting of number of input factors, total number of runs, total number of changes in run sequences along with layout of designs for central composite designs with minimally changed run sequences for input factors upto 10 is also prepared.

Experimental designs in the presence of indirect effects of treatments

Indirect effects are effects which occur in an experiment due to the units which are adjacent (spatially or temporally) to the unit being observed. For example, in a fertilizer trial, plants in an unfertilized plot may rob a share of the plants in a nearby heavily fertilized plot, thereby resulting in spatial indirect effects. It is thus important to include these indirect effects in the model to have the proper specification and obtain experimental designs in the presence of indirect effects of treatments that satisfy the statistical properties.

Design balanced for temporal indirect effects up to order two in incomplete units has been obtained. The parameters of the design so obtained are v (prime or prime power) treatments, $p = v-1$ periods and $n = v(v-1)$ experimental units. Another class of designs balanced for temporal indirect effects up to order two has been obtained with parameters v (prime or prime power) treatments, $p = 3v$ periods and $n = v-1$ experimental units. A class of complete, circular block designs balanced for spatial indirect effects from neighbouring units has been shown to be universally optimal for the estimation of direct effects and neighbour effects (left and right) of treatments under the non-additive mixed effects model.

Row-column design for odd number of treatments balanced for non-directional spatial indirect effects has been obtained. Another series of row-column designs minimally balanced for adjacent directional spatial indirect effects (neighbour effects) in four directions has been obtained for even number of treatments (v) in $p = v$ rows, $q = v$ columns and number of times the other treatments appear as neighbour is $\mu = 1$. This series of minimally balanced row-column designs for adjacent directional spatial indirect effects (neighbour effects) was found to be partially balanced for directional spatial indirect effects up to order two following a circular association scheme.

Information system for planning and analysis of experiments of All India Coordinated Research Project on vegetable crops

A webpage of All India Coordinated Research Project on Vegetable Crops (www.iasri.res.in/aicrpvc) has been developed with information on mandate, centers, crops and achievements.



Login screen of information system



Experiment creation module, Data upload and scrutiny module, Management module and Administrator module have been developed for



Experiment created using information system



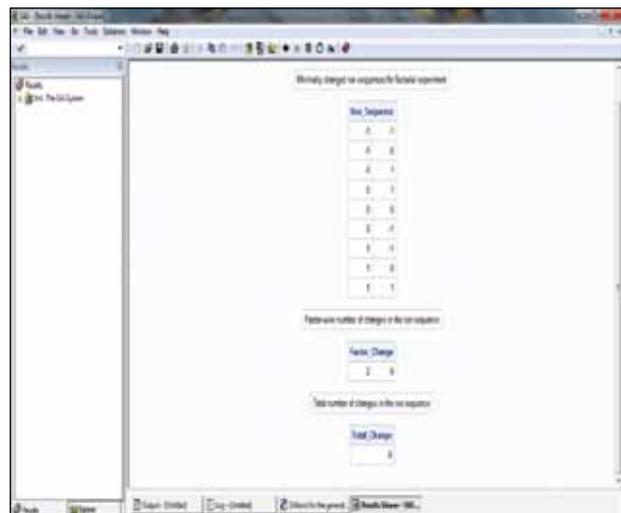
Information System for Planning and Analysis of Experiments. b-version of the Information System was released by Dr. Kirti Singh, Former Chairman, ASRB and Former Vice-Chancellor, IGKV, Raipur during XXXII Group Meeting of All India Coordinated Research Project on Vegetable Crops, Varanasi organized at IGKV, Raipur during June 24-27, 2014.

For customizing the application, crop table has been updated with 59 crops classified into 8 different families. The users as experimenters have been created with the identification of center of AICRP on VC. Database for updating attribute tables (characteristics/observations to be observed for each crop and for each trial (including initial evaluation trials, germplasm evaluation trials, integrated nutrient management, insect pest management, vegetable production, hybrid trials, and others) is being finalized. The line entries of various crops for Initial evaluation trials, Advanced varietal trial-I and Advanced varietal trial-II are being updated in the corresponding database tables.

Factorial experiments with minimum level changes in run sequences

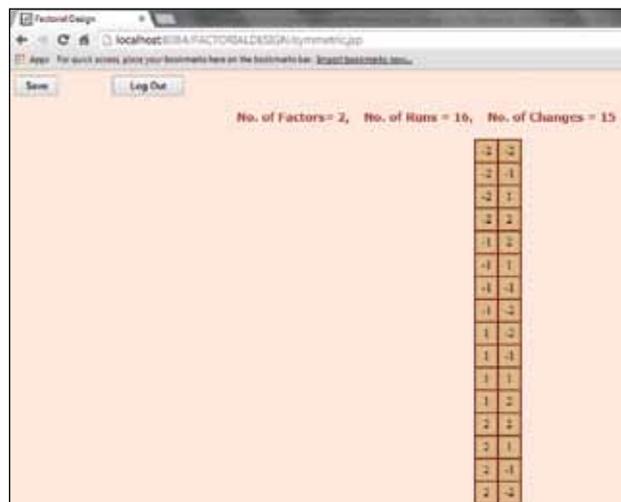
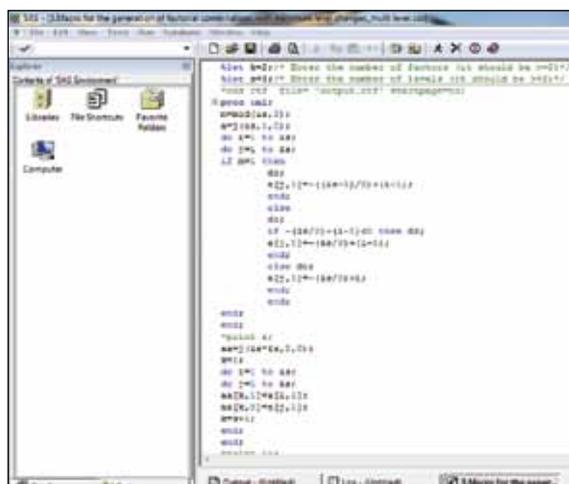
Factorial experiments with minimum level changes in run sequences are useful in experiments wherein it is difficult to change the levels of factor(s). Considering this, a general method for obtaining s^k factorial with minimum level changes in the run sequences has been developed. The general expression for factor wise number of level changes has been obtained in the developed s^k factorial. For i^{th} factor (for $i = 1, 2, \dots, k$), the expression has been obtained as $(s-1) s^{i-1}$.

A SAS macro for the generation of s^k factorial with minimum level changes in the run sequences has been developed and made available for end users at <http://www.iasri.res.in/sscnars/sftsmcrs.aspx>. The online availability of this SAS macro will help



the end users in getting a readymade layout plan of s^k factorial with minimum level changes in the run sequences.

A web module has also been prepared for generation of s^k factorial experiments with minimally changed run sequences.



For quick reference, a catalogue was prepared for symmetric factorial experiments with minimally changed run sequences for number of factors upto ten each having maximum of five levels. The catalogue consists of number of factors, number of levels per factor, total number of runs, total number of changes in run sequences along with designs.

Further, considering the practical importance of different levels for different factors, a general method has been developed for constructing mixed level factorial experiment with minimally changed run sequences. The general expression for the last factor i.e. for k^{th} factor which will require maximum number of changes in case of developed mixed level factorial with minimally changed run sequences was obtained as $(s_k - 1) \prod_{j=1}^{k-1} s_j$ where s_k is the level of k^{th} factor.

Planning, designing and analysis of ON FARM research experiments planned under AICRP_IFS

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 which are small (ii) the fertility of soil and the level of management at research stations are superior to those in cultivators' field. 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. ICAR-IIFSR has been conducting Integrated Farming Systems Research at national level through AICRP on Integrated Farming Systems. The three types of experiments conducted are (i) Response of nutrients (N, P and K) in farming systems, (ii) Intensification and/or diversification of the existing farming systems and (iii) Agronomic management practices for increased production of the farming system. ICAR-IASRI had been closely associated with the planning, designing and analysis of experiments in the project.

Analysis of datasets on Experiment-III (IFS) conducted during 2012-13 at all centres have been finalized and sent to IIFR, Modipuram. Out

Production, marketable surplus, cost and net profit of existing and improved farming system at Panchmahal, Gujarat

Centre : Derol
NARP Zone : Middle Gujarat III, AZ 84

Farming System	Area (ha)	No. of Households	Existing System				Improved (Diversified System)				P value Significance - Existing vs Improved			
			Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)	Production (kg)	Marketable Surplus (kg)	Cost (Rs)	Profit (Rs)
Crop + Dairy	0.91	7	9481.99 (1726.05)	7818.78 (1630.90)	78501.29 (10027.19)	32986.71 (17811.35)	7805.50 (1042.32)	6977.25 (970.95)	59808.57 (8956.08)	78769.71 (16883.87)	0.128	0.426	0.006*	.013*
Crop + Dairy + Goat	0.68	8	10619.80 (1614.57)	8603.018 (1525.57)	73205.75 (9379.58)	47277.13 (16660.99)	8659.20 (975.00)	8059.12 (908.24)	67227.63 (8377.64)	91753.75 (15793.41)	0.170	0.704	0.258	0.061
Crop + Dairy + Goatery + Poultry	1.04	8	9476.59 (1614.57)	7380.74 (1525.57)	83309.75 (9379.58)	21348.88 (16660.99)	7645.02 (975.00)	6537.00 (908.24)	70971.44 (8377.64)	44051.63 (15793.41)	0.118	0.400	0.063	0.171
Crop + Dairy + Poultry	0.84	1	5778	4331	40530	20105	8046.43	7202.50	47324	107362	-	-	-	-
CD [P = 0.05]	FS1 vs FS2		4930.16	4658.37	28640.91	50874.97	2977.20	2773.34	25581.45	48225.78				
	FS1 vs FS3		4930.16	4658.37	28640.91	50874.97	2977.20	2773.34	25581.45	48225.78	-	-	-	-
	FS 2 vs FS 3		4762.98	4500.42	27669.75	49149.89	2876.25	2679.30	24714.03	46590.53				

* indicates significance at 5% level
 - Values in () indicates standard error of mean values
 - The farming system Crop + Dairy + Poultry is not considered for ANOVA as well as for paired t test as only one household is available in this farming system.
 - Dairy includes Cow / Buffalo

of all centres, significant enhancement in income has been found for 16 OFR centres viz. Amritsar, Angul, Aurangabad, Chettinad, Chittorgarh, Deesa, Dindori, Kangra, Kendrapara, Kollar, Pune, Punea, Raigarh, Sivgangi, Sirsa, Warangal and discrepancy on dataset for rest of the centres has been sent to PDFSR, Modipuram. Based on Bench Mark data, Under Experiment II, grouping of 24 farmers has been done into four groups

- (i) Cropping System (CS) + Dairy including cow and buffalo: 7 Farmers
- (ii) CS + Dairy + Goatery: 8 Farmers
- (iii) CS + Dairy + Goatery + Poultry: 8 Farmers
- (iv) Other Farming Systems (FS): 1 Farmer

Total production, cost, surplus and profit were computed for existing as well as diversified systems taking into consideration all farming systems spread over 3 seasons and various systems. One-way ANOVA was carried out to identify the best FS (ignoring FS-4) with respect to production, cost, surplus and profit, and it was observed that there was no significant difference between the 4 farming systems at Panchmahal centre. Again, ignoring FS-4, paired t-test was carried out for comparing existing and diversified farming systems with respect to production, cost, surplus and profit. It was seen that with respect to profit, there was a significant difference for FS-1, *i.e.* CS + Dairy. Format of summary table for each centre was finalized, results of Panchmahal centre was consolidated and sent to ICAR-IIFSR.

A one day training programme (March 24, 2015) on data processing and data analysis was organized at ICAR-IASRI for technical officials of ICAR-IIFSR and ICAR-IASRI working under this project.

Planning, designing and analysis of experiments planned ON STATIONS under the AICRP_IFS

The experiments on stations under the Project Directorate for Farming Systems Research 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 designs, Strip plot designs, $3^2 \times 2$ balanced confounded factorial experiments and Split-split plot design. Data of 210 experiments for the year 2013-14 were received and analysis

work for 112 experiments was completed. For rest of the centres, data files are being prepared for the analysis. Data sheets of all the experiments under AICRP on IFS have been modified.

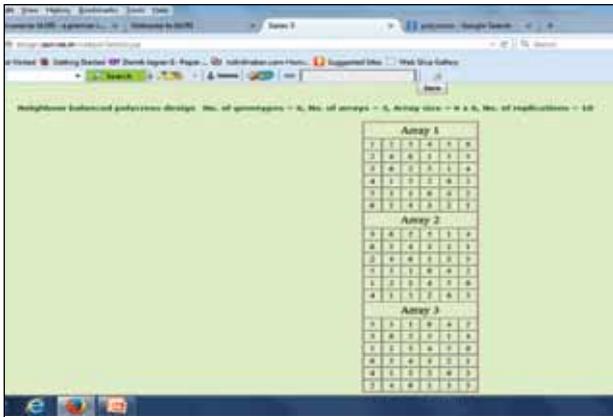
Under the project Development of Innovative Farming Practices to Mitigate the Effect of Climate Change which was started in the year 2011-12 at 37 centres with a suggested layout of Split plot design with two main plot factors [Tillage (two levels viz., T1 and T2) and Cropping System (three levels viz., CS1 CS2 and CS3)] and two sub plot factors [Mulch (two levels viz., M1 and M2) and Fertilizer rates (two levels viz., F1 and F2)], analysis of data for the year 2013-14 pertaining to the two centres viz., Bhubaneswar and Navsari was completed. Data on grain yield was converted to calorific value and gross return before analysis to make them comparable. For rest of the centres, data scrutiny as well as analysis is in progress. Multiple comparisons among various effects and their interactions were done using Tukey's HSD and the best treatment combination was identified for each of the centres.

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

The data generated from long term fertilizer experiments on various crop wise characters viz. grain and straw yield, plant nutrients concentration/uptake and available soil nutrients from cooperating centres for each season pertaining to the experiments were undertaken for two cooperating centres for the year 2011-12 and for four cooperating centres for the year 2012-13 and for one cooperating centre for the year 2013-14. Soil Quality Index (SQI) was worked out for Akola Centre for the year 2012-13. The treatment T3 (150% NPK) gave the highest SQI followed by T6 (100% NP). Minimum SQI was for the treatment T11 (75% NPK + 25% N through FYM) for Kharif season and T10 (FYM @10 t ha⁻¹) for Rabi season.

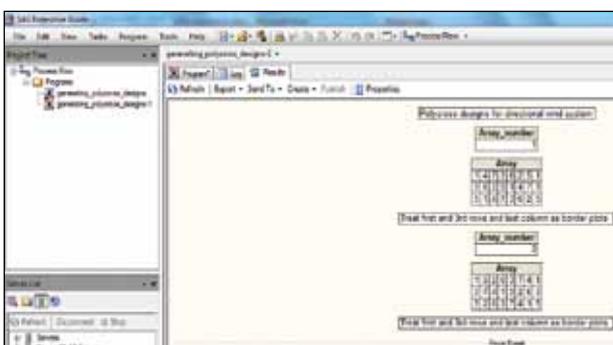
Data for Jabalpur centre for the period 1980-81 to 2010-11 (31 years) was taken for combined analysis. These data pertained to soybean in Kharif and wheat in Rabi season. The observations over years were not independent and the error structure was having unequal variance-covariance. Therefore, these data were analyzed as repeated measures data taking the variance-covariance structure into consideration. There were ten treatments: T₁ - 50% NPK, T₂ - 100% NPK, T₃ - 150% NPK, T₄ - 100% NPK+HW, T₅ - 100% NPK +Zn, T₆ - 100% NP, T₇ - 100% N, T₈ - 100%

displays the layout plans by entering the value of v (number of genotypes) and also displays the parameters of the designs.



Along with the designs, the software also displays a complete description about the methods of construction along with example for all the five different series of designs. The online catalogue ($v \leq 20$) of all the five series of polycross designs has also been prepared and included in the software, giving the parameters from where design can also be generated.

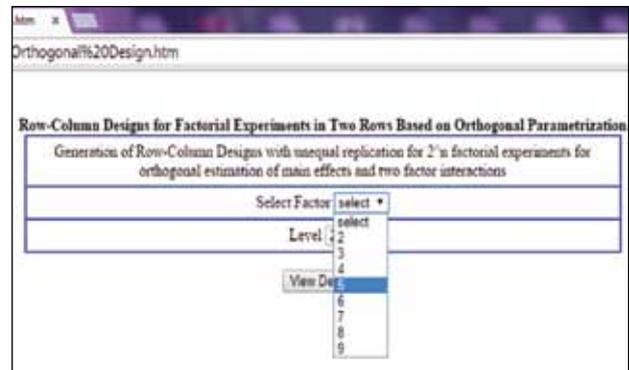
SAS Macro has also been developed to generate the series of polycross designs for v (odd) genotypes in v arrays of size $(v+1)/2 \times v$ each and each genotype replicated $v(v+1)/2$ times, balanced for neighbours in eight directions. SAS Macro has also been developed to generate a series of neighbour restricted row-column designs for $v (=4m)$ genotypes in $v/4$ arrays of size $2 \times v$ each and each genotype replicated $v/2$ times. Another Macro has been developed for generating polycross designs, for nurseries having prevailing wind system in a direction, for v genotypes (v being a prime number of the form $3t+1$) in $(v-1)/3$ sets, each set having 3 rows of size v each.



Generation of row-column designs for factorial experiments with two rows

A web application has also been developed for online generation of row-column designs in two rows with unequal replication of treatment combinations for

orthogonal estimation of main effects and two factor interactions for wider dissemination of the results obtained. The application has been developed using C# and asp.net.



Selection of number of factors



Row column design for 25 factorial experiment for orthogonal estimation of main effects and two factor interactions

To deal with the situation of baseline parameterization, a general procedure of obtaining row-column designs in two rows for n -factor mixed level factorial experiments has been developed. Web application for generation of row-column designs in two rows for orthogonal and baseline parameterization has also been developed.



Selection of number of factors and their levels



Column	1	2	3	4	5	6	7	8	9	10	11	12
1	101	102	103	104	105	106	107	108	109	110	111	112
2	201	202	203	204	205	206	207	208	209	210	211	212
3	301	302	303	304	305	306	307	308	309	310	311	312
4	401	402	403	404	405	406	407	408	409	410	411	412
5	501	502	503	504	505	506	507	508	509	510	511	512
6	601	602	603	604	605	606	607	608	609	610	611	612
7	701	702	703	704	705	706	707	708	709	710	711	712
8	801	802	803	804	805	806	807	808	809	810	811	812
9	901	902	903	904	905	906	907	908	909	910	911	912
10	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012
11	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112
12	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212

2x3x2 factorial experiment for estimation of factorial effects based on baseline parameterization

Strengthened Design Resources Server

For dissemination of research in Design of Experiments, Design Resources Server (www.iasri.res.in/design) was further strengthened through adding new link on response surface designs at http://www.iasri.res.in/design/Response%20Surface/RS_Home.html. These designs are used (i) to determine and to quantify the relationship between the response and the levels of quantitative factors and (ii) to obtain optimum combinations of levels of various quantitative factors. To meet these objectives, the data from the experiments involving quantitative factors can be utilized for fitting the response surfaces over the region of interest. Response surfaces besides inferring on the twin purposes can also provide information on the rate of change of the response variable and can help in studying the interactions between quantitative factors. A screen shot of this link is as given below:



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 through link ‘Ask a Question’ were answered for providing e-advisory services. During April 01, 2014-March 31, 2015, Google analytics gave 12,098 page views through 518 cities of 97 countries. Average time taken on page is 3.08 minutes.

Programme 2: FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA

Forecasting agricultural commodity prices using time series data

The study was undertaken to forecast prices of selected important agricultural commodities such as Onion, Wheat, Mustard seeds, Lentil (Massor grain) and Gram. Univariate and Multivariate techniques were adopted for analysis. In case of Univariate approach, Autoregressive Integrated Moving Average (ARIMA) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) methods were applied whereas for multivariate approach, Vector Auto Regressive (VAR) model was used. In case of Onion price forecast, the GARCH (1,1) was concluded to be a better model than other models in forecasting spot price of Onion because the percent deviation in forecast values from actual values were smaller in GARCH model. Also both the AIC and SIC values from GARCH model were smaller than that obtained from other model. For Wheat price forecast, all the three models were examined. ARIMA (1, 1, 0) gives reasonable and acceptable forecasts; GARCH (1, 2) has also been attempted to forecast price but found not suitable because there was no persistent volatility in the price data series. In VAR Model, the lag quantity arrival and lag prices in the market influence the forecasts of wheat prices to some extent. On the basis of information criterion, AIC and SIC values from ARIMA model were smaller than VAR model. However forecast performance on the basis of different test statistics of VAR model give better results than ARIMA. For forecasting Mustard prices, ARIMA (0, 1, 1) gives reasonable and acceptable forecasts; it does not perform very well when there is volatility in the data series. In VAR Model, the lag quantity arrival and lag prices in the market influence the forecasts of Mustard prices to some extent. The model that has been selected for forecasting Lentil prices is ARIMA (1, 1, 1). This model gives reasonable and acceptable forecasts; it does not perform very well when there exists volatility in the data series. In this study, GARCH (1, 1) has also been attempted to forecast price and found most suitable because there was persistent volatility in the data series. In VAR Model, the lag prices in the market influence the forecasts of Lentil prices to some extent. The GARCH (1, 1) was concluded to be most suitable model for this data series. ARIMA model was applied for forecasting Gram prices and model gives reasonable and acceptable forecasts. But, it did not perform very well when there exist

volatility in the data series. GARCH model was also fitted to forecast Gram prices. The GARCH model performs better on account of its ability to capture the volatility by the time varying conditional variance. The GARCH was found to be a better model than ARIMA in forecasting spot price of Gram because the values for RMSE, MAE and MAPE calculated using GARCH model were lesser than ARIMA model. AIC and SIC values were also lower in GARCH model than that from ARIMA model. The deviations between actual and forecasted Gram prices were little in GARCH model.

Mapping the cultural authority of science across Europe and India (MACAS-EU & India 2012-14)

This is a collaborative project with London School of Economics (LSE) and other European partners to develop composite indicators for agricultural livelihood. The major responsibility of IASRI is to extend the technical expertise and logistic support to study group in the areas of statistical / mathematical data mining, model based on supervised / un-supervised learning, discourse analysis, computer text analysis, large scale survey research, composite index building, etc. The proposed/developed methodology at IASRI using Principal Component Analysis (PCA) for construction of Science Culture Index (SCI) is statistically sound and is able to identify important indicators. 29 different Science Indicators (SI) were used to obtain SCI for the states. SCI have been obtained for 19 states using PCA methodology and Non-linear PCA was used to obtain SCI for 6 states. It is observed that the SCI calculated using both the methods do not differ much. Results indicate that for different states different SI are included in the construction of SCI. Some of the SI's are also common between states. The variations in SI may be due to cultural differences. Survey has been conducted in 21 major states excluding North-East, J&K and UTs. 20195 respondents have been surveyed on SIs and other attributes (income, expenditure, etc.). Preliminary data analysis including data correction has been carried out.

STAR and SV families of non-linear time-series models for describing cyclicity and volatility in agriculture

The one-step and two-step ahead optimal forecast for Exponential smooth transition autoregressive (ESTAR) family of parametric nonlinear time-series model has been derived by making use of conditional expectation. Further, it has been applied to forecast the fish landings data in Kerala. It is concluded that ESTAR models perform better than ARIMA methodology for the dataset under consideration.

The Stochastic Volatility (SV) model was represented in state space form for implementation of Particle filtering technique to estimate the parameters using "prediction error decomposition" form of the likelihood. In missing observation cases EM algorithm was employed for parameter estimation. Subsequently, the volatility process was also obtained from the fitted model. Further, the developed methodology was also employed in real data series which had missing observations for illustration purpose.

Volatility spill over of agricultural commodity prices

For the present study monthly wholesale prices of onion crop for Mumbai, Nashik and Delhi markets have been collected from the website of *agmarket.nic.in*. For analysis purpose R software has been used. At first stationarity test i.e. ADF test has been performed in each series to check stationarity of price series. Appropriate order of Generalized Auto Regressive Conditional Heteroscedastic (GARCH) model is identified for each series. In order to understand, volatility spillover among those monthly wholesale prices, multivariate GARCH models such as Baba Engle Kraft and Kroner (BEKK) and Dynamic Conditional Correlation (DCC) model has been applied.

Further, semiparametric approach has been conducted in the two stages. At first, estimates as well as standardized residuals from parametric multivariate GARCH model were obtained. In the second stage, Nadaraya-Watson estimator was applied to obtain the estimator of semiparametric conditional covariance matrix. Both the methods i.e. parametric and semiparametric multivariate GARCH model established the presence of volatility spillovers between onion markets prices under consideration.

Enhancing resilience of agriculture to climate change through technologies, institutions and policies

Monthly average temperature and total annual rainfall data during 1901 to 2002 for four climatic zones of India i.e. arid, humid, semi-arid temperate and semi-arid tropic was analyzed. For Humid Zone, temperature for January, February, March, August, October, November and December comes out to be significant. And in each case there is an increasing temperature trend. Analysis revealed that during the study period, the temperature for January has increased by 0.47°C, for February 1.14°C, for March 0.7°C, for August it is 0.12°C, for October it is 0.40°C, for November and December 1.22°C and 1.19°C

respectively. In the same way conclusions were drawn for Semi-Arid-Temperate Zone. It was found that there is a significant increase in temperature for February, November and December. For February the increase in temperature is 1.23°C, for November it is 1.38°C and for December it is 1.23°C. Temperature in September shows a decreasing trend and temperature is decreasing by 0.45°C. For Semi-Arid Tropic Zone, temperature for January-April and then from September-December comes out to be significantly increasing. For January there is 0.52°C increase, February 1.17°C, March 0.93°C, April 0.70°C, September 0.42°C, October 0.68°C, November 1.51°C and December 1.31°C increase during the study period respectively. Arid Zone shows an increasing trend in temperature for February, April, November and December and over the years the increase in temperature in these months is 1.18°C, 1.27°C, 0.97°C and 0.84°C respectively. For July there is a 0.81°C decrease in temperature during the study period.

The rainfall data analysis for the same time period by using above methodologies for above four zones revealed that only for Arid zone, rainfall comes out to be significantly increasing. For other three zones the trend in rainfall is not significant.

Modeling and forecasting of time-series with long memory process

Daily time series data for spot prices of gram in Delhi Market during 1 January, 2009 to 31 July, 2013 has been considered. The return series are computed as differences in log prices. The data was collected from Ministry of Consumer's Affairs, Government of India. The data for the period January 1, 2009 to June 31, 2013 was used for model building and the remaining data was used for model validation. In order to test for stationarity, two tests namely Augmented Dickey-Fuller unit root test and Philips-Peron unit root test are used. It was found that both the returns as well as squared return spot price series data were stationary. The GPH tests for testing long memory (LM) to the return and squared returns of the spot prices of gram. For the return series, the test showed no evidence of LM patterns; as the null hypothesis of no persistence was not rejected. The result for squared return was different from that of the returns. Indeed, long memory property was found to be highly significant for the squared returns. Since squared returns are a good proxy for volatility, these findings thus suggest that the conditional volatility of return would tend to be range-dependent, persist and decay slowly. Intuitively, this volatility persistence can be appropriately modeled by a LMSV process

because it allows for long memory behavior and slow decay of the impact of a volatility shock. It is, however, important to note that the estimate of the LM parameter d is less than 0.5 for squared return indicating the stationarity of the process. One-step ahead forecasts of volatility for the period July 01, 2013 to July 31, 2013 in respect of above fitted model were computed. For measuring the accuracy in fitted time series model, Root mean square error (RMSE), Mean absolute prediction error (MAPE) and Relative mean absolute prediction error (RMAPE) were computed and they were found to be 244.45, 237.40 and 8% respectively. Therefore it may be concluded that when there is long memory in the volatility, LMSV model is appropriate for forecasting.

Network project on market intelligence

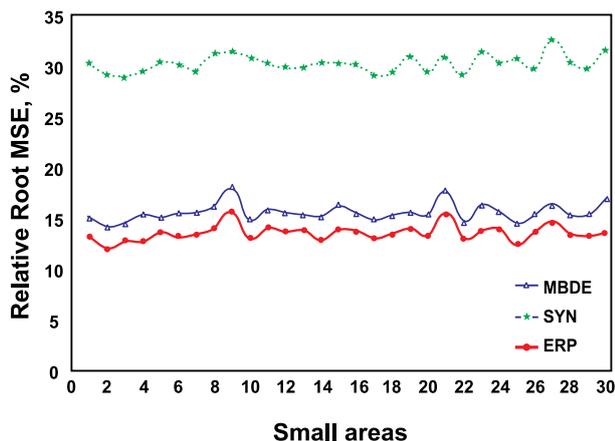
The price behaviour of agricultural commodities in various regions of the country plays an important role in understanding the markets. The price signals guide and regulate production, consumption and marketing decisions over time. Therefore, if markets are not well integrated, the price signals are distorted. The prices in cotton value chain seem to be supply driven; any change in the price of raw cotton in the long run will impact the prices of yarn and cloth. It is, therefore important to analyse how price signals from these markets are transmitted to other major markets. The horizontal price movements was analyzed in seven selected cotton markets from three major cotton producing states of India based on the volume of transactions. Adoni market from Andhra Pradesh, Rajkot, Gondal and Jamnagar from Gujarat; and Akot, Gevrai and Parbhani from Maharashtra were related. Due to higher cotton consumption by textile mills in Andhra Pradesh and Maharashtra, the short term deviations from equilibrium either from domestic or international markets would take more time to fade away in the Andhra Pradesh market as compared to the Gujarat market. Within Gujarat, the speed of adjustment is found to be higher in Jamnagar as compared to Rajkot and Gondal markets.

Programme 3: DEVELOPMENT OF TECHNIQUES FOR PLANNING AND EXECUTION OF SURVEYS AND STATISTICAL APPLICATIONS OF GIS AND REMOTE SENSING IN AGRICULTURAL SYSTEMS

Small area estimation for skewed data

Commonly used Small Area Estimation (SAE) methods based on linear mixed models can lead to both biased and inefficient small area estimates

for skewed data. Two approaches are described in literature for SAE of skewed variables based on log scale linear mixed model, the model-based direct estimation (MBDE) and the synthetic type estimation (SYN). For skewed data these two small area methods provide efficient estimates of small areas as compared to the linear mixed model based empirical best linear unbiased predictor. However, the MBDE is a direct estimator and unbiased in the presence of between area heterogeneity, but can yield unstable estimates if sample sizes are too small. On the other hand, the synthetic type of empirical predictor only accounts for between area variability through the covariates and therefore can lead to biased estimates when heterogeneity exists between the areas. An empirical best predictor for small area means (EBP) has been developed which addresses both of these issues simultaneously. Simulation studies were carried out to evaluate the empirical performance of different small area estimation methods. The empirical results show



Area-wise values of relative Root MSE (%) for different methods.

that the developed small area estimation method (EBP) for skewed data is efficient than the existing methods (MBDE and SYN). In Figure, it is seen that there is a considerable gain in precision in small area estimates produced by applying developed EBP method as compared to MBDE and SYN.

Assessment of quantitative harvest and post harvest losses of major crops/commodities in India

A national level study was undertaken by ICAR-CIPHET, Ludhiana and ICAR-IASRI to make a quantitative assessment of harvest and post harvest losses for 45 agricultural produces in the country. In this study, a previously developed methodology for conducting large scale survey for estimation of

quantitative harvest and post harvest losses of major crops/commodities in the country was applied. The sampling design used for selection of respondents was stratified multistage random sampling. A large scale field data collection was carried out in 120 districts considered under the study. An updated version of enquiry-based and observation-based data entry software was developed. Subsequently, data entry operation was carried out and further cross checked, scrutinized and randomly validated. Finally, data of 107 districts covering harvesting, collection, sorting/grading, threshing, winnowing, drying, packaging and transportation as well as storage loss at household, warehouse/cold stores, wholesaler, retailer and processing unit level were analyzed by developing codes in Statistical Analysis System (SAS) software. The estimates of percentage loss of different crops and commodities at National level as well as Agro-climatic zones level were obtained along with their percentage standard errors. The estimates of operation-wise percentage loss as well as over all percentage loss were found reliable. The average range of losses altogether for food grains, oilseeds and fruits and vegetables were found to be 4.65% to 15.88%, which indicate that overall losses have gone down by about 2% as compared to previous study in 2005-2007 despite tremendous increase of production in last 10 years. Statistical testing for differences between losses during 2013-14 *vis-à-vis* 2005-2007 reveals that the losses during 2013-2014 reduced significantly for wheat, mustard, groundnut, mango, guava, mushroom, tapioca, arecanut, black pepper and coriander. Whereas, the estimated losses significantly increased during 2013-14 for maize, sorghum, chickpea, soybean, sunflower, citrus, sapota, cauliflower, cashew, marine fish, meat and poultry meat.

Pilot study for estimation of seed, feed and wastage ratios of major food grains

A netting factor of 12.5 percent as the ratios of seed, feed and wastage in the total production of food grain crops is being accounted since 1950's in the country. But due to adoption of high yielding varieties of seeds, use of modern agricultural implements for harvesting of the crops and availability of better facilities for storage, these ratios should be on lower side. Therefore, a need was felt to conduct a pilot study for revising these ratios as such to find the net availability of food grain production to the human population in the country. The aim of the study was to collect reliable information by way of primary data collection on seed, feed and wastage of food grains with the main objectives; to estimate the quantity

of seed and feed used in food grains production, to estimate wastage at harvest and post harvest stages of food grains production, and to estimate seed, feed and wastage ratios in food grains production and net availability of food grains for human consumption.

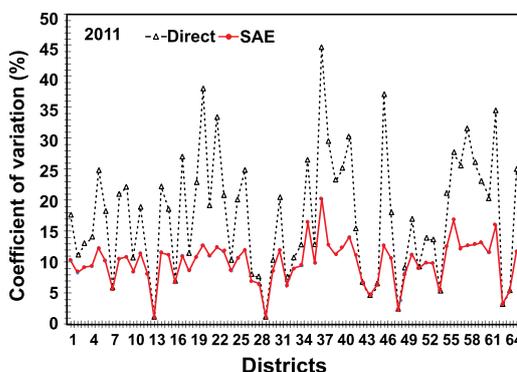
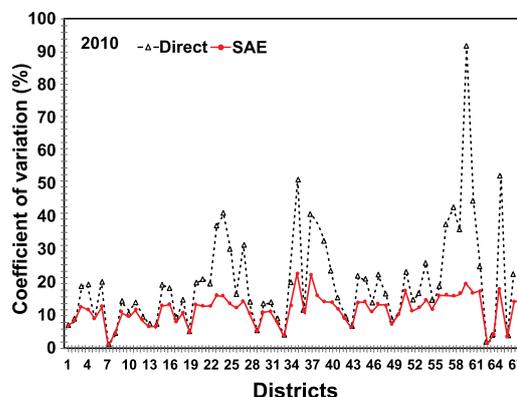
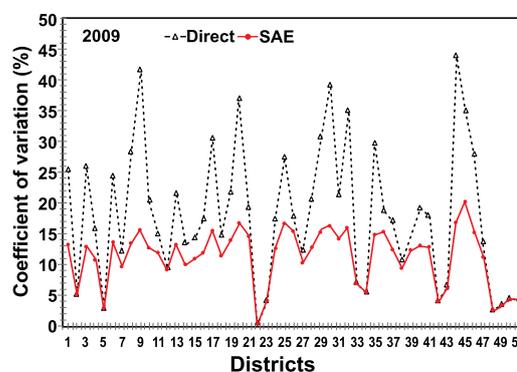
The data collection work was done for 4 States namely; Karnataka, Madhya Pradesh, Rajasthan and Uttar Pradesh for the Agricultural Year 2013-14. The randomly selected districts were Barabanki, Bareilly, Bulandshahr and Varanasi in Uttar Pradesh, Jabalpur, Bhopal, Indore and Ujjain in Madhya Pradesh, Bharatpur, Jodhpur, Chittorgarh and Sikar in Rajasthan and Belgaum, Tumkur, Bijapur and Haveri in Karnataka pertaining to kharif and rabi season 2013-14.

The data entry software in MS Access was developed and the data pertaining to kharif and rabi season 2013-14 of all the four states have been transferred to digital form. Estimation procedure was finalized and SAS codes were developed for statistical analysis of the data. The provisional estimates of yield, seed used, live stock feed and wastages (kg/ha) together with percent standard errors of major food grain crops grown in kharif season 2013-14 in the randomly selected districts of the states of Rajasthan, MP, Karnataka and UP were worked out and submitted to the funding agency. The provisional estimates of ratios of seed used, live stock feed and wastages to the yield of major food grain crops grown in kharif season 2013-14 were also submitted to the funding agency.

Development of innovative approaches for small area estimation of crop yield, socio-economic and food insecurity parameters

Sample surveys are generally planned to produce reliable estimates of averages and other parameters at national and large domain levels. Sample sizes are fixed in such a way that direct estimators (calculated using only domain-specific sample data) of parameters of these planned domains provide reliable estimates. However, estimates are often needed for many unplanned small domains or small areas. When sample sizes for these unplanned small domains or small areas are too small to support reliable direct estimators, small area estimation (SAE) methods that ‘borrow strength’ via statistical models can be used. SAE method was applied to produce district level estimates of crop yield for wheat in the State of Uttar Pradesh using the data on Crop Cutting Experiments (CCE) supervised

under Improvement of Crop Statistics Scheme (ICS) collected by National Sample Survey Office (NSSO) and the secondary data from Population Census and Fertilizer Statistics. ICS data for the year 2009, 2010 and 2011 was used for this analysis. District wise direct survey estimates were produced and estimates of associated standard error and per cent coefficient of variation (CV) of wheat crop for the year 2009, 2010 and 2011 were then used. Set of selected suitable auxiliary information from Population Census and Fertilizer Statistics was worked out for fitting small area models. Subsequently, SAE technique was employed to generate reliable district-wise crop yield estimate and per cent CV for both sample and non-sample districts. It is noteworthy that SAE provide



District-wise coefficient of variation (%) for Direct and SAE method for sample districts in the year 2009, 2010 and 2011.

estimates for those districts where there is no sample information under ICS and so direct estimates cannot be computed. Further, estimates generated by using SAE approach have smaller values of per cent CV as compared to direct estimates (see Figure). This clearly indicates that the SAE technique can be satisfactorily applied to produce reliable district level estimates of crop yield using CCE supervised under ICS scheme.

Calibration estimators under two stage sampling design when study variable is inversely related to auxiliary variable

In survey sampling, situation arises that available auxiliary variable is inversely related to the study variable. Calibration is a well-known approach to make better use of auxiliary information. Work related to calibration approach are restricted to only uni-stage sampling designs. But, medium to large scale surveys are mostly based on two stage and multistage sampling design.

Several calibration based product type estimators are proposed for estimation of finite population total using calibration approach under two stage sampling design when auxiliary variable is inversely related to study variable. As per availability of complex auxiliary information (Särndal et al., 1992), different cases under two stage sampling design have been considered to develop different calibration based product type estimators such as

Case A: Population level complete auxiliary information is available at the fsu level.

Case B: Population level complete auxiliary information is available at the ssu level for all the fsus in the population.

Case C: Population level auxiliary information is available only for the selected fsus.

In all the cases, design weights under two stage sampling designs were calibrated using available auxiliary information at different stages. Further, following Deville and Särndal (1992), Särndal et al. (1992), the approximate variance and the Yates-Grundy form of estimate of variance of all the proposed calibration based product type estimators are also obtained.

Planning of technical details for simulation studies for empirical evaluation of developed calibration based product type estimators under Objective-I is under process and SAS codes shall be written for the same.

Study to test the developed alternative methodology for estimation of area and production of horticultural crops: ICAR-IASRI component of CHAMAN project under MIDH

The Coordinated Programme on Horticulture Assessment and Management using GeoInformatics (CHAMAN) under Mission for Integrated Development of Horticulture (MIDH) was launched by Secretary (A&C) on 16th September, 2014 in a National Workshop held at NASC Complex, New Delhi. Under this study, the developed alternative sampling methodology for estimation of area and production of horticultural crops in the previous study undertaken by IASRI, will be tested in six states before its implementation in all the states of the country. The methodology will be tested using the sampling design and estimation procedures proposed in the previous study with a few modifications such as (i) Modification in sampling design and (ii) Use of domain estimation technique in estimation procedure etc. An attempt will also be made to explore the possibility of utilizing Personal Digital Assistant (PDAs)/Tabs for collection/uploading of data in one district in each of the six states proposed under study. The validation of estimates of area under important fruits and vegetables using Remote sensing techniques will also be done under this study and for this, only one district in each of the six states will be taken up on pilot basis.

The district-wise data of area and production of horticulture crops of the five states namely, Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat and Himachal Pradesh for the year 2012-2013 and of Maharashtra for the year 2011-2012 was obtained from Division of Horticulture, DAC. The proposed sampling design to be adopted for the survey is stratified multistage random sampling. On the basis of obtained district-wise area figures under fruits and vegetables of the State, first of all, all the districts of a State have been stratified into two strata i.e. high productive districts covering about 70-80% of the total area under fruits and vegetables in the entire State and low productive districts i.e. rest of the districts of the State. From stratum one, about 40% districts out of the total number of districts and two districts from stratum two have been selected by simple random sampling without replacement (SRSWOR). The selection of districts for the survey has been completed for all the six states.

An attempt is being made to customize "Survey Solutions: CAPI (Computer Assisted Personal Interviewing) Software" developed by World Bank team in collaboration with Food and Agriculture

Organization of United Nations, for our purpose with the help of World Bank officials and set up and configure an in-house server for the CAPI software so that the data from the field can be uploaded by the Field Investigators to IASRI server dedicated for this purpose.

Robust and efficient small area estimation methods for agricultural and socio-economic surveys and their application in indo-gangetic plain

Survey data often contain measurements for variables that are semicontinuous in nature, i.e. they either take a single fixed value (we assume this is zero) or they have a continuous, often skewed, distribution on the positive real line. Standard methods for small area estimation (SAE) based on the use of linear mixed models can be inefficient for such variables. SAE techniques for semicontinuous variables under a two part random effects model that allows for the presence of excess zeros as well as the skewed nature of the non-zero values of the response variable is studied. In particular, the excess zeros are first modeled via a generalized linear mixed model fitted to the probability of a non-zero, i.e. strictly positive, value being observed, and then model the response, given that it is strictly positive, using a linear mixed model fitted on the logarithmic scale. Empirical results suggest that the proposed method lead to efficient small area estimates for semicontinuous data of this type. A parametric bootstrap method is proposed to estimate the MSE of the proposed small area estimator. These bootstrap estimates of the MSE are compared to the true MSE in a simulation study.

Method of sampling of imported fertilizers from ships/containers

A Technical Sub-Committee, on Sampling Procedure of imported fertilizers from ships/containers under the Chairmanship of Director, ICAR-Indian Agricultural Statistics Research Institute (ICAR-IASRI), New Delhi, was constituted in the First Meeting of the Technical Committee held on 29.10.2013 under the Chairmanship of Deputy Director General (NRM), ICAR, New Delhi to examine the methods of sampling and analysis. The purpose of constitution of this Sub-Committee was to study the existing methods of sampling of imported fertilizers from ships/containers and recommend the changes in the methods of sampling being followed as per the prescribed procedure in the Fertilizer Control Order (FCO), Govt. of India, if required. The final report of

the Sub-Committee was prepared and the report was discussed with the Chairman of the Sub-Committee. The final report was discussed in the Third meeting of the Sub-Committee held on 23.04.14 at ICAR-IASRI. After incorporating the suggestions of the Committee the revised final report will be submitted to Technical Committee for examining the methods of sampling and analysis shortly.

The suggestions as per the third meeting of the Sub-Committee on Sampling Procedure of imported fertilizers from ships/containers under the Chairmanship of Dr. U.C. Sud, Director, ICAR-IASRI held on 23.04.14 at ICAR-IASRI were incorporated in the report. After incorporating the suggestions the revised final draft report was submitted to the Technical Committee for examining the methods of sampling and analysis.

The submitted report was discussed at length in the third meeting of the Technical Committee held on 28.05.2014 under the Chairmanship of Deputy Director General (NRM), ICAR, New Delhi. The minutes of the meeting of the Technical Committee for examining the methods of sampling and analysis of imported fertilizers from ships/containers held on 28.05.2014 under the Chairmanship of Deputy Director General (NRM), ICAR, New Delhi has been received and being looked into for its finalization. The minutes of the meeting of the Technical Committee for examining the methods of sampling and analysis of imported fertilizers from ships/containers held on 28.05.2014 under the Chairmanship of Deputy Director General (NRM), ICAR, New Delhi was looked into critically and finalized.

Agricultural Research Data Book (ARDB)

Information pertaining to agricultural research, education and related aspects available from different sources is scattered over various types of published and unpublished records. This Agricultural Research Data Book (ARDB) 2014, which is the Seventeenth in the series, is an attempt to put together main components/indicators of such information. The Data Book comprising 155 Tables, is organized, for the purpose of convenience of the users, into ten sections namely, Natural Resources; Agricultural Inputs; Animal Husbandry, Dairying and Fisheries; Horticulture; Production and Productivity; Agricultural Engineering & Produce Management; Export & Import; India's Position in World Agriculture; Investment in Agricultural Research & Education; and Human Resources under National Agricultural Research and Education System (NARES). This edition contains the latest information / data as

available in the country by the end of June, 2014. In ARDB 2014, some value additions like predicting the future year production of food grain crops etc., based on previous years data using statistical models, pictorial/graphical representations of data have been done. For depicting state-wise data, thematic maps have been prepared using Geographical Information System (GIS). Efforts have been made to incorporate the comments and suggestions received from various users. The first ARDB was brought out in the year 1996. Subsequently, this was updated and brought out in the years 1997, 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011, 2012 and 2013 (Sixteenth edition).

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

Statistical approach for prediction of eukaryotic splice sites

A new approach for finding associations among nucleotides is proposed and is applied on the true and false splice site separately, by considering splice site of length 20 base pair. From the heat map of true and false sites it is observed that the association surrounding the splice junction exists in case of true and no such association is present in case of false splice site. By observing this difference, the window size is determined as 9 base pair length (3bp at exon end and 6bp at intron start excluding conserved GT at the beginning of intron). After determining the window size, an approach based on nucleotide dependencies is proposed for the classification true and false 5' splice sites in vertebrate genome. In the proposed approach, the true and false data set are divided into 10 non-overlapping subsets. In each fold, nine sets are used to determine a threshold value and the test instances are classified based on this threshold. Finally, a threshold value of -7.61 is obtained by taking average over all the 10-fold which is used for final prediction. This approach is also tested with other window sizes surrounding splice junction. It is observed that the window size of 9bp length is most appropriate for the prediction of donor splice site. The performance of this approach is also assessed with imbalanced dataset in terms of estimate of area under ROC curve (AUC) and found that the AUC in 10-fold is invariant to the presence of imbalanced-ness in the dataset. The performance of the proposed approach is also compared with existing approaches i.e., MEM, MDD, WMM and

MM1 in terms of AUC and is found to perform better than these approaches. Based on the proposed approach, a web application was developed to predict the donor splice sites in vertebrates and is available at <http://cabgrid.res.in:8080/sspred/>.

Estimation of heritability under correlated errors

SAS codes for data generation as well as heritability estimation for different correlation structure of errors (AR(1) and AR(2)) in case of half sib model have been developed. Estimates of heritability and means square error (MSE) are obtained for heritabilities (0.1, 0.25 and 0.5), for different sample sizes (100, 200, 500, 1000) and different correlations values ranging from -1 to +1. It has been observed that if correlation increase from -1 to 0 by 0.1 interval the MSE are decreasing but if correlation increase from 0 to +1 by 0.1 interval the MSE are increasing. In case of AR(2) fixing one error if the other error is changed, the same trend is obtained. SAS codes for data generation as well as heritability estimation for different correlation structure of errors (AR(1) and AR(2)) in case of full sib model have been developed.

Estimation of breeding value using longitudinal data

An attempt has been made to derive the joint and conditional distributions of response variable and sire effects under correlated sire and error structures. For this purpose initially the log likelihood function based on the observed data and the latent data has been derived theoretically. Subsequently, a theoretic expression for the Q-function which is the conditional expectation of the complete data likelihood function given the observed data and the current estimate has been derived. The derivation of Q-function leads to the completion of E-step of ECM algorithm. Also the derivation of theoretical expression for conditional maximization (CM) steps has been derived.

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

The raw micro-array data for rice and soybean under different abiotic stress conditions were pre-processed by using RMA algorithm implemented in R software. The probes which are expected to have some role in stress were identified by using a three stage filtering process from the pool of probes. Then the selected probe ids were matched to the respective gene id by using available database. Further, the modeling of transcriptional regulatory networks was done by directly taking micro-array

values as gene expression values. The regulatory networks were constructed by using value of the regulatory strengths and the obtained results were validated by using published literature and available database. For time-series gene expression experiment, a feature (gene) selection criteria was developed by using support vector machine and mutual information based algorithms.

National Agricultural Bioinformatics Grid in ICAR

The National Agricultural Bioinformatics Grid (NABG) has five domain institutions i.e. NBPGR, New Delhi, NBAGR, Karnal, NBFGR Lucknow, NBAIM Mau and NBAII, Bangalore. During the period under report following major research activities have been taken up:

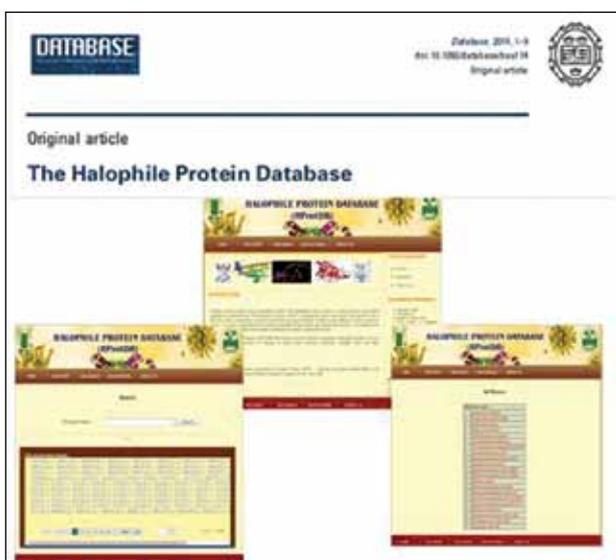
The halophile protein database

Halophilic archaea/bacteria adapt to different salt concentration, namely extreme, moderate and low. These type of adaptations may occur as a result of modification of protein structure and other changes in different cell organelles. Thus proteins may play an important role in the adaptation of halophilic archaea/bacteria to saline conditions. The Halophile protein database (HProtDB) is a systematic attempt to document the biochemical and biophysical properties of proteins from halophilic archaea/bacteria which may be involved in adaptation of these organisms to saline conditions. In this database, various physicochemical properties such as molecular weight, theoretical pI, amino acid composition, atomic composition, estimated half-life, instability index, aliphatic index and grand average of hydropathicity (Gravy) have been listed. These physicochemical properties play an important role

in identifying the protein structure, bonding pattern and function of the specific proteins. This database is comprehensive, manually curated, non-redundant catalogue of proteins. The database currently contains 59 897 proteins properties extracted from 21 different strains of halophilic archaea/bacteria. The database can be accessed through link (<http://webapp.cabgrid.res.in/protein/>).

BIS-Goat: Breed Identification Server for Goat with locus minimization

Molecular markers, viz. microsatellites and single nucleotide polymorphisms, have revolutionized breed identification through the use of small samples of biological tissue or germplasm, such as blood, carcass samples, embryos, ova and semen, that show no evident phenotype. Classical tools of molecular data analysis for breed identification have limitations, such as the unavailability of referral breed data, causing increased cost of collection each time, compromised computational accuracy and complexity of the methodology used. The successful use of an artificial neural network (ANN) in background is reported here to decrease the cost of genotyping by locus minimization. The webserver is freely accessible (<http://nabg.iasri.res.in/bisgoat>) to the research community. It is demonstrated that the machine learning (ANN) approach for breed identification is capable of multifold advantages such as locus minimization, leading to a drastic reduction in cost, and web availability of reference breed data, alleviating the need for repeated genotyping each time one investigates the identity of an unknown breed. To develop this model web implementation based on ANN, 51 850 samples of allelic data of microsatellite-marker-based DNA fingerprinting on 25 loci covering 22 registered goat breeds of India for training. Minimizing loci to up to nine loci through the use of a multilayer perceptron model, were used 96.63% training accuracy was achieved. This server can be an indispensable tool for identification



of existing breeds and new synthetic commercial breeds, leading to protection of intellectual property in case of sovereignty and bio-piracy disputes. This server can be widely used as a model for cost reduction by locus minimization for various other flora and fauna in terms of variety, breed and/or line identification, especially in conservation and improvement programs.

SBMDB: First whole genome putative microsatellite DNA marker database of sugar beet for bioenergy and industrial applications

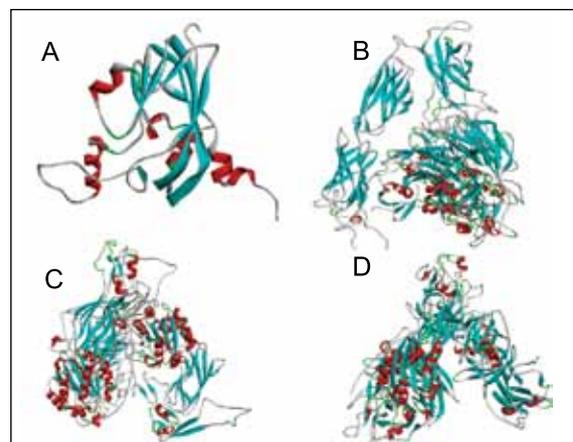


DNA marker plays an important role as valuable tool to increase crop productivity by finding plausible answers to genetic variations and linking the QTL of beneficial trait. Prior approaches in development of STR markers were time consuming and inefficient. Recent methods invoking the development of STR markers using the whole genomic or transcriptomics data has gained wide importance with immense potential in developing breeding and cultivator improvement approaches. Availability of whole genome sequence and *in silico* approaches has revolutionised the bulk marker discovery. The sugarbeet whole genome marker discovery and database, SBMDB (<http://webapp.cabgrid.res.in/sbmdb/>) has been developed with 145K markers unified in a common platform using MySQL, Apache and PHP. The embedded markers and corresponding location information can be selected as per desired chromosome, desired location/ interval and primers can be generated using Primer3 core, integrated at the backend. Analyses revealed abundance of 'mono' repeat (76.82%) over 'di' repeats (13.68%). Highest density (671.05 markers/Mbp) was found in chromosome 1 and lowest density (341.27 markers/Mbp) was in chromosome 6. Current investigation of sugarbeet genome marker density has direct implications in increasing the mapping marker density by > 400 folds. This will enable present linkage map having marker distance of ~2 cM i.e., from 200 Kbp to 2.6 Kbp, thus facilitating QTL/gene mapping.

These markers can be used for DUS test of variety identification and MAS/GAS in variety improvement program. The database presents a wide source for developing and implementing new approaches for molecular breeding, which are required to accelerate industrious use of this crop, especially for sugar, health care products, medicines, and color dye. Identified markers will help in improvement of bioenergy trait of bioethanol and biogas production along with reaping the advantage of crop efficiency in terms of low water and carbon footprint especially in era of climate change.

Docking and molecular dynamic simulations deciphering foot-and-mouth disease (fmd) virus-host tropism

The study was conducted to decipher the interaction of FMD virus VP1 protein and host integrin in susceptible (Bos) and resistant species (Gallus and Canis) through homology modelling, docking and interactional analysis and deduce the effect of this interaction post site directed mutation *in silico*. FMD virus VP1 protein and integrin protein sequences of Bos, Gallus and Canis from PDB were retrieved and used for homology modelling. Models generated using discovery software were screened for Ramachandran plot, Errat and 3D score and models were considered for further docking studies. From post docking, it was deduced that interactions were observed between bos intergin and FMDV VP1 protein at ¹⁴²RRGD¹⁴⁵ region. On the contrary, no such interactions were obtained between the FMD VP1 protein and gallus and canis integrin models. Further, *in silico* site directed mutation of the FMDV VP1 protein RGD domain amino acids to KGD resulted in loss of interaction between FMD VP1 protein and bos integrin. FMDV tropism in susceptible and resistant species and the importance



3D Model of FMD VP21 (A); Bos integrin (B); Gallus integrin (C); Canis integrin (D) Legend: Red: Alpha Helix; Blue: Beta Sheet; White and Green: Coils and Loop.



(VP1- ITGA6) Interactions between FMDVP1 protein. Arginine, Glycine and proline of Virus VP1 is involved in interaction with Leucine, Glycine, Arginine and tyrosine of alpha integrin protein of host *Bos tarus*

of RGD domains for virus recognition and entry was deciphered through docking and interaction analysis *in silico*.

Bio-prospecting of genes and allele mining for abiotic stress tolerance

A databank on “Resources Augmented and Knowledge Generated” has been developed and made available at <http://bioinformatics.iasri.res.in/NAIP4BSR/naipc4/>. This site provides insights into the genetic and genomic resources developed, identified and generated from various sub-projects financed under the NAIP component-IV. Besides, it covers the information on sub-projects, products, publications, patents, protocols developed etc., which could be of long term use to post-graduate students, researchers, research managers, regulatory bodies, policy administrators, and agri-input industry.



Whole genome association analysis in complex diseases

Rheumatoid Arthritis and Ulcerative Colitis are the two common complex diseases in humans. These diseases are largely governed by gene x environment interactions. While assessment of environmental determinants remains a difficult task, identification of genetic components like Single Nucleotide Polymorphisms / genes seems to be more realistic. An approach based on Random Forest (RF) methodology was proposed (combined Random Forest) for the prediction of disease risk from imbalanced case-control data. The proposed approach was compared with the existing methods meant for imbalanced data, namely, Balanced Random Forest (BRF) and Weighted Random Forest (WRF) based on performance metrics, viz., sensitivity, specificity, classification accuracy, and precision. The proposed approach was illustrated using a case-control data set of Rheumatoid arthritis and found to perform better in terms of prediction accuracy over the existing BRF and WRF. Besides, SNPs associated with ulcerative colitis and rheumatoid arthritis diseases were identified at whole genome level by employing Least Absolute Shrinkage and Selection Operator (LASSO), a penalized regression technique. In addition, the disease status of individuals was further predicted by applying machine learning approaches such as LASSO, support vector machine (SVM) and RF. A comparison among the performances of all the three methods showed that the sensitivity, specificity and overall accuracy of RF were highest with values 0.80, 0.59 and 0.70 respectively.

Consensus gene regulatory network for abiotic stress responsive genes in rice

Identification of genes and transcription factors, which are co-expressed in multiple stress response, are important for understanding the underlying gene regulatory network. The 3-C attribute (construction, comparison and consensus) of gene regulatory network in response to abiotic stress conditions was accessed. Meta-analysis of five abiotic stresses response in rice was performed by analyzing a total of 118 microarray samples belonging to 18 microarray studies. Further, for screening of the genes for gene network study differential expression analysis were performed. Total of 1353 genes were differentially expressed in 70% and above of the taken experiments in this study. We observed 0.5, 1.3 % and 3.9% of differentially expressed genes were observed in

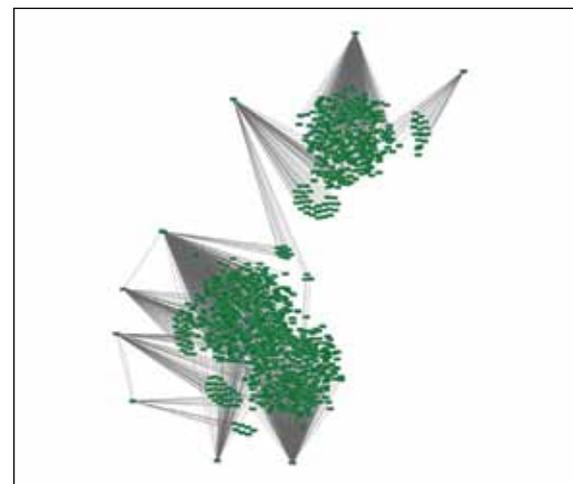
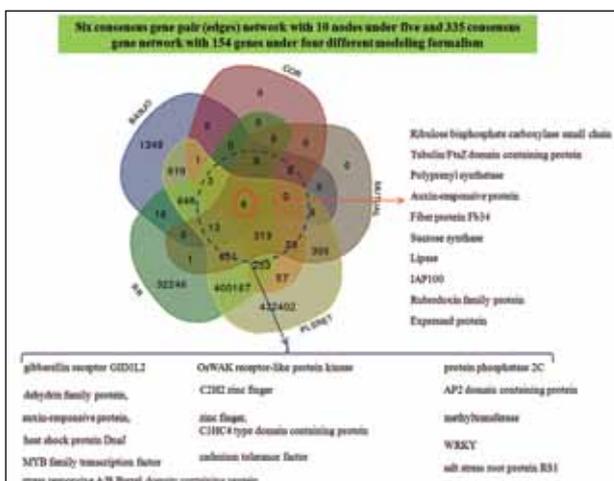
15, 14 and 13 (out of 18) in different abiotic stress related microarray experiments taken in this study. These frequencies of common DEGs conserved expression status in multiple stresses. Therefore, these 1353 genes were subjected for network construction via five different modeling formalism viz. 1) BANJO for bayesian, 2) mutual information, 3) correlation (COR), 4) partial least squares (PLSnet), 5) ridge regression (RR) to compute the connectivity scores and identify the consensus GRN in response to abiotic stress conditions. For fair comparisons, the default parameters were used for each algorithm without additional tuning. Further, to identify the statistically significant gene pair with false discovery rate (FDR) $\leq 0.1\%$; “fdrtool” package of R were utilized. Comparing the network identified from five different modelling formalisms, the set of six consensus gene pair (edges) network with 10 genes under five and 335 consensus gene networks with 154 genes based on DEGs common in different abiotic stresses under four different modelling formalisms were obtained.

Further, the 335 consensus genes network were studied in greater detail. MCL clustering identified multiple modules that show high co-expression and further gene ontology enrichment analysis showed the stress specific modules and hub genes with high connectivity. The gene ontology enrichment analysis clearly demarcated the response and stress, water, lipid transport, oxidation reduction and related biological processes. Several of the hub genes such as Haloacid Dehalogenase (HAD), IAP100, rubredoxin family protein, GPI-anchored protein, ribulose biphosphate carboxylase small chain, inorganic phosphate transporter, core histone H2A/H2B/H3/H4, PTAC16 were highest degree hub nodes. Pathway analysis showed the involvement

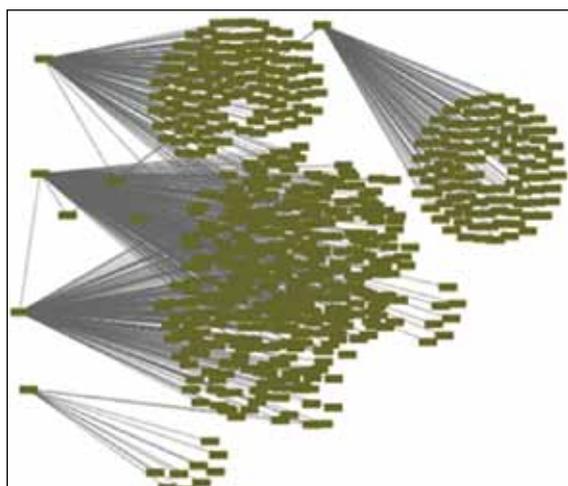
of genes in sucrose, carbohydrate, transport metabolism and Metabolism of terpenoids and polyketides.

Deciphering tissue-specific combinatorial gene regulation under combined drought and salt stress: predicting crosstalk’s in between rice tissues

Tissue regulatory gene networks (TRGNs) with respect to salt and drought were reconstructed and investigated in rice under combined effect of salt and drought stress. Total 196 microarray data sets were downloaded from GEO database in .cel file format. These were log transformed and median centered per array. Array probe sets with expression mean $\mu < 50$ and $\sigma < 0.3\mu$ were measured as non-informative and therefore omitted, leaving 35,254 probe sets for further analysis. This data was further normalized using RMA (Robust Multichip Average) algorithm and was used as subject dataset for network reconstruction using ARACNE (AR), CLR and RN methods. Further, 15 transcription factors were used as “Hub genes” in gene regulatory network inference. A combined stringent cut off of an error tolerance $\epsilon = 0.2$ and a p-value threshold of mutual information (MI) at 0.05 and 100 bootstrap were used as parameter. It was observed that 9 TF’s, highly expressed in leaf tissue, regulates 1225 downstream targets, whereas root specific 6 TF’s were found to target 612 genes in corresponding TGRNs. Network topological analysis suggested that (a) the tissue regulatory network has a property of “small niche”; (b) there is substantial coordination between these niches mediated by common transcription factors. Expression pattern of these dependent TF’s further showed biasness towards contrasting genotypes. Pathway analysis of these



Leaf regulatory gene network involving 9 transcription factor



Root regulatory gene network involving 5 transcription factor

subset of dynamic target genes were found to be involved with the processes such as stomatal closures, photosynthesis, root elongation and wax biosynthesis suggesting their probable role in providing stress tolerance in rice.

Systematic validation of selected transcription factors (TF's) of synergetic regulatory networks mediated by microRNAs and TF's under salinity, heat and drought stress in *Oryza Sativa* spp

TF's knock-down approach has been used for in silico validation of developed network that mimics in-vitro knockdown experiment. The 10 TF's (Nuclear transcription factor Y subunit A-10, ADO3/flavin-binding, AGL16, OsFBDUF57, OsNAC5, bZIP, OsMYB, ARF2, ARF8, SPL2) out of 11 TF's were

used for validation. Each of the TF's was knockdown one by one systematically at the time of modelling network by removing the expression values of the concerned TF. Construction of the perturbed network was performed using reduced adjacency matrix resulted in reduced network for each of the knocked TF with less number of targets. Given a perturbed constructed network and a list of target genes significantly affected by a specific knock-down of TF concerned, the descendants of the knock-downed TF were classified in the perturbed network. In this case, each of these descendants was named as true positive (TP), as false positive (FP) if it was not affected by the perturbation, and finally a gene was affected by the knock-down experiment but it was not inferred as a descendant in the network, it was named as false negative (FN). This classification then allowed to compute a quality measure such as the F-score for the perturbed network.

$$F = \frac{2TP}{ATP+FP+FN} ; F \in [0, 1]$$

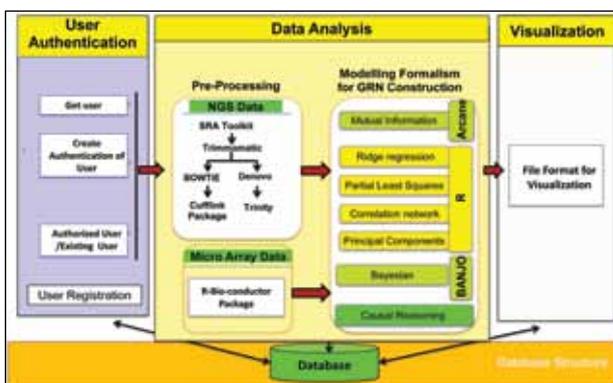
where, F = 1 corresponds to the perfect classification of the affected genes and F = 0 to no correctly identified affected genes. It was found that the F value ranges between 0.61 to 0.76 and on an average each perturbed network fit with score of 0.70. This indicates that the constructed network had correctly identified the effected target genes governed by each of the 10 TF's with an accuracy of 70%.

The quality measurement of the constructed network for 11 TF's used

Transcription Factor's	Total Number of Targets under knock down condition	Total Number of Targets (Control condition)	TP	FP	FN	F-Score
ADO3/flavin-binding	129	133	129	100	29	0.66
AGL16 | AGAMOUS-like 16	104	133	104	36	60	0.68
OsFBDUF57	120	133	120	49	32	0.75
OsNAC5	115	133	115	95	38	0.63
bZIP transcription factor family	102	133	102	87	46	0.61
OsMYB	107	133	107	59	74	0.62
ARF2	121	133	121	73	58	0.65
ARF8	110	133	110	64	32	0.70
SPL2	113	133	113	44	58	0.69
WRKY family transcription factor	128	133	128	61	58	0.76

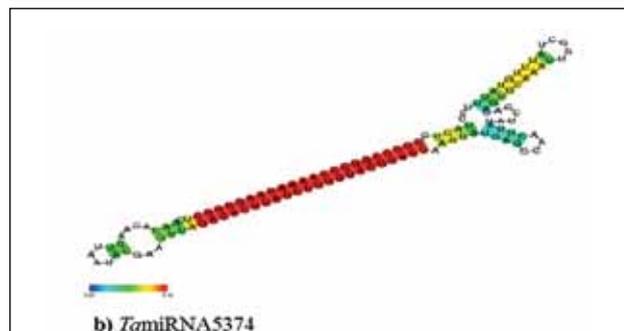
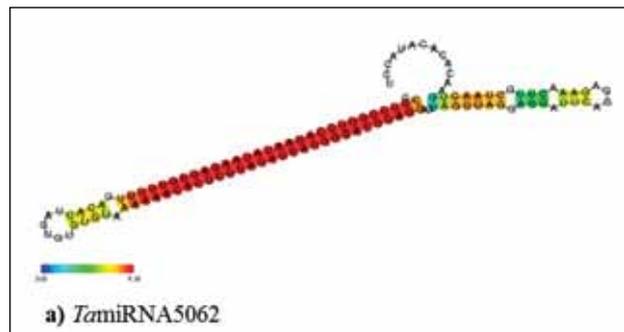
Web based tool for modeling Gene Regulatory Network (GRN)

This online tool facilitates pre-processing Next Generation Sequencing (NGS)/ microarray data, constructing GRN via different modeling formalisms and visualization of network. The program computes gene expression from microarray and NGS data, which can be used further for reconstruction of regulatory networks and thereby subjected to visualization. This tool has three modules a) User Authentication- where users can register and upload all relevant data/information. Majorly, it contains file and project management system. It supports upload of data files types, .sra, .fasta, .fastq, .fna, or reference genome. b) Data Analysis: this module support all pre-processing for NGS and micro array data and reconstruction of gene regulatory network models and c) Visualization of network. A pipeline for pre-processing NGS data with the available tools have been developed and five methods of modeling regulatory network have been integrated. Following tools has been used in the pre-processing pipeline: a) SRA Toolkit for converting gene expression data file in SRA format to FASTQ format, b) Trimmomatic for quality check and initial pre-processing, c) Bowtie-Cufflink packages for reference based assembly and d) SoapDenovo-Trinity packages for denovo assembly. Open source software package Java programming language, Perl and R has been used for development.

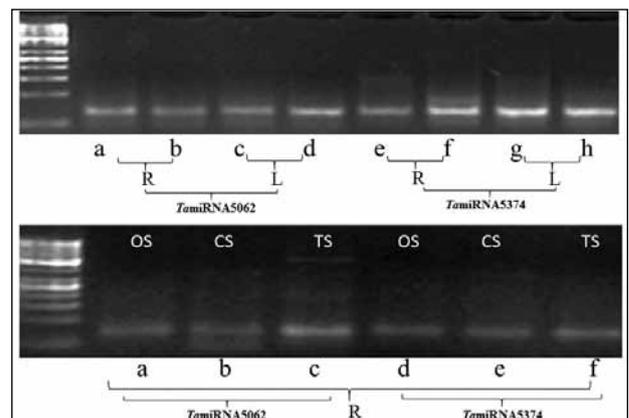


A new distributed computing framework for data mining

MicroRNAs (miRNAs) are the key modulators of target gene regulation involved in different metabolism. Bread wheat (*Triticum aestivum*) is a hexaploid species with A, B, and D ancestral genomes. To date, only a few conserved miRNAs have been predicted in wheat. Here total ESTs 12, 87,279 were examined from NCBI to identify novel miRNAs and their target genes from wheat draft genome. 262 pre-miRNA candidates were predicted and 39 novel mature miRNA's targeting over 22,468 target genes across 21 chromosomes. Gene ontology (GO) analysis of the target genes showed enriched activity related to nitrogen, starch, sucrose, glucan and fructan biosynthesis process. Two novel miRNA's were verified by stem loop pulsed RT-PCR for their expression in root and leaf tissue under nitrogen starvation.



Structure of two top ranking miRNA's among 39 miRNAs identified from wheat EST database a) TamiRNA5062 and b) TamiRNA5374

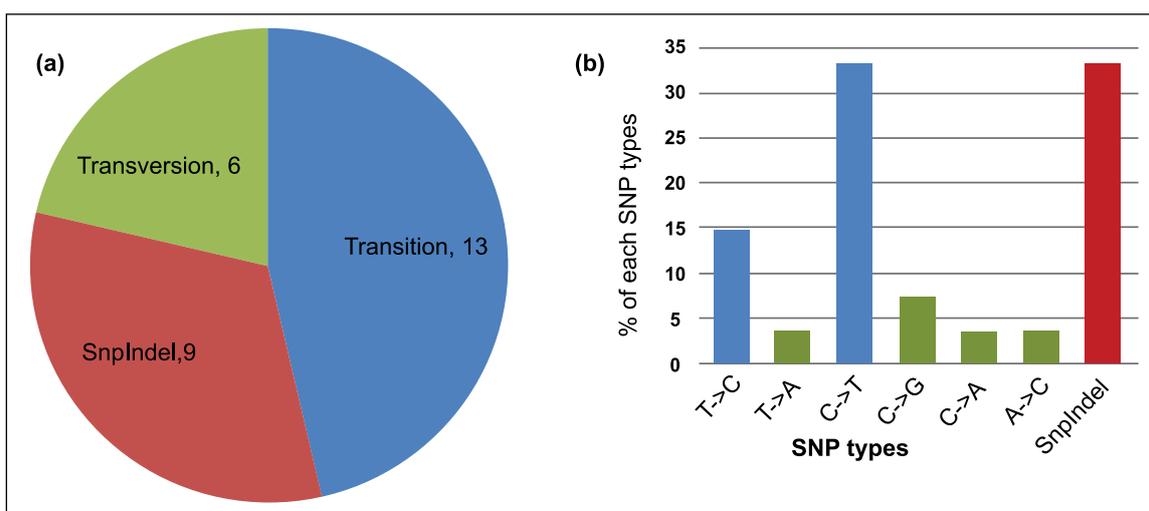


Detection of novel micro RNA identified by Stem-loop pulsed reverse transcription followed by End-point PCR. Plants were grown hydroponically in modified MS medium (no N source) containing 4mM and 0.04mM NO₃ - . A: Small RNA isolated from both root and shoot sample grown under optimum and starved NO₃ - condition for 15 days (chronic). TamiR1 was detected in both root (R) (a-b) and leaf (L) (c-d) tissues. Similarly TamiR2 was also detected in both root (R) (e-f) and leaf (L) (g-h) tissues. B: Small RNA isolated from root sample grown under optimum (O) (15 days) and starved NO₃ - condition for chronic (C) (15 days) and transient (T) (24 hrs). TamiR1 was detected in root tissues optimally (O) (a) and chronically (C) (b) and transiently (T) (c) starved condition. Similarly TamiR2 was also detected in root tissues optimally (O) (d) and chronically(C) (e) and transiently (T) (f) starved condition.

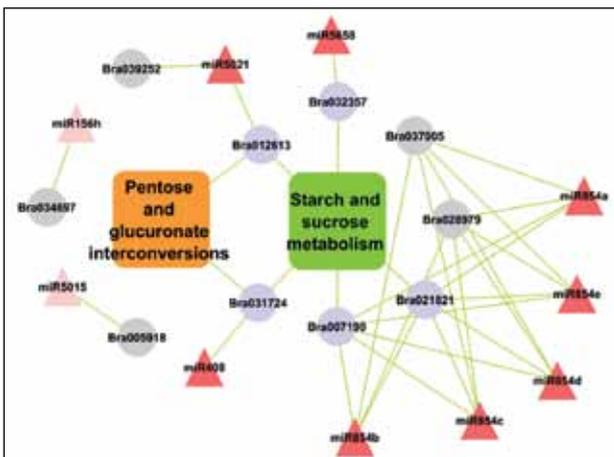
Potential abiotic stress specific miR-markers and their miRNA-target regulatory network in Brassica juncea: An insight for marker assisted breeding

Abiotic stress, especially during seedling and flowering stage, is one of the major factors responsible for huge yield losses in *Brassica juncea*. MicroRNA plays a key role in adaptive responses of the plants towards abiotic stress conditions through post transcriptional gene regulation. In the present study, 14 potential miRNAs were predicted in *Brassica juncea* using comparative genomics

approach. It was found that these miRNAs targeted several transcription factors, transporter family proteins, ATP synthase, kinase, protease, etc. Also, Gene Ontology enrichment analysis of target genes showed their significant involvement in regulation of transcription, response to stimulus, transcription factor activity etc. The sucrose-starch metabolism and pentose-gluconate interconversion pathways were found to be significantly enriched. These GO terms and KEGG pathways indicated their functional role in abiotic stress responses. For the first time, miR-markers (molecular markers on miRNA) i.e. Simple Sequence Repeats (miR-SSR) and Single Nucleotide Polymorphism (miR-SNP) were identified in *B. juncea*. Similarly, molecular markers were also identified on target genes of these miRNA. This analysis resulted in 7 miR-SSRs and 28 miR-SNPs on 6 and 2 miRNA respectively. Noticeably, one of the miR-SNP (C/T) at the 5th position from the 5' end was found on the mature region of miR2926. This C/T transition led to the distorted and unstable hairpin structure of miR2926 consequently there was complete loss of its function. Furthermore, miRNA regulatory networks were explored for their target co-operative and multiplicity behaviour. In this, 10 distinct miRNA regulatory networks were found. Out of this, three networks pertain to miR2926, miR408, miR3434. These were found to be related with heat stress. The findings of this study will lay foundation for marker assisted breeding for abiotic stress tolerant varieties of *B. juncea*.



Single nucleotide polymorphism (SNP) (a) frequency and (b) nucleotide variation on miRNA precursor sequences of in *B. juncea*.



Relationship of miRNAs and target genes in starch-sucrose pathway and pentose and glucuronate interconversions in *B. juncea*. Nodes in red colours are miRNAs; rectangular boxes are pathways and in purple are target genes significantly enriched. Additions of nodes in gray colour are with “glycosyl related terms”.

Buffalo Genome Information Resource

Epigenetics refers to the changes in gene expression that do not involve changes in the DNA sequence. This concept implies that, once established, a new genetic state can be stably propagated through mitosis or meiosis independently of the inducible signal, yet can still revert to its original state. The information related to the epigenetic mechanisms in livestock species is not available at one place. Moreover, analysis of epigenetic information is required for improvement in production traits and controlling diseases in livestock.

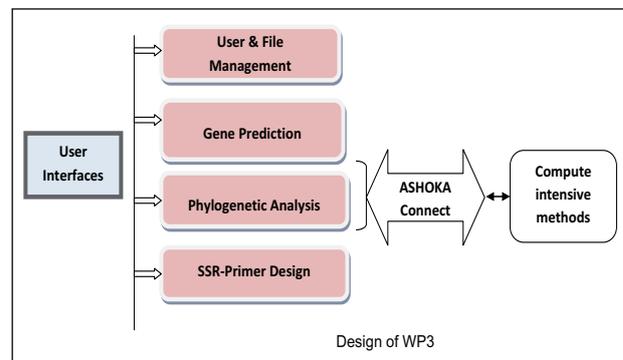


A web-based “Livestock Epigenetic Information System” has been developed (<http://bioinformatics.iasri.res.in/edil/>) with MySQL database as bottom layer, PHP as server side application-middle layer and HTML, CSS and JavaScript at top layer.

Parallelized workflows for gene prediction, phylogenetic analysis and primer designing

The workflows make use of these tools in the form of a pipeline and run on a high performance computing (HPC) systems for efficient and faster results. A web based software (WP3) has been developed for carrying out phylogenetic analysis, simple sequence repeat (SSR) to primer design and expressed sequence tag (EST) to gene prediction. WP3 has been developed for web platform using Java Server Pages (JSP), Cascading Style Sheets (CSS) and Java programming language. HPC usually breaks problems into pieces, works on those pieces at the same time and then combining the results later on to produce final output.

The design of WP3 has been shown in the figure that schematically shows the modules developed under the software. A separate library has been developed for connectivity to the ASHOKA supercomputing platform and the computations thereon. These are developed as reusable components that can be utilized in other Java based applications of various types like windows, web application and web services. A separate location was allocated to the MPI-BLAST database and Blast2Go database.



Design of WP3

WP3 is web based software that is freely accessible to users. User authentication is needed to ensure security. WP3 is accessible only after entering valid user name and password. For getting user name and password, any user may signup by clicking on appropriate link on home page. The home page has links in the form of horizontal menu bar which has links for “Home”, “About”, “File Handling”, “Workflows”, “Help”, “Feedback” and “Contact Us”. The links “About”, “File Handling” and “Workflows” have submenus too. File Handling has links for “Upload File”, Delete File”, “My Files”, “Download Files” and “Data Download”. User management module of the software provides the facilities of creating a new user, changing and retrieving user password and input data handling. Input data handling module has

been designed and developed for reading data for computation in WP3. Client is required to upload the input data in 'fasta' format or can also paste or enter the data on the text box provided in each workflow.



Home page of WP3

Phylogenetic analysis: This workflow development includes connection of bioinformatics tools – MPIBLAST, CLUSTALW and PHYLIP. These tools have been connected by developing a web interface which also have facility to specify the parameter settings for all the tools. The final result is provided to the user on the browser window with a link for downloading it on the client's machine. A parser program has been developed for parsing results of MPI-BLAST tools. The tools available for running on parallel architecture has been utilized. The job submitted to a tool on ASHOKA sends the output back to the server which is then shown to the client's browser window. The steps for selection of MPI-Blast program and its parameter, blast parser options and options for multiple sequence alignment have been provided. The user is provided with the option of selecting number of nodes and process per node for specifying cluster parameter. After completion of this process, the option to view the result on the browser or download to the local drive for viewing later is provided.



Phylogenetic analysis screen

SSR primer design: This workflow includes connection of bioinformatics tools / programs – Degenerate bases, MISA and PRIMER3. These tools are available on open domain web sites / as a bio-library. These tools have been connected by developing a web interface which also has facility to specify the parameter settings for all the tools. The final result is provided to the user on the browser window with a link for downloading it on the client's machine. In this workflow the steps for selection of degenerate bases and its parameters, MISA program options and options for primer design program (Primer3) have been provided.



Snapshot of SSR primer design screen

Gene prediction: This workflow includes connection of bioinformatics tools – Seqclean/ Seqtrim, RepeatMasker, CAP3 and FGENESH. The tools available for running on parallel architecture have been utilized.

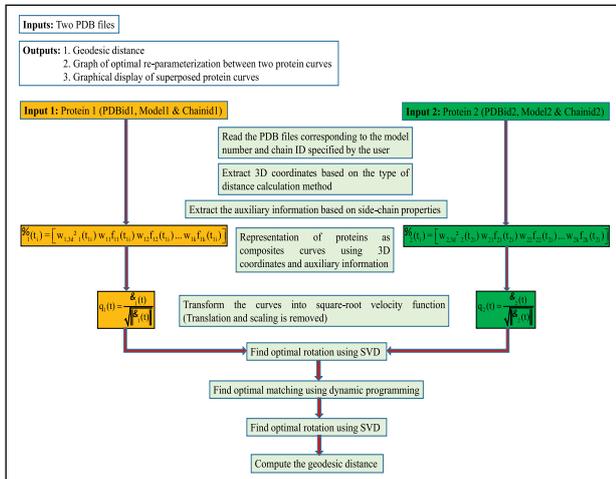


Gene prediction workflow screen

Methodology for protein structure comparison and its web implementation

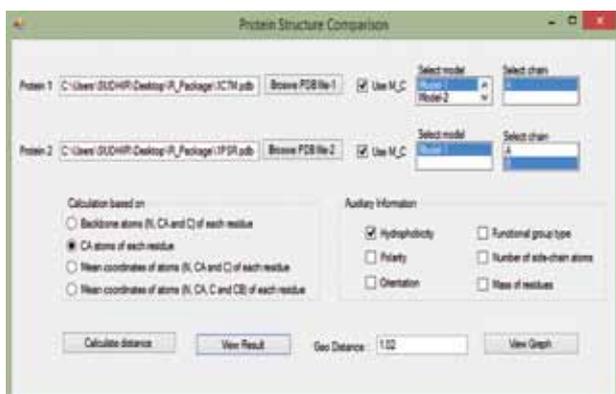
Protein structure comparison (PSC) is an important task for understanding the evolutionary relationships among proteins, predicting structure and function of proteins. Structures are compared to find homologous proteins for their functional classification and for the discovery of structural motifs. Various methods have been proposed for comparing protein structures, each method optimizing its own scoring scheme. Various technologies and work done under this project are as follows:

Scoring algorithm: An algorithm has been developed for PSC using different distance calculation criteria and auxiliary information based on side-chain properties. Geodesic distance has been used as the dissimilarity score.

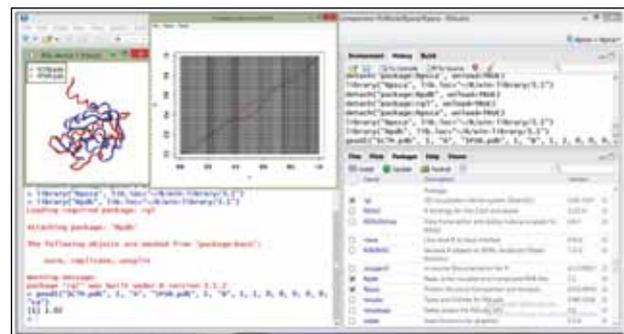


Flowchart of protein structure comparison

Software for protein structure comparison: Standalone software for PSC has been developed in Visual Studio 10 using R. It has a user-friendly graphical user interface allowing the users to compare protein structures using different criteria and auxiliary information. It gives the distance between the protein structures, and graphical display of optimal matching and superposed protein curves.



R-Package for protein structure comparison analysis (Rpsca): A package in R (Rpsca) has been developed and added to R library for use by R programmers. This library is similar to other libraries in R (e.g., Rpdb for reading, writing, visualizing and manipulating PDB files). User can use the various functions and modules for analysis at each step. The distance matrix calculation for a large number of protein structures can be used for cluster analysis and a better score for automatic structural classification of proteins can be developed.

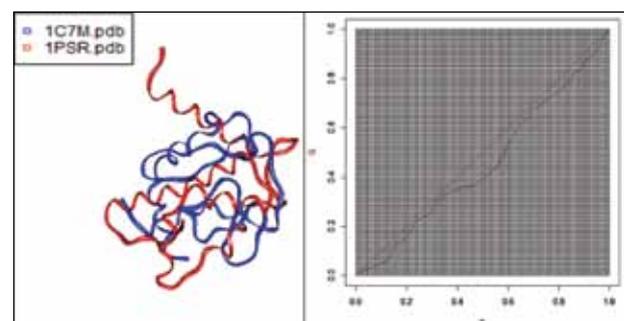


R package showing distance calculation

Software for protein structure comparison (web based): A web-based application has been developed for PSC that can be accessed freely by the users for performing the protein structural analysis. It computes the geodesic distance and also the graphical display of superposition of two protein curves and optimal matching between the curves, e.g., results of comparing two protein structures with PDB ids “1C7M.pdb” (Model 1 and Chain A) and “1PSR.pdb” (Model 1 and Chain B), geodesic distance = 1.02.



Web-interface showing the various input parameters specified by the user for protein structure comparison



Graphical display of superposition of two protein curves (left) and Optimal re-parameterization between the curves (right)

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

Whole genome sequence data of Mangur fish (*Clarias batrachus*) were generated from Roche 454 and Ion Torrent sequencing platforms. NGS data were used to assemble the complete mitogenome. Both de novo and reference based approaches yielded best assembly of mitogenome with 16,510 bp size. The mitogenome annotation resulted in 13 coding genes, 22 tRNA genes, 2 rRNA genes and one control region and the gene order was identical to that of other catfishes. Variation analyses, using *C. batrachus* mitogenome as a reference, revealed 51 variations. The phylogenetic analysis of coding DNA sequences (CDS) and tRNA supports the monophyly of catfishes.

Multilabel functional classification of abiotic stress related proteins in Poaceae

The data used for multilabel classification of proteins was obtained from Uniprot. The data obtained was not sufficient for proteins common to multiple classes such as heat and drought cold and drought, salt and drought, heat, cold, drought and salinity etc. The data was collected from microarray experiments performed on plants belonging to Poaceae. The data was further analysed to obtain differentially expressed genes common to various combination of stresses. For Heat Only, Drought Only, Cold Only, Cold and Drought, Cold and Heat, Drought and Heat, Drought and Salinity, Cold, Heat and Drought, 1003, 8542, 312, 1765, 670, 5329, 347, 3996 sequences were collected respectively. Post translational modification patterns such as Palmitoylation, KEN and D box, Calpain Cleavage sites, Polo like Kinase sites, Pupylation sites, S-Nitrosylation sites, Nitration Sites and Sumoylation were analysed. The physico-chemical properties of these proteins were also deduced and analyzed.

Development of a tool for comparison of protein 3D structure using graph theory

The quantitative comparison of protein 3D structures is an important and fundamental task in structural biology to study evolutionary and structural relatedness with other proteins. This helps biologists to understand various aspects of function, evolution from structures and identify its structural neighbors. Now database of three-dimensional protein structures are becoming large, hence fast and precise search tools and comparison methods are essentially required. Structure comparison may play

a key role in understanding the diversity of structure by analyzing and searching structures to derive interesting scientific insights. Based on literature survey, graph theoretic approach can be used for quantifying 3D protein structure and pair wise comparison. In this view, MATLAB codes have been written for reading PDB files and converting into undirected weighted graph model. The structure of 3D protein contains secondary structure segments like alpha helix, Beta sheet and coil hence there is need to partition the graph to find similarity among partitions. Partitioning the graph using spectral graph partitioning algorithm with eigen value gap and another method Markov CLustering (MCL) algorithm have been employed. Two sets of bench mark data containing 100 and 342 protein structures have been collected and also three standard existing tools (jFATCAT, CE and elastic shape analysis) have been installed to compare with the proposed technique for further analysis. Graph partitions obtained by spectral clusters shows significantly improved result to decipher secondary structure segments and folding information than MCL. MATLAB codes for cluster analysis have been developed for further analysis and comparing 3D structures.

Antimicrobial peptides (AMPs)

Antimicrobial peptides (AMPs) are the defense molecules of the host gaining extensive attention worldwide as these are natural alternative to chemical antibiotics. Machine learning techniques have capabilities to analyze large biological data for detection of hidden pattern in understanding complex underlying biological problems. Presently, development of resistance to chemical antibiotics in cattle is unsolved and growing problem which needs immediate attention. In the present study, attempt was made to apply machine learning algorithms such as Artificial Neuron Network (ANN) and Support Vector Machine (SVM). It was found that performance of SVM based models for in silico prediction/identification of AMPs of cattle is superior to ANN. A total of 99 AMPs related to cattle collected from various databases and published literature were taken for this study. N-terminus residues, C-terminus residues and full sequences were used for model development and identification/ prediction. It was found that best SVM models in this case for C-terminus residues, N-terminus residues and full sequence were with kernels Radial Basis Function (RBF), Sigmoid and RBF with accuracy as 95%, 99% and 97%, respectively. These SVM models were implemented on web server available at <http://cabin.iasri.res.in/amp/> for classification/prediction of



novel AMPs of cattle. This computational server can accelerate novel AMP discovery from whole genome proteins of a given cattle species for bulk discovery with very high accuracy. This is the first successful attempt for development of species specific approach for prediction/classification of AMPs, which may be used further as a model in other species as well.

Programme 5: DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

Strengthening Statistical Computing for NARS

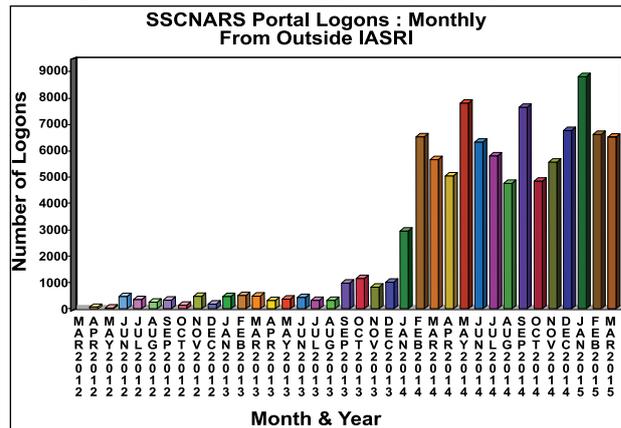
Installation, license files and technical support

License files for 2014-15 were received and uploaded on the Resource Page of the Indian NARS Statistical Computing Portal and all Nodal Officers were informed through E-mail regarding their availability. Technical support regarding installation issues and license renewal, was provided to Nodal Officers/researchers from ICAR-CISH, Lucknow; ICAR-IIVR, Varanasi; ICAR-NDRI, Karnal; ICAR-CSSRI, Karnal; ICAR-DWR, Karnal; ICAR-NBPGR, New Delhi regarding copying the Depot and installation JMP Genomics; ICAR-CIFE, Mumbai; ICAR-CIFT, Kochi; ICAR-CIRG, Makhdoom; ICAR-National Research Center for Banana, Trichy for installation of SAS 9.3 in Windows 8.1; ICAR-IGFRI, Regional Station, Dharwad for getting installation from UAS, Dharwad; Sardarkrushinagar-Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada; IGKV, Raipur; BSKV, Dapoli and N.M. College of Agriculture, Navsari Agricultural University, Navsari. SAS 9.3 TS1M2 installation on one system with OS Window 8.1. A training programme on Installation of SAS and basic concepts on use of SAS was provided to two scientists from ICAR-National Institute of Biotic Stress Management, Raipur during February 09-12, 2015. The Installation training was also attended by Nodal Officer and one Senior Research Fellow from ICAR-PDFSR, Modipuram on February 09, 2015.

Indian NARS Statistical Computing Portal

IP Authentication was got functional from ICAR Data Centre. For accessibility of Indian NARS Statistical Computing Portal and downloading of license files IP addresses of ICAR-DOR, Hyderabad; ICAR-DRMR, Bharatpur; ICAR-CRIJAF, Barrackpore; UBKV, Cooch Behar; BCKV, Kalyani; ICAR-CSWRI Avikanagar; ICAR-CSWCTRI, Dehradun; ICAR-National Institute of High Security Animal Diseases, Bhopal; MPKV, Rahuri; Sardarkrushinagar-Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada; PDKV,

Akola; College of Horticulture, PDKV, Akola; ICAR-CIFT, Kochi; ICAR-NRC on Pomegranate, Sholapur and Madras Veterinary College, Chennai were updated. 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 01 April 2014- 31 March 2015 are 76,559 which is on an average more than 200 logged in per day.



Macros for customized analysis

Developed macros for customized analysis of data from

- (i) Split Factorial (Main AxB, Sub C) designs (<http://www.iasri.res.in/sscnars/spltfctdsgnm2s1.aspx>)
- (ii) Strip-Split Plot Designs (<http://www.iasri.res.in/sscnars/stripssplit.aspx>).

Sensitization of researchers

Website of the project is being maintained and updated regularly. The website was updated by including the (i) final report; (ii) reviews and comments received from SKUAST-Jammu Users; (iii) Updated Reference Manual on Data Analysis Using R by adding two additional Chapters as (a) About R and R-Studio: Download, Instalation and Usage and (b) R-Scripts for Statistical Analyses using



Snapshot of the NISAGENET report showing students strength

R-Studio; (iv) updated list of Nodal Officers and (v) new macros developed. Website is registered under google analytics on November 15, 2010. Till March 31, 2015, there were 61,832 page views across 572 cities of 84 countries. Average time on page is 2.54 minutes. During April 01, 2014 - March 31, 2015, there were 19,018 page views across 526 cities of 84 countries.

An e-mail was sent to all Nodal Officers regarding usage of the Statistical Computing Environment on March 11, 2015. As a follow up action on this mail, nodal officers from IARI, New Delhi; CISH, Lucknow, DMAPR, Anand; IIVR, Varanasi and CRIJAF, Barrackpore informed that 5, 6, 2, 2 and 1 research papers (16) have been published /accepted for publication in which statistical computing environment has been used.

Project Information & Management System of ICAR (PIMS-ICAR)

This system was developed and implemented at IASRI server (<http://pimsicar.iasri.res.in/>). System has been implemented for ICAR institutes for effectively managing the research projects data management. This system has the provision for duplication detection in research projects at the level of title, objectives, keyword and activities. System has various reports to facilitate scientist, PME and Managers level. At present 6416 ongoing and 6865 completed projects data are available in the PIMS-ICAR. Support is being provided to PIs and Nodal officer for data entry in to PIMS-ICAR across ICAR institutes. HYPM is an ongoing activity of ICAR which is linked with PIMS-ICAR for sharing project information. Support is being provided for the same.



National Information System on Agricultural Education Network (NISAGENET)

National Information System on Agricultural Education Network (NISAGENET) in India was designed, developed and is being maintained at

the servers of IASRI. It is accessible from <http://nisagenet.iasri.res.in> to act as a single Window Information delivery system. For improving the quality of the data and meeting the desired timelines a Data Acquisition Mechanism has been developed along with corresponding As on Date and Data Entry Dates for all the data items of six schedules. The mechanism also includes active participation of Education Division along with IASRI. The mechanism is approved by the Education Division and has been circulated to all the universities through email and by providing the link in NISAGENET website. A new functionality has been developed and integrated in the production servers to allow access to faculty to update their profiles. The profile includes basic data of faculty members along with their publication list, awards, courses taught, and their research areas. The faculty profile is also accessible on Internet through their individual link.



Snapshot of the NISAGENET report showing students strength

A series of five workshops were organized during this period to improve the data quality, to interact with the nodal officers to show the new functionalities and to discuss the implementation of new data acquisition mechanism. Two days National Workshop on NISAGENET for Appraisal cum Validation of Data was organized at Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during 11-12 November 2014. Two days National Workshop was organized at Rajasthan University of Veterinary & Animal Sciences, Bikaner during 16-17 December, 2014. Two days National Workshop was at TNAU, Coimbatore at Agriculture College & Research Institute (AC&RI), Madurai during 8-9 January, 2015. Two days Workshop was organized at MPKV during 9-10 March, 2015. One day Workshop was organized at College of Agriculture, Mahatma Phule Krishi Vidyapeeth, Pune, Maharashtra on 24th March, 2015.

On the basis of feedback, multiple new reports such as year wise student admitted/passed, college



level nodal officers, faculty search etc. have been developed.

S.No	University Name	Course	Year	Admitted Strength		Passed Strength			
				Male	Female	Total	Male	Female	Total
1	CCS Haryana Agricultural University, Bhiwar (Haryana)	Bachelor	2011-2012	247	181	432	126	70	196
			2012-2013	264	188	432	127	89	204
		Bachelor	2013-2014	193	178	369	124	54	208
			2015-2016	89	82	184	79	72	151
		Master	2012-2013	112	90	208	89	48	148
			2013-2014	111	88	200	29	28	57
		Diploma	2011-2012	41	47	88	4	21	25
2012-2013	58		58	114	7	22	29		
	2013-2014	68	42	110	23	29	52		

NISAGENET report showing student strength

Management system for post graduate education-II

Management System for Post Graduate Education (MS-PGE) is an online university management system for management of various academic activities of a university. The system caters to the requirements of different users: Dean, Registrar, Heads, Guides, Faculty, Teachers, Students, Administrators and Officials for performing their assigned tasks. The system is operational in PG

Sl. No.	Report	Discipline	Year	Submitted	Reviewed	Approved	Remarks
1	2017-18	AGRICULTURE	2017-18	2018-03-15	2018-03-15	2018-03-15	2018-03-15
2	2018-19	AGRICULTURE	2018-19	2019-03-15	2019-03-15	2019-03-15	2019-03-15
3	2019-20	AGRICULTURE	2019-20	2020-03-15	2020-03-15	2020-03-15	2020-03-15

Discipline wise report showing multiple campuses

School IARI from academic year 2009-10. This year IARI has opened two new campuses viz. CIAE Bhopal and IIHR Bengaluru. These centers will start Ph.D. in Agricultural Engineering and 4 disciplines of Horticulture. The existing MS-PGE system was designed for single campus and is therefore required to be extended for these two new campuses. A demo and basic training of the existing system has been imparted to the visiting team of IIHR in August 2014. It was observed that the system requires major redesigning and all the modules will be affected to accomplish this. As a first step, system registration module has been extended, tested and integrated with the main system for IIHR and CIAE.

All the faculty members of IIHR and newly admitted students have been registered in the system. After system registration, other modules such as student trimester registration module, grades assignment module, course schedule upload, PPW and ORW workflow modules have been extended and implemented in IIHR Bengaluru. Implementation at CIAE Bhopal is being done.

PPW-ORW status report showing multiple campuses

A new module has been developed for online course evaluation. Another new functionality to add multiple roles to a single user has been developed and integrated with the system. Many new reports have been developed as per the user feedback, such as maximum marks distribution for each course at professor and dean level, schedule for each course at course leader, professor and dean level.

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

Results framework document is an instrument that helps prioritizing and measuring the performance of any department / organization. It also ensures that things are done in the right direction with effectiveness and efficiency and doing the desirable things in the right direction from the national point of view. RFD is being prepared by all the ICAR institutes and submitted annually to the authorities for effective monitoring and evaluation of performance of the individual institutes. But, currently there is

no electronic system available for submitting the results framework document in ICAR institutes to the respective subject matter divisions (SMD) and for preparing consolidated reports and evaluating overall performance of the institutes by the ICAR headquarters. Thus, Results Framework Document Management System (RFD-MS) was initiated to manage RFD activities in ICAR. The RFD-MS facilitates institutes to prepare, submit and report RFDs targets and achievements online and provide access to officials authorized by the Institutes, respective SMDs and RFD coordination unit in ICAR. It also facilitates generation of consolidated reports.

RFD-MS has been designed and developed in 3-tier architecture on the .NET platform. The system has a user interface for online data entry, updation and modification of various sections of RFD document. The system has been divided into two modules, institute and administrator. The institute module has the access to the system for online data entry, updation and modifications of various sections of RFD document time to time. The administrator module of this system has the control to create a new member of this RFD-MS, manage the database, delete unwanted information and modify the existing database etc.

The system consists of 6 input options viz., Section 1 to Section 6 of RFD. Each of these sections further constitutes different options that help the user to see various input screens for various components of RFD. The section 1 constitutes the vision, mission objectives and functions of the institute. Section 2 constitutes the key objectives, actions, success indicators and composite view of the institute. Section 3 facilitates entry of trend values. The institute can enter trend values of the success indicators. Section 4 comprises the description, definition of the success indicator and proposed measurement methodology option. Choosing this option displays a page where institute may enter description, definitions and

methodology used to define objectives and success indicators and their weights. Section 5 comprises the requirements from other Departments option. By choosing this option department may enter specific performance requirements from other departments that are critical for delivering agreed results. Section 6 facilitates entry of outcome and impact of activities of organization. The interface for report and queries as per the requirement has been designed and developed. The consolidated reports of RFD with print option have been designed.

Tobacco Agridaksh: An online expert system

Development of web based expert system on Tobacco using Agridaksh tool was initiated with Central Tobacco Research Institute, Rajahmundry to provide knowledge based system on various aspects of tobacco crop. The system aimed to design and develop various modules on tobacco such as insect pests and diseases, abiotic stresses, varieties, soil types and nutrient disorders, weed management and world tobacco scenario. Pests and disease module gives detailed information about pests and diseases attacking tobacco both in nursery and field crops including insects, fungal, bacterial, viral and nematodes and their management. The module on abiotic stresses gives detailed information on abiotic stresses including post-harvest management. Module on varieties gives comprehensive information on parentage, year of release, yield potential and suitability to the locations. Module on soil types and nutrient disorders provide information on soil types suitable to the tobacco cultivation and nutrient requirements including macro and micro nutrients and their deficiencies and adjustments. The module on weeds include information on types of weeds in tobacco and their management in both nursery and field crop. The information system for world tobacco includes tobacco production and problems in the different countries. Various aspects of tobacco information was collected and the desired attributes were identified and documented. The customization, designing and development of tobacco expert system was done using the Agridaksh tool. The customization for disease management module was done. This module is farmer oriented and user friendly platform which provides the disease management information with images of tobacco crop, so that users can retrieve disease knowledge. The administrative control module of disease management was configured, which manages the master data, delete unwanted information and modify the existing database etc.



Home page of RFD-MS



Retrieval of tobacco disease information

Management Information System (MIS) including Financial Management System (FMS) in ICAR

ICAR-ERP system is available for access at <http://icarep.iasri.res.in>. System has been implemented in 108 ICAR institutions. Data digitization work was carried out in all ICAR institutions with the help of hired agency. Data was loaded in the system using scripts. More than 20000 users have been created in the system. Modular approach in implementation was followed. Finance module is completely operational in all the institutes. Coordination with nodal officers of these institutes for data related and support issues were undertaken. Training sessions were organized in the institutes during one month support by consultant. More than 10000 personnel have been trained on system. Training details of scientists, approximately 7000 records, have been uploaded in the system. Almost 3 lakh transactions have been recorded in different modules till March 2015.

ICT Infrastructure, Unified Messaging and Web Hosting Solution for ICAR

ICAR Data Centre (Tier-III) has been established at IASRI to provide Unified Mail Messaging and Web Hosting solution in ICAR. The Data Centre provides shared resources as well as co-locating the application specific servers and Storage Area Network (SAN) facility for hosting the applications. Domain name “icar.gov.in” has been registered and the Unified Communication and Web Hosting Services have been made operational. Digital certificates of Servers were procured and installed SSL to provide the services of different applications through <http://icar.gov.in> domain. Coordination has been made with NIC to strengthen the existing NKN connectivity to newly created Data Centre (Dual link has been established). Naming policy for email-id/storage has been created. Process standardization was done for smooth operation of Data Center.

Computing Environment	Services Offered
<ul style="list-style-type: none"> • 448 Core Computing • 150 TB storage • Microsoft OS • Linux OS • Microsoft SQL DBMS • MySQL • Active Directory • Microsoft Exchange 2013 • Microsoft Lync 2013 • Virtualization 	<ul style="list-style-type: none"> • Unified Communication • Messaging (Webmail and POP) • Phonebook • Calendar • Schedule meetings • Chat • Presence • Web Conferencing • Video Conferencing including Presentation Sharing • Virtual Machine & Data Storage • Web Hosting



Unified messaging solution (email with chat features) has been implemented (<https://mail.icar.gov.in>). It can be accessed through webmail, outlook and mobile. Microsoft Lync provides instant messaging. E-mail ids have been issued for all Director’s and key officials of ICAR-HQ. Email ids are being created for ICAR employees after verification of data from institutes. Accounts have been created for more than 70 institutions. KRISHI Portal, Agroweb, NAIP and other application running from IASRI server (HYPM, NISAGENET) have been migrated into Data center environment.

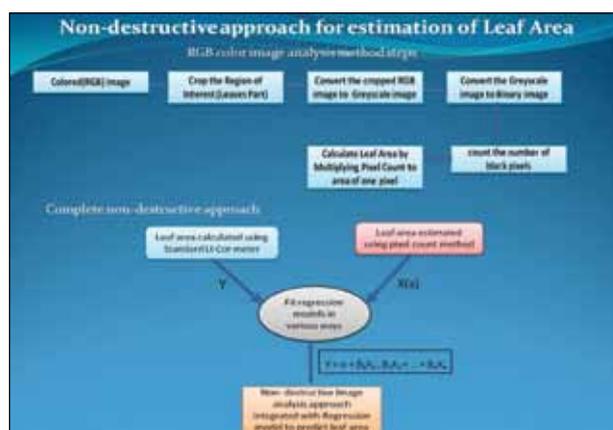


Phenomics of moisture deficit and low temperature stress tolerance in rice

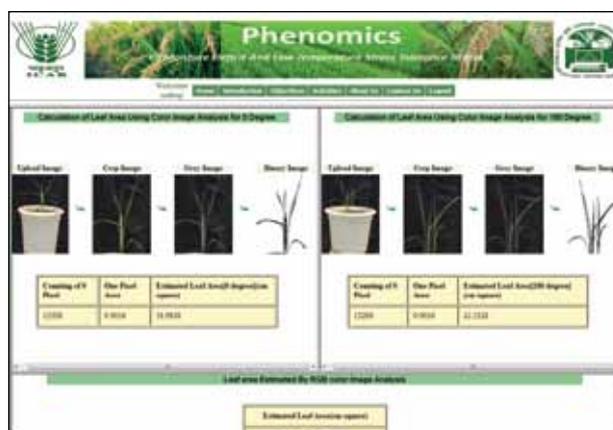
The creation of phenome database and a multimedia data management system for capturing the data generated has been designed and developed. The system has been developed using IDE NETBEANS IDE 7.0., Apache Tomcat 7.0 server and, JSP, XML, HTML languages. The system is having a facility for uploading excel files in which data have been entered. It also has utility for uploading pictures, slides and graphs. The system has been extended with advanced facilities such as uploading of multiple images in the form of zip file or by selecting multiple files, uploading of any kind of file related to experiment, selecting a portion of the image and cropping it online. Some of the key features of the system are as follows;

- Generic System for data capturing – can cover multiple commodities such as crops, animals, fisheries.
- Experiment as a base for capturing data rather than project.
- Secure – Data sharing based on roles and privileges.
- Modular System - At present captures numeric, alphanumeric, and image data, but can be expanded to cover genomic, satellite data etc. It has analysis module for estimation of leaf area and chlorophyll but can be scaled up for many more analysis modules.

The approach for estimation of leaf area of rice plant through image analysis has been enhanced by using the approach in which front and rear image of the plant is taken and used for estimation of the leaf area. The same has been developed in the online software and is deployed on the production server. This has increased the accuracy level significantly.



Procedure for estimation of leaf area using image analysis



Online tool for estimation of leaf area



Image collection for chlorophyll estimation

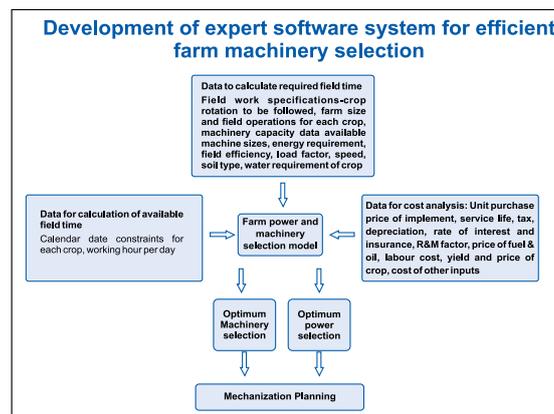


Expert system for farm power and machinery selection

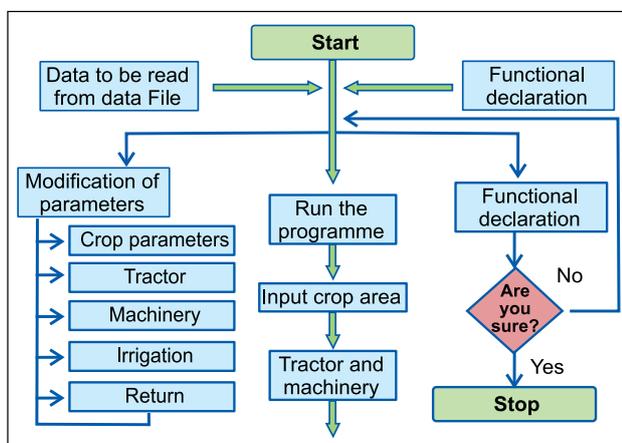
Availability and selection of appropriate requirement of farm power and machinery is the most essential component of any farm enterprise and farming community. Among various inputs to the crop production system, power and machinery jointly represent the largest single item of expenditure, constituting about 60% of the total investment on a farm. The decision on optimum size of machinery is quite critical, not only because of the high proportion of total cost attributed to machinery, but also due to the infrequency and irrevocability of such decisions. The software Expert System for Farm Power and Machinery Selection has been developed using C# with ASP.NET in Microsoft .NET technology. It almost utilizes all the important features of Object-Oriented Technologies viz., Objects, Classes, Inheritance, Polymorphism, Reusability and Multithreading etc. DLL (Dynamic Link Libraries) and API (Application Programming Interface) have been developed for each module used in this software. It is a complete web based solution or web based expert system for

farm power and machinery selection for Rice-Wheat crops.

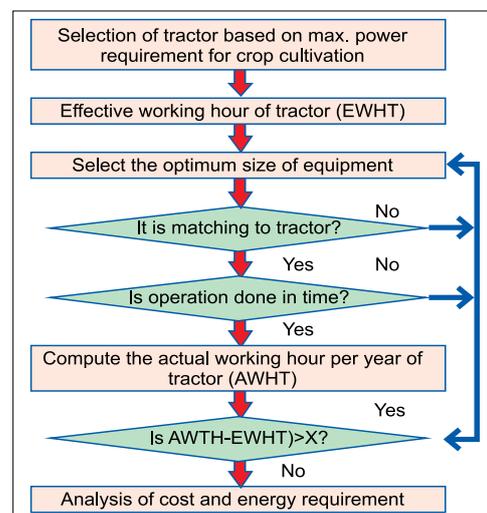
Modules have been developed for the selection of optimum size, optimum power and optimum machinery system for different operations for a particular implement with inputs like area under the crop, number of operations for each crop, time gap, crop rotation and time available for each operation, etc. The model selects an optimum tractor size from amongst the available sizes and its matching implements keeping in view the field capacity of machinery to complete the operation in scheduled time for a given farm. The model also computes the working hours and energy requirement for different field operations along with various cost components. This expert system is very beneficial for both the farmers and entrepreneurs for seeking advice in the selection of size of power source with matching equipment. This software also gives all the important links such as State wise directory of agricultural machinery manufacturer's in India, National portals on farm mechanization, User guide to farm mechanization, some important institute websites.



Flow chart for efficient selection of farm power and equipment



Flow chart for selection of size of equipment



Flow chart for selection of size of power source

Flow chart for development of expert system for efficient farm machinery selection



Home page of expert system

Electronic learning and diagnostic for health management of dogs

Dog Health Management Trainer (DHMT) was designed and developed to provide the detailed stepwise information to dog owners. Dog breeds database has been developed using IndexedDB database. The texts, audio and visual of the particular aspect/activity of dogs were synchronized. The interface for E-learning module DHMT has been developed using HTML5, CSS and Java scripts. It facilitates users to access flash based application by content. In this system, user can select the particular aspect related to dog health and able to view the text information with visual and audio. The system

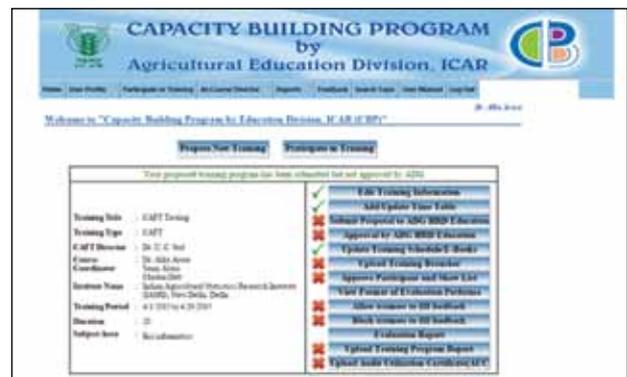


provides the detailed stepwise information to the dog owners regarding various important aspects i.e., general management, breeds of dog, registration, common behavior, house management, breeding and reproduction, feeding, health management, diseases, housing, vaccination and deworming. It educates the dog owners about the first aid for various common ailments of dogs and provides information on the vaccination and deworming schedules. DHMT serves as expert for training of the dog owners who are beginners and are been to know the scientifically correct methods of dog rearing.

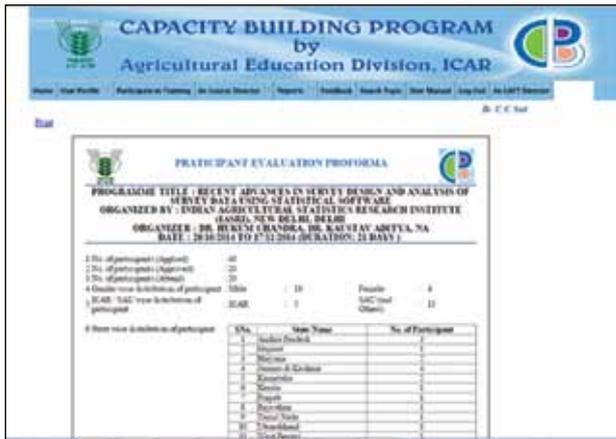
CBP Vortal

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 and is available at <http://iasri.res.in/cbp>. Different modules have been created for different types of users. Functionality enhancement has been done at various level based on the requirement from users and Education Division.

Course Coordinator module/ CAFT Director module: Course Director/ CAFT Director is responsible for management of training related activities online. Functionality has been enhanced for filling the evaluation proforma online by participant after approval from Course Director and online evaluation report of the training program is also generated from the system. Evaluation report presents summarized opinion of participants about the training program and at the same time provides details about participants for different criteria (State, Male/ Female etc.)



Home Page for Course Director



Training Evaluation Report

ADG Module: Managers at the Education division do the training evaluation and approval process online in work flow manner in CBP system. Training proposals are invited online under different categories. Functionality has been done for

generation of letter for approved training programs online. Summarized reports were added in the system on various parameters for different training programs (State Wise, Discipline Wise and Institute Wise). Results can be exported to PDF and Excel formats.



Discipline wise participation report at ADG level



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 from current academic year. A brief description of human resource development during the year is given in the sequel.

Degree Courses

The Institute is conducting 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 their major area but also in other areas in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics, etc. The Courses in Mathematics, Agricultural Statistics, Computer Application and Bioinformatics are offered at this Institute while the courses in Agricultural Sciences are offered at IARI.

Number of students admitted / completed various courses during 2014-15

Courses	Number of students	
	Admitted	Completed
Ph.D. (Agricultural Statistics)	6	5
M.Sc. (Agricultural Statistics)	8	6
Ph.D. (Computer Applications)	0	0
M.Sc. (Computer Application)	7	2
Ph.D. (Bioinformatics)	6	0
M.Sc. (Bioinformatics)	5	5

DISSERTATIONS APPROVED

Ph.D. (Agricultural Statistics)

- (i) **Shashi Shekhar**
Chairperson: **Dr. LM Bhar**

A Study on Multiple Biological Assays

Bioassays or biological assays are used in many fields of sciences, especially in life sciences. In many practical situations for conducting experiments on biological assays, the interest of the experimenter lies in comparing several test preparations with a single standard preparation. Multiple bioassays have been proved to be a more practical approach and are also significantly less resource intensive. The main purpose of a bioassay is the estimation of the relative potency of test preparation with respect to standard preparation. Therefore, only some specific contrasts are required to be estimated. It is desired that when a block design is used for the assay, these contrasts of interest are estimated with high efficiency. This study deals with the construction of such high efficient designs for

multiple biological assays both for parallel line and slope ratio assay. A general method of construction of A-optimal binary block designs for symmetric parallel line assays has been obtained which has been extended for multiple parallel line assays as well. Another method of constructing A-optimal binary block designs for asymmetrical parallel line assays has also been proposed. Two cases have been considered. In the first case, designs obtained are of equal replications of the doses and in the second case, designs with unequal replications are obtained. This methodology has also been extended for multiple asymmetric cases. Methods of constructing block designs for multiple parallel line assays based on balanced incomplete block design have also been considered. Designs obtained here are highly efficient as all the contrasts of interest can be estimated with high efficiency. For the case of multiple slope ratio assays, a general method of constructing efficient block designs for symmetric case has been proposed. Catalogue of the designs so generated is also prepared.

(ii) **Ankur Biswas**
Chairperson: Dr. Anil Rai

A Study of Spatial Bootstrap Techniques for Variance Estimation in Finite Population

In agricultural surveys, the important parameters of crop production are often spatial in nature, in which observations from neighbouring units tend to share similar statistical properties. In literature, spatial sampling designs are suggested to provide reliable spatial statistics using the spatial dependency among the sampling units. Here, a new efficient approach, viz. spatial estimation procedure, for estimation of the mean of spatially correlated finite population units is developed by incorporating the spatial dependency at the estimation stages of traditional without replacement sampling designs like Simple Random Sampling (SRS) and Ranked Set Sampling (RSS). In this approach, Spatial Estimators (SE) of population mean were developed following prediction approach in which unobserved population units were predicted based on their distances with observed sampling units following Inverse Distance Weighting (IDW) method. Since the proposed SE's were non-linear in nature, Rescaled Spatial Bootstrap (RSB) techniques were developed for unbiased estimation of variance of the SE under both the designs. Also, a spatial simulation study was carried out in order to study the performance of

proposed SE with respect to the corresponding classical estimators of population mean under both the designs along with its variance estimation following proposed RSB methods. Proposed SE under both designs were found to be almost unbiased, consistent, stable and more efficient for estimation of population mean. Further, in the context of without replacement sampling both by SRS as well as RSS designs for spatially correlated finite population, naive bootstrap approach results in considerably high amount of bias in the estimator of variance of the SE of population mean, whereas, the proposed RSB methods were found to be approximately unbiased. Further, the statistical properties of these RSB methods were not desirable in presence of missing observations. Thus, Proportional Spatial Bootstrap (PSB) methods were proposed using spatial imputation techniques for unbiased variance estimation of SE under SRS without replacement design. Efficient rescaling Jackknife and Bootstrap methods for unbiased estimation of variance of the RSS mean estimator in case of finite population was also studied.

(iii) **Prabina Kumar Meher**
Chairperson: Dr. AR Rao

Development of Statistical Procedures for Genome Sequence Analysis

Several functional elements like Transcription Factor Binding Sites (TFBS), splice sites, Single Nucleotide Polymorphisms (SNPs) are present on genome and identification of these elements in wet-lab experiments is quite expensive. Hence, development of computational methods for the prediction of functional elements on genome is essential to understand the underlying complex biological phenomena. One such phenomenon involves the prediction of disease risk of an individual using whole genome level information on SNPs. However, disease risk prediction studies involve imbalanced case-control data, where controls are higher than the cases. Moreover, the number of SNPs remains larger than sample size. Another important area in genomics is to predict splice sites, which in turn helps to predict gene structures in eukaryotes. However, the existing procedures suffer from drawbacks like assumption of independency between positions at splice sites, larger window size and transformation of sequence information to numeric form. This study was taken up to develop a procedure to classify cases and controls under imbalanced data and predict disease risk of an individual, determine a suitable

window length and propose an approach to predict donor splice sites in rice and identify TFBS in a family of genes of Arabidopsis using Gibbs sampling. For the classification of imbalanced case-control data, Combined Random Forest (CRF) was proposed and its performance was found to be better in terms of prediction accuracy as compared with the Balanced Random Forest and Weighted Random Forest. For the prediction of splice sites in rice, an encoding approach with SVM, ANN and RF were proposed. A comparison revealed that the encoding approach with RF predicts the splice sites with higher accuracy. Similar result was found while comparing the performance of RF with the existing approaches: NNsplice, Splice view, MM1, WMM, MDD and MEM. In addition, a 9bp window length having 3bp at the exon end and 6bp at the intron start was found to discriminate the true splice sites from false splice sites. Based on the proposed approach, a web server was also developed to predict the donor splice sites in eukaryotes. In order to identify the TFBS, a MAD box family of genes in Arabidopsis was considered and Gibbs sampling methodology was applied. Motifs of 10bp length in 1K upstream region of genes were found as probable TFBS. Thus, application of Gibbs sampler was recommended over other techniques for TFBS identification.

(iv) Rohan Kumar Raman
Chairperson: Dr. UC Sud

Some Contributions to Calibration Estimators in Survey Sampling in the Presence of Non-Response

The mail questionnaire method is commonly used to collect data in surveys as the cost in this method is considerably reduced. However, non-response can be serious problem in this method and may result in biased estimates, particularly, when the respondents differ from the non-respondents. The calibration technique is widely used to obtain precise estimators of population parameters and provides a systematic approach for incorporation of auxiliary information at the estimation stage. Calibration implies that a set of starting weights (usually the sampling design weights) are transformed into a set of new weights, called calibrated weights. Here, estimators for population total have been proposed through the calibration approach, for different situations. Expressions for variance and estimator of variance, to the first order of approximation, of proposed calibrated estimators in presence of non-response have been developed. The

performance of developed calibrated estimators is evaluated through a simulation study where the study population is generated through an assumed model and also by making use of real data. The estimator is developed for the situation where the information on auxiliary variable is assumed known for the entire sampled units and the proposed calibrated estimators outperform the Hansen and Hurwitz estimators in terms of efficiency. Further, estimators using multiple sets of weights in the context of non-response are considered. In terms of percent relative biases, the calibrated estimator based on known auxiliary information dominates the other estimators i.e., Hansen and Hurwitz estimator, Cochran ratio estimator and double sampling ratio estimator. For positive correlation between known auxiliary variable and the study variable, the proposed calibrated estimator outperforms in terms of relative root mean square error. The double sampling approach based calibrated estimator is developed when auxiliary information is unknown. Simulation results reveal that maximum improved performance occurs for large sample size as well as for high correlation between study and auxiliary variable. When information on a auxiliary variable is negatively correlated, the proposed calibrated product estimator has consistently smaller values of the percent relative root mean square error. However, if auxiliary information is not available for entire population, the double sampling approach based calibrated product estimator is preferable.

(v) Rupam Kumar Sarkar
Chairperson: Dr. AR Rao

Statistical Evaluation of Complex Traits Based on Genomic Information

An empirical procedure involving six different combined distance measures, seven clustering methods, three allocation strategies have been applied on the germplasm data of rice to identify mini-core sets. Based on a proposed evaluation criteria for core set identification, a combination of combined distance measure A_1B_2 – the distance based on the “average of the range-standardized absolute difference” for quantitative data with the “rescaled distance based on the average absolute difference” for qualitative data; k-means clustering method; and proportional allocation strategy was found best for the identification of mini-core set of rice germplasm. Also, the optimum values of tuning parameters of Random Forest (RF) have been identified to predict the breeding value of the trait – kernel

length in maize crop. Besides, the comparison of RF with Least Absolute Shrinkage and Selection Operator (LASSO), Elastic net (EN) and Ridge Regression (RR) for genomic prediction reveals that the correlation between the predicted and observed trait response is higher in RF than the others. In case of planning the RNA-Seq experiments, the Area Under Curve (AUC) for three different design setups (Un-blocked designs (A), Balanced block designs (B) and Incomplete Block designs (C)) and four simulated conditions (with batch effect and lane effect (S1), batch effect and no lane effect (S2), no batch effect and lane effect (S3) and no batch effect and no lane effect (S4)) have been obtained. The results reveal that the performance of incomplete block designs (C) are at par with that of Balanced Block designs (B) and superior to Unblocked designs (A) in terms of testing the difference in expression of genes under different treatment conditions. Moreover, a decrease in the noise increases the AUC marginally.

M.Sc. (Agricultural Statistics)

(i) Pramod Kumar Moury

Chairperson: Dr. Tauqueer Ahmad

A Study on Estimation of Average Yield of Cotton

An alternative sampling methodology has been developed for estimation of average yield of cotton using limited number of pickings. The component sampling approach under uni-stage sampling design framework for estimating average yield of cotton at district level has been proposed and the same has been extended to stratified three stage sampling. Under component sampling approach, it is proposed to consider the yield of different pickings as the components of total yield. Estimates of average yield of cotton along with percentage standard error (%S.E.) have been obtained for Amravati and Aurangabad districts of Maharashtra and Warangal and Guntur districts of Andhra Pradesh for the year 2012-2013 using component sampling approach under uni-stage as well as stratified three stage sampling design framework. The estimate obtained using the proposed methodology is reliable and almost at par with the estimates obtained using General Crop Estimation Survey (GCES) methodology and an alternative methodology using double sampling regression procedure under stratified two stage sampling design framework. The proposed methodology will save cost of the survey significantly and will also be operationally

more convenient than GCES procedure. Also double sampling technique under stratified two stage sampling design framework has been proposed for estimation of average yield of cotton at tehsil level considering third picking of cotton crop as auxiliary variable. Using the proposed estimation procedure, estimates of average yield of cotton along with %S.E. have been obtained at tehsil level for Amravati and Aurangabad for 2012-2013. The estimates obtained are fairly reliable at tehsil level.

(ii) Md. Harun

Chairperson: Dr. Cini Varghese

Statistical Designs Involving Three-way Crosses

The objective of a breeding programme is to create variability and to select genotypes for raising or for further breeding purpose. The most common designs used by a geneticist to study genetic parameters and their interpretations are diallel (single cross), triallel (three-way cross) and quadriallel (double cross). Three-way crosses are intermediate between single and double cross hybrids with respect to uniformity, yield, stability and the relative simplicity of selecting and testing and hence are increasingly gaining popularity among breeders. Considering a full model including general and specific combining ability effects and a reduced model ignoring specific combining ability effects, the information matrices for the estimation of combining ability effects have been derived for designs involving three-way crosses. Four methods of constructing designs for breeding trials involving complete/partial three-way crosses have been developed. Among these, two methods are based on Mutually Orthogonal Latin Squares (MOLS), which yield variance balanced designs involving three-way crosses arranged in blocks. The other methods are derived from Association Schemes and Partially Balanced Incomplete Block (PBIB) designs. Also, for experimental situations in which the interest of the experimenter is in comparing a number of test lines with a control line, four series of designs involving complete/partial three-way crosses have been obtained using MOLS, PBIB designs and their association schemes. In all the designs obtained, three-way crosses are arranged in incomplete blocks. SAS codes have been developed using PROC IML to compute the information matrices and variances pertaining to general combining ability effects of full parents as well as half parents for different groups of interline comparisons.

(iii) Saurav Guha**Chairperson: Dr. Hukum Chandra****Some Investigations on Outlier Robust Survey Inference**

In many surveys, like agriculture, income and expenditure surveys, data are typically outlier contaminated that contain few extreme values and linear model assumptions are questionable. Influential observations may appear due to imperfections of the survey design that cannot fully account for the dynamic and heterogeneous nature of the population. An observation may become influential due to a relatively large survey weight, extreme value or combination of the both. The generalized regression (GREG) estimator is widely used in survey sampling when the auxiliary data are available. However, the GREG estimator is vulnerable in the presence of outliers. Many robust procedures have a smaller variance than non-robust procedures in the presence of outliers. However, the bias can be dominant in the mean square error when the sample sizes become large. A winsorized approach based estimator of population total was proposed with a choice of cutoff points that guarantees that the resulting mean squared error is lower than the variance of the original survey weighted estimator. The upper and lower bias parameter estimates depends on the values of the top and bottom weighted residuals. If the data used to generate the cutoff values is same as the data for which the winsorized cutoff values are to be applied, then those units with the values of the top and bottom weighted residuals will be winsorized. However, if the data used to generate the cutoff values is different, then it is assumed that the data for which the winsorized cutoff values are to be applied fits the same model as the data used to generate the cutoff values. The expression for its mean squared error estimator is obtained. The improved performance of proposed estimator was demonstrated using a Monte Carlo simulation study. The developed estimator was also applied to a real life survey data.

(iv) Prateesh P. Gopinath**Chairperson: Dr. Rajender Parsad****Two Dimensional Balanced Sampling Plans Excluding Adjacent Units**

A two dimensional balanced sampling plan excluding adjacent units are the sampling plans in which all the first order inclusion probabilities are equal and second order inclusion probabilities for pairs of adjacent units are zero and constant for all other pairs of non-adjacent units. These plans

are useful for the situations in which units in the population are arranged in two dimensions and it is expected that the adjacent units provide similar information. Two dimensional balanced sampling plans excluding adjacent units [2-BSA(m), where m denotes the distance between units] have been developed for populations with circular ordering of units for the situations when adjacent units that share a common border may provide similar response on characteristics under study (sharing a border adjacency scheme) and when all the units surrounding a selected unit may provide similar observations regarding the observed character (island adjacency scheme). In both these situations, it is assumed that $m = 1$ or 2 . Algorithm based on linear programming approach was developed for construction of 2-BSA(m) plans under both adjacency schemes for $m \leq 2$. For execution of linear programming formulation, codes were written using PROC IML and PROC LP of SAS. Some results on existence of 2-BSA(m) plans have also been obtained for each adjacency scheme separately. Catalogues of 2-BSA(m) plans for the parameters satisfying $RC \leq 50$, $n \leq 5$ and $m \leq 2$ have been prepared for both adjacency schemes. Here, R is the number of rows, C the number of columns, $RC = N$, the population size and n is the sample size.

(v) Rajeev Ranjan Kumar**Chairperson: Dr. Girish Kumar Jha****Co-integration Approach for Energy-Use in Agriculture**

In view of increasing share of energy in the cost of cultivation as well as deregulation of prices of some petroleum products, agricultural commodity prices are vulnerable to the rise in energy prices, particularly of crude oil. In this study, an attempt has been made to examine the co-movement between energy and agricultural commodity prices with the help of Johansen co-integration technique using monthly wholesale price indices for the period April 1994 to March 2014. Since the process of deregulation started from April 2002 onward, the entire period was divided in two equal parts, so that before and after period analysis will provide a clear picture of a potential link between prices. The results clearly revealed that energy and selected agricultural commodity prices are integrated in the long-run since 2004 while fruits prices were integrated even before deregulation of petroleum price. This means that there is an increasing tendency for price changes in selected agricultural commodities

corresponding to changes in international crude oil prices in recent years. Further, an effort was also made to examine energy growth linkage in major states of India with the help of panel co-integration using annual time series data of real GSDP from agriculture and allied sectors and corresponding electricity consumption for agriculture during 1990-2010. The empirical analysis fully supported a positive long-run co-integrated relationship between GSDP and electricity consumption when the heterogeneous state effect was taken into account. There is long-run unidirectional causality running from energy consumption to agricultural growth. This implies that reducing energy consumption does not adversely affect agricultural growth in the short-run but would in the long-run and thus energy demand will increase in future in order to achieve higher agricultural growth.

(vi) Sadikul Islam

Chairperson: Dr. UC Sud

An Application of Calibration Approach for Estimation of Finite Population Ratio under Two-Phase Sampling Design

The calibration approach is frequently used to develop precise estimators of important population parameters. Further, the chi-square type distance function is usually used for determination of revised or calibrated weights. A higher level calibration approach has also been proposed for improving the variance estimator. The calibration approach is used to estimate finite population ratio under two phase sampling design. Different types of calibrated weights are obtained for different situations of available auxiliary information as well as for single and double system of weights. The two situations of auxiliary information considered are the totals of both the auxiliary variables pertaining to numerator and denominator is available for first phase sample separately and only the ratio of the totals of auxiliary variable is available for first phase sample. The expression for variance and estimator of variance of the estimators are developed for general sampling design as well as for SRSWOR as a special case. The performance of the different calibrated estimators is studied through a simulation study. It revealed that simple ratio estimator which does not make use of auxiliary information perform equally to calibrated estimators when the study variables are highly correlated but the correlation between study and auxiliary variable is very low.

But for fixed correlation value between study variable, increase in correlation between study and auxiliary variable efficiency of calibrated estimator gradually increases. Further, the calibrated estimator based on two systems of weights is found to perform better than the other calibrated estimators based on single weight.

M.Sc. (Computer Application)

(i) Sanchita Naha

Chairperson: Dr. Sudeep Marwaha

Recommender System for Crop Variety Selection

The internet is growing with tremendous speed and is developing rapidly regarding both content and users. This has led to an information overload problem and it is difficult to locate the right information at the right time. Recommender systems overcome this problem by guiding users through the big ocean of information. It uses the opinion of members of a community to help individuals to identify the information interesting to them or relevant to their needs. These systems use the similarity between the users' choices and the content of the items to form recommendation list for the user. However, these systems have not been exploited to that extent in agricultural domain. Therefore, an innovative idea that enables to integrate the recommendation technique with the word-of-mouth information exchange between farmers has been attempted. This study presents recommender system for crop variety selection with a focus on maize and a prototype system has been developed. The system creates a personal Farmer Agent for each registered farmer. The farmer agent stores the socio-economic profile of the farmer as well as his experiences of growing a crop variety. Java Agent Development Environment (JADE) has been used to develop these agents as well as to provide the message passing among these agents. A registered farmer can get the variety recommendation through its agent which in turn asks the recommendation from the peer farmer agents having the similar socio-economic profile. All the received recommendations are ranked and top five are shown to the requesting farmer. The system has been built on modular approach and facilitates integration of other complex recommendation algorithms. It also allows creating agents on distributed servers. The cold start problem has been tackled by registering the farmers selected for front line demonstration for maize as well as scientists who have conducted

experimental trials on the released varieties. The system has a capability to transfer agricultural technologies using both top-down as well as through peer to peer interaction approaches and will help in faster adoption of new crop varieties/ technologies.

(ii) **Linkon Kumar Saha**

Chairperson: Dr. Alka Arora

Information Module on Integrated Pest Management for AGRIdaksh

Integrated Pest Management (IPM) is the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of healthy crops with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. AGRIdaksh is an online knowledge management tool developed at ICAR-IASRI which facilitates creation of expert system with the help of domain experts for different crops and has the capability to transfer location specific technologies and advice to the farmers efficiently and effectively. System has database of varieties, diseases and pest etc. With the increasing demand of IPM practices in agriculture, IPM module is developed and linked with AGRIdaksh for dissemination of information of IPM practices for different crops. System has been developed using web based three tier architecture and it provides information about diseases, pests and IPM practices to control them. Java Server Pages (JSP) technology has been used for programming the business logic and input forms developed using HyperText Markup Language (HTML) and validation done using java script. Database has been implemented using SQL Server 2008. Source code for developing user interfaces has been written using Netbeans 7.4 Integrated Development Environment (IDE). System has been tested using data of Tomato crop which is important vegetable crop in India. Data about IPM practices for tomato has been taken from the technical bulletin, IPM strategies for vegetables crops published from NCIPM. System provides information about different insects, weeds, diseases, nematodes of tomato crop and their corresponding IPM practices. This system also provides images for different disease and pests. These images are helpful for the identification of disease and pests.

M.Sc. (Bioinformatics)

(i) **Amit Kairi**

Chairperson: Dr. AR Rao

Development of Information System on Buffalo Genome

India has the largest herds of buffalo and cattle and produces highest amount of milk in the world. Among the livestock species, buffalo has remained an integral part of the Indian rural economy. With the advent of genome sequencing technologies, the whole-genome sequence assembly of Murrah breed of water buffalo has been done recently in India. Also, significant amount of information on different functional elements of various breeds of buffalo genome are available in public domain. However, the annotations of functional elements on the genome are not available. In addition, the 3D structures of buffalo proteins are not available and there exist no browser to visualize the genic information on buffalo genome. The nucleotide and protein sequence information was retrieved from NCBI and parsed. The 3D structures of proteins were predicted, validated, refined and stabilized. The parsed sequence information and protein's sequence and structure information has been imported into a database. An information system on buffalo genome with 3-tier architecture has been developed with MySQL database as bottom layer, PHP as server side application-middle layer, HTML, CSS and JavaScript at top layer as client side application layer. The developed information system contains 930 complete CDS, 1154 partial CDS, 656 Exon sequences, 237 Intron sequences, 1709 Mitochondrial DNAs, 73 sequences of Promoter Region and 67 sequences of UTR region. Out of 930 buffalo genes, 837 have been found to be mapped onto *Bubalus bubalis* (female Murrah breed). The developed genome browser shows that maximum number of genes have been distributed on chromosome 4 followed by chromosome 18 with 324 and 155 number of genes respectively. The results from the study also reveal that 837 out of 930 buffalo genes have been mapped onto *Bubalus bubalis* genome whereas, 561 buffalo genes are mapped onto *Bos taurus* genome. Further, 202 genes have been found to be predicted as orthologues between cattle and buffalo genomes. The developed information system provides several user-friendly facilities like search, filter, download, print, visualisation and browsing. The system on buffalo genome can be accessed at <http://cabingrid.res.in/bgjs/homepage.html>.

(ii) Priya Prabhakar**Chairperson: Dr. Anil Rai****In Silico Study of Host-Pathogen Interaction under Mutation Effect on Blast Resistance Genes in Rice**

The effect of mutation on proteins of blast resistance gene was analysed by detecting and comparing the natural variations (SNPs and InDels) present in 30 alleles of *Pi-ta* gene in *Oryza* spp. *O. sativa indica*. Three-dimensional structure of *Pi-ta* proteins were predicted through I-TASSER software. 3D refine web server (<http://sysbio.mnet.missouri.edu/3Drefine/>) was used to bring the initial model closer to the native structure. The stereo chemical quality of the model was checked using the 'Protein Quality Assessment' parameter option of Discovery Studio. Quantitative structural evaluations were performed to find out the stability and disease response of *Pi-ta* alleles upon mutation. Average number of nucleotide difference between two sequences was found lower in *Oryza indica* in comparison with the nucleotide difference surveyed from *O. rufipogon*. InDel diversity per site ($\Pi_i = 0.00061$) was found lower than nucleotide diversity per site ($\Pi = 0.00255$) in the selected accessions of *Pi-ta* gene. More number of synonymous substitutions were observed in non-coding region. Susceptible *indica* cultivar C101A51 showed maximum number of InDels events in the gene. Most of the changes in secondary structure elements were observed in NBS-LRR region. More number of coils were found in LRR region in comparison to helix. The predicted *in silico* protein structure of the *Pi-ta* alleles was observed to be affected by mutation *i.e.* SNPs and InDels. Quantitative assessments of these structures showed differences in value of ASA, SFE and number of H-bonds. Normal mode analysis of modelled proteins showed differences in region of maximum atomic displacements between different alleles of *Pi-ta* gene. A total of 101 accessions of *Avr-Pita* proteins were found in NCBI from which 12 dominant effectors *Avr-pita* proteins and 8 recessive *Avr-pita* proteins were selected from 19 isolates of *M. oryzae* strain. All these sequences were not 100% similar. Value of SFE and number of H-bonds were less in recessive *Avr* proteins in comparison to dominant effector proteins. An approximate degree of flexibility for proteins was determined by secondary structure elements present in the structure. BAK40873.1 and BAK40874.1 contain more number of coils as compared to other structures which can lead to more degree of flexibility than others. CCD21951.1 contains least number of coils than

others, so it is most rigid structure. In normal mode analysis, region of maximum atomic displacements was found different in recessive and dominant effector proteins. In another experiment, direct interaction between proteins of *Pi-ta* alleles and their corresponding *Avr-pita* was observed by two methods. First method is interaction in gene-for-gene manner and second is *in silico* mutagenesis and interaction of polymorphic sites in the LRR region of R proteins. Maximum BE was observed in complex of BAF91347.1 and BAK40873.1. It also contained maximum number of hydrogen-bonds. Least BE was observed between docking complexes of *Pi-ta* proteins from susceptible *Oryza* cultivars and recessive *Avr* proteins. Mutation analysis of the polymorphic sites in the LRR region showed that mutability of these sites is different. The mean of the binding free energy change distribution over 19 mutations was found negative for 8 out of 11 sites. A very less correlation was found between mutations that increase stability and mutations that favour complex formation.

(iii) Sayanti Guha Majumdar**Chairperson: Dr. AR Rao****Development of Epigenetic Database in Livestock Species**

Demand for livestock products is constantly increasing with the continuous population growth. To meet such demand it is essential to understand molecular mechanisms of livestock species. With the advent of new technologies, it has become possible to understand the underlying mechanisms present in the growth and development of important traits of livestock species. Epigenetics is an emerging field which deals with the study of mitotic and meiotic (or both) heritable changes in gene function that cannot be explained by changes in DNA sequence. Broadly, three epigenetic mechanisms, viz., DNA methylation, Histone modification and RNA interference (RNAi) occur in nature. However, the information related to the said epigenetic mechanisms in livestock species is not available at one place. Moreover, analysis of epigenetic information is required for improvement in production traits and controlling diseases in livestock. The gene and protein sequence information related to epigenetic mechanisms of livestock species was downloaded from NCBI, UCSC and CABin. Besides, the microRNA information of cattle and sheep was retrieved from miRBase. Subsequently, a tool known as "Sequence Manipulation Suit: CpG Islands" was used to obtain the probable methylation sites present in the 1k upstream region of 10,990

genes in cattle. The results reveal that the CpG islands are found in 8033 genes. In addition, the three dimensional structures of histone proteins of cow, sheep, goat, camel have been predicted, validated, refined and stabilized. Also, the probable genomic regions of histone proteins in buffalo were identified by using tBLASTn tool. The BLAST results were then parsed and kept in a suitable format to populate a database. In case of RNAi, the secondary and tertiary structures of microRNAs of cattle and sheep were predicted by RNAfold and RNAcomposer respectively. Since the miRNA information in buffalo species is not available, the genomic regions of the same were mapped by considering miRNAs of cattle as query sequences in BLASTn. For ready use of the parsed data by users, a web-based "Livestock Epigenetic Information System" has been developed with MySQL database as bottom layer, PHP as server side application-middle layer and HTML, CSS and JavaScript at top layer. The developed information system can be accessed at <http://bioinformatics.iasri.res.in/edil/>.

(iv) **Neeraj Budhlakoti**

Chairperson: Dr. Anil Rai

Web Application for Classification of Proteins Responsible for Abiotic Stress in Cereals

Abiotic stress severely limits plant growth and development as well as crop yield. Various proteins of the plants are responsible for regulation of these abiotic stresses. Therefore *in silico* prediction of function of an unknown protein is very important as this helps in regulation of related biological process of the plant for mitigation of adverse effects of abiotic stress. In order to predict function of different proteins numbers, *in silico* approaches are being followed but it was found that physicochemical properties plays very important role in determination of different functions of protein. Perl script has been written for calculating the physicochemical properties of unknown sequences instead of using ProtParam tool. This library of different physicochemical properties is used in this web application for calculating the physicochemical properties automatically for protein sequences which is provided by user as an input for prediction of function through this web server. Then this server calls the model for prediction separately for each abiotic stress which runs at backend. This server is capable to predict the function of sequences into five classes of abiotic stress. Predicting protein into a particular class does not ensure that it cannot be related to other stress. This web application filters out this

problem by predicting the protein sequences into all overlapping classes i.e. Heat, Cold, Drought, Salinity, ABA with corresponding accuracy of falling into particular classes. Presently this web application only predicts sequences which are related to cereals only. In future same approach can be extended to other crop also.

(v) **Purru Supriya**

Chairperson: Dr. KV Bhat

Assembly, Annotation, Functional Classification of Transcriptomes and identification of Key Genes for Moisture Stress Tolerance in *Cucumis Melo*

Musk melon (*Cucumis melo* L., *Cucurbitaceae*) is an important fruit crop. It is considered to be the most variable species in the genus *Cucumis* and one of the most diverse among the cultivated vegetables. Moisture stress is one of the major restraining factors for its production. To minimize the yield losses caused by moisture stress, there is a need to identify the genes possessing stress tolerance. The main objective of present study was to identify key genes that play a major role in moisture stress tolerance by *de novo* assembly and annotation of musk melon transcriptome. Transcriptomic analyses of plant responses to stress are an effective way in which genes, pathways and processes responsible for plant stress tolerance can be identified. A high-throughput, SOLiD sequencing technology was employed to characterize the *de novo* transcriptome of musk melon. A total of 47,035,393 and 45,152,235 high quality unique reads for *cucumis melo* control sample and stress sample were assembled into 12859 and 13448 transcripts, respectively using CAP3, DNA STAR and CLC *de novo* assembly programs. Merging of assemblies by CAP3 resulted in larger and robust transcripts instead of using a single program alone. This *de novo* assembly of melon transcriptome from control and stress samples provides a rich source for gene identification. These transcripts were annotated with gene ontology (GO) terms. All the GO terms were classified into 37 functional groups including biological processes, cellular component and molecular function. Comparison of gene expression levels between control and stress transcriptomes by RNA-Seq mapping revealed that 122 stress responsive genes were commonly expressed in both the samples whereas 72 genes were highly up regulated in stress sample such as kinases, DREB genes, heat shock proteins, MYB transcription factors, Zinc-finger, and AP2 / ERF domain containing transcription factors. Among these, 4 genes are

involved in path ways such as plant-hormone signal transduction, protein processing in endoplasmic reticulum and Inositol phosphate metabolism. These selected genes will not only facilitate understanding of genetic basis of moisture stress response, but also accelerate genetic improvement through marker-assisted selection in musk melon.

Certificate Course

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 Institutes of the Council, State Agricultural Universities, State Government Departments, and 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 17 to Nov. 22, 2014. The Course comprised of two

independent modules of three months duration each. Module – I was organized during June 17 to August 19, 2014 and Module-II was organized during September 2 to November 22, 2014. The courses covered under both the modules are as given:

Topic	Instructor
Module – I	
Statistical Methods	Dr. Prawin Arya, Dr. Prabina Kumar Meher and Dr. Arpan Bhowmik
Official Agricultural Statistics	Dr. A K Gupta
Use of Computers in Agricultural Research	Dr. Amrit Kumar Pal, Md. Wasi Alam, Sh. Pal Singh and Sh. Upendra Kumar Pradhan
Module – II	
Sampling Techniques	Dr. Prachi Misra Sahoo and Dr. Kaustav Aditya
Econometrics and Forecasting Techniques	Dr. Prawin Arya and Md. Wasi Alam
Design of Experiments	Dr. Eldho Varghese and Dr. Arpan Bhowmik

Category	No. of Training Programmes	No. of Participants
CAFT	6	122
NAIP	13	403
Resource Generation	4	67
Others	2	44
Total	25	636

Details of Training Programmes Organised

S. No.	Title	Venue	Date	Sponsored by	No. of Participants
Centre of Advanced Faculty Training					
1.	Forecast Modelling Analytics in Crops Coordinator : Dr. Prawin Arya Co-Cordinator : Dr. Sanjeev Panwar	IASRI, New Delhi	30 May - 19 June 2014	Education Division ICAR	23
2.	Agricultural Web Applications Development using Content Management Tools Coordinator : Dr. Mukesh Kumar Co-Cordinator : Dr. N Srinivasa Rao	IASRI, New Delhi	24 September - 14 October, 2014	Education Division ICAR	16
3.	Recent Advances in Survey Design and Analysis of Survey Data using Statistical Software Coordinator : Dr. Hukum Chandra Co-Cordinator : Dr. Kaustav Aditya	IASRI, New Delhi	28 October - 17 November, 2014	Education Division ICAR	20
4.	Advances in Omics Data Analysis: Learning by Examples Coordinator : Sh. Sanjeev Kumar Co-Cordinator : Dr. DC Mishra	IASRI, New Delhi	03-23 December 2014	Education Division ICAR	22

5.	Advanced Statistical Techniques in Horticulture Science Research Coordinator : Dr. Sukanta Dash Co-Cordinator : Dr. Susheel Kumar Sarkar	IASRI, Delhi	New	02-22 January 2015	Education Division ICAR	15
6.	Recent Advances in Statistical Genetics Coordinator : Dr. AK Paul Co-Cordinator : Dr. RK Paul	IASRI, Delhi	New	03-23 February 2015	Education Division ICAR	26
National Agricultural Innovative Project						
7.	Basic Training on Discovery Studio Coordinators : Dr. MA Iquebal : Dr. Sarika	IASRI, Delhi	New	01-03 May 2014	NAIP	20
8.	High Performance Computing with the collaboration of C-DAC, Pune Coordinator : Sh. KK Chaturvedi	IASRI, Delhi	New	12-17 May 2014	NAIP	20
9.	Oracle Database 11g: Administration Workshop Coordinator : Sh. KK Chaturvedi	KLJ Solution Ltd. Motinagar, New Delhi		19-23 May 2014	NAIP	16
10.	Six Modules of SAS Software Coordinator : Md. Samir Farooqi • SAS Data Integration Studio: Fast Track • Data Flux Data Management Studio: Fast Track • Text Analytics Using SAS Text Miner • Managing SAS Analytical Models Using SAS Model Manager • Grid Computing (SAS Enterprise Scheduling with Platform Suite for SAS) • SAS Content Categorization Studio: Building Models	IASRI, Delhi	New	26 May - 19 June 2014 26-30 May 2014 02-06 June 2014 09-10 June 2014 11-13 June 2014 16-17 June 2014 18-19 June 2014.	NAIP	20
11.	Advance Training on Discovery Studio Software Coordinators : Dr. Sarika : Dr. MA Iquebal	IASRI, Delhi	New	17-21 June 2014	NAIP	20
12.	Post ICAR-ERP Implementation Coordinator: Dr. AK Choubey	IGFRI, Jhansi		21-22 July, 2014	NAIP	10
13.	Knowledge Enhancement Session or MIS/FMS Solution by IBM Coordinator : Dr. NS Rao	IASRI, Delhi NAARM, Hyderabad	New	22-24 December 2014 10-11 October, 2014	NAIP NAIP	28 50
14.	Post Go-Live Knowledge Enhancement Session for MIS/FMS Solution	IASRI, Delhi	New		NAIP	
	Cordinator : Dr. NS Rao Co-Cordinator : Dr. AK Choubey			01-05 August 2014		67
	Cordinator : Dr. Anshu Bhardwaj Co-Cordinator : Dr. Alka Arora			August 20- 23 2014		46
	Cordinator : Dr. Alka Arora Co-Cordinator : Dr. Sudeep			15-18 September 2014		16
	Cordinator : Dr. Anshu Bhardwaj Co-Cordinator : Dr. Mukesh Kumar			23-26 September 2014		35
	Cordinator : Dr. AK Choubey Co-Cordinator : Dr. Alka Arora			29-30 September 2014		27
	Cordinator : Dr. Mukesh Kumar Co-Cordinator : Dr. AK Choubey			22-24 December 2014		28

Resource Generation					
15.	Data Analysis and Interpretation for ISS Probationers of XXXV Batch Course Director : Dr. Rajender Parsad Co- Course Director : Dr. Eldho Varghese	IASRI, New Delhi	05-23 May 2014	Central Statistics Office, Ministry of Statistics and Programme Implementation	21
16.	A Refresher Training Programme on Statistical Techniques Course Director : Dr. Hukum Chandra	IASRI, New Delhi	08-12 September, 2014	Livestock Department Government of Chhattisgarh	20
17.	International Training Programme on Importance of Statistical and Experimental Designs, Data Analysis and Biometrical Techniques in Agriculture Research Course Director : Dr. Rajender Parsad Co- Course Directors : Dr. Eldho Varghese Dr. Sukanta Dash	IASRI, New Delhi	17 November, 2014 -07 February, 2015	Ministry of Agriculture, Irrigation and Livestock (MAIL), Afghanistan	16
18.	International Training Programme on Applications of Remote Sensing and GIS in Agricultural Surveys Course Director : Dr. Prachi Misra Sahoo Co- Course Director : Dr. Tauqueer Ahmad	IASRI, New Delhi	12 February - 04 March 2015	African-Asian Rural Development Organization (AARDO)	10
Others					
19.	Office Automation using Oracle ERP for Technical Personnels of ICAR Coordinator : Dr. Sudeep Co- Coordinator : Dr. Anshu Bhardwaj	IASRI, New Delhi	09-13 March 2015	ICAR	22
20.	Office Automation using Oracle ERP for Technical Personnels of ICAR Coordinator : Dr. Alka Arora Co- Coordinator : Dr. N Srinivasa Rao	IASRI, New Delhi	16-20 March 2015	ICAR	22

Faculty Members of PG School, IARI In Agricultural Statistics

S. No.	Name	Year of Induction
1.	Dr. UC Sud, Director	1995
2.	Dr. VK Gupta, National Professor	1984
3.	Dr. Seema Jaggi, Professor (Agricultural Statistics) from July 23, 2014	1995
4.	Dr. Anil Rai, Professor (Bioinformatics) and Head (Centre for Agricultural Bioinformatics)	1995
5.	Dr. KN Singh, Principal Scientist and Head (Forecasting and Agricultural System Modelling)	2011
6.	Dr. Rajender Parsad, Principal Scientist and Professor Agricultural Statistics till July 22, 2014	1995
7.	Sh. SD Wahi, Principal Scientist	1987
8.	Dr. KK Tyagi, Principal Scientist (Retired on September 30, 2014)	1995
9.	Dr. Lal Mohan Bhar, Principal Scientist	1998
10.	Dr. Amrit Kumar Paul, Principal Scientist	1998
11.	Dr. Tauqueer Ahmad, Principal Scientist	1998
12.	Dr. AR Rao, Principal Scientist	1998

S. No.	Name	Year of Induction
13.	Dr. Girish Kumar Jha, Principal Scientist (at IARI)	1999
14.	Dr. Cini Varghese, Principal Scientist	2000
15.	Dr. Himadri Ghosh, Principal Scientist	2004
16.	Dr. Hukum Chandra, National Fellow	2003
17.	Dr. Anil Kumar, Principal Scientist	2010
18.	Dr. Prachi Misra Sahoo, Senior Scientist	2002
19.	Dr. Amrender Kumar, Senior Scientist (at IARI)	2003
20.	Md. Wasi Alam, Scientist	2003
21.	Dr. Prawin Arya, Senior Scientist	2003
22.	Dr. Sanjeev Panwar, Scientist	2011
23.	Dr. Ranjit Kumar Paul, Scientist	2011
24.	Dr. Mir Asif Iqbal, Scientist	2011
25.	Dr. BN Mandal, Scientist	2011
26.	Dr. Susheel Kumar Sarkar, Scientist	2011
27.	Dr. Eldho Varghese, Scientist	2011
28.	Dr. Kaustav Aditya, Scientist	2012
29.	Dr. Bishal Gurung, Scientist	2013
30.	Dr. Sukanta Dash, Scientist	2013
31.	Dr. Arpan Bhowmik, Scientist	2014

Faculty Members of PG School, IARI in Computer Application

S. No.	Name	Year of Induction
1.	Dr. PK Malhotra, Professor (Computer Application) (Retired on September 30, 2014)	1991
2.	Dr. Seema Jaggi, Professor (Computer Application) from October 1, 2014	
3.	Dr. Anjani Kumar Choubey, Head (Computer Applications)	2014
4.	Dr. Alka Arora, Senior Scientist	2001
5.	Dr. Sudeep, Senior Scientist	2002
6.	Ms. Shashi Dahiya, Scientist	2001
7.	Md. Samir Farooqi, Scientist	2001
8.	Sh. KK Chaturvedi, Scientist	2002
9.	Ms. Anu Sharma, Scientist	2004
10.	Sh. SN Islam, Scientist	2004
11.	Sh. SB Lal, Scientist	2004
12.	Dr. Anshu Bhardwaj, Scientist	2004
13.	Dr. Sangeeta Ahuja, Scientist	2002
14.	Dr. Rajni Jain, Principal Scientist (at NIAP)	2007
15.	Sh. Pal Singh, Scientist	2010
16.	Dr. Mukesh Kumar, Senior Scientist	2014
17.	Dr. N Srinivasa Rao, Senior Scientist	2014
18.	Dr. AK Mishra, Senior Scientist	2014

Faculty Members of PG School, IARI in Bioinformatics

S. No.	Name	Year of Induction
1.	Dr. Anil Rai, Professor (Bioinformatics) and Head (Centre for Agricultural Bioinformatics)	2010
2.	Dr. KC Bansal, Director, NBPGR	2010
3.	Dr. Rajender Parsad, Principal Scientist	2010
4.	Dr. Seema Jaggi, Principal Scientist and Head (Off.) Design of Experiments	2010
5.	Dr. AR Rao, Principal Scientist	2010
6.	Dr. Sudeep, Senior Scientist	2010
7.	Sh. SB Lal, Scientist	2010
8.	Md. Samir Farooqi, Scientist	2010
9.	Ms. Anu Sharma, Scientist	2010
10.	Dr. TR Sharma, Director, NRCPB	2010

11.	Dr. Kishore Gaikwad, Senior Scientist	2010
12.	Dr. T Napoleon, Senior Scientist	2010
13.	Dr. PK Singh, Senior Scientist	2010
14.	Dr. KV Bhat, Principal Scientist	2010
15.	Dr. SS Marla, Principal Scientist	2010
16.	Dr. Sunil Archak, Senior Scientist	2010
17.	Dr. DC Mishra, Scientist	2010
18.	Dr. Sarika, Scientist	2010
19.	Sh. Sanjeev Kumar, Scientist	2010
20.	Dr. AK Mishra, Senior Scientist	2010
21.	Dr. Mir Asif Iquebal, Scientist	2013
22.	Dr. Monendra Grover, Senior Scientist	2013
23.	Dr. UB Angadi, Senior Scientist	2014
24.	Sh. KK Chaturvedi, Scientist	2014

Research Fellowships

During this period, 27 Ph.D. and 41 M.Sc. students received research fellowship. 22 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 @12,000/- p.m. in addition to Rs.10,000/- per annum as contingent grant. There was 01 departmental candidate.

03 Ph.D. students received DST-Inspire scholarship @ 18,000/-+30% HRA P.M. in addition to Rs.20,000/- per annum as contingent 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 25 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. There are 03 foreign students who have not received the fellowship from the institute.

Strengthening of Post Graduate Programme

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

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

The system is being updated regularly by adding new features.

53rd Convocation of Post Graduate School IARI

53rd Convocation of Post Graduate School IARI was held during 16-20 February 2015. A total of 18

students in the disciplines of Agricultural Statistics, Computer Application and Bioinformatics have been awarded with Ph.D. / M.Sc. degrees. The discipline-wise number of students who got degrees are as follows:

- 5 Ph.D and 6 M.Sc. (Agricultural Statistics)
- 2 M.Sc. (Computer Application)
- 5 M.Sc. (Bioinformatics)

A session on 'Significant Educational Achievements 2014-15' was also organized in which Dr. Seema Jaggi, Professor (Agricultural Statistics and Computer Application) and Dr. Anil Rai, Professor (Bioinformatics) made presentation of their respective disciplines.



Courses taught during the Academic Year 2013-14 in Agricultural Statistics

Trimester - III				
Code	Course Title	Credits		Instructors
		L	P	
PGS 504	Basic Statistical Methods in Agriculture	2	1	Susheel Kumar Sarkar, Sarika, Kaustav Aditya
AS 503	Basic Sampling and Non-parametric Methods	2	1	KK Tyagi, Anil Rai, Wasi Alam
AS 563	Statistical Inference	4	1	KN Singh, LM Bhar, Hukum Chandra
AS 564	Design of Experiments	3	1	Seema Jaggi, VK Gupta, Rajender Parsad
AS 566	Statistical Genetics	3	1	SD Wahi, Amrit Kumar Paul
AS 662	Advanced Design for Multi-factor Experiments	2	1	Rajender Parsad, Eldho Varghese, Sukanta Dash
AS 664	Inferential Aspects of Survey Sampling and Analysis of Survey Data	2	1	UC Sud, Hukum Chandra
AS 667	Forecasting Techniques	1	1	Amrender Kumar, Wasi Alam
AS 691	Seminar	1	0	Kanchan Sinha

Courses taught during the Academic Year 2014-15 in Agricultural Statistics

Trimester - I				
Code	Course Title	Credits		Instructors
		L	P	
PGS 504	Basic Statistical Methods in Agriculture	2	1	Eldho Varghese, AK Gupta, Upendra Pradhan
AS 501	Basic Statistical Methods	2	1	Mir Asif Iquebal, Kaustav Aditya
AS 550	Mathematical Methods	4	0	Cini Varghese, Himadri Ghosh
AS 560	Probability Theory	2	0	KN Singh
AS 561	Statistical Methods	2	1	Seema Jaggi, RK Paul, Eldho Varghese
AS 567	Applied Multivariate Analysis	2	1	AR Rao, Bishal Gurung
AS 568	Econometrics	2	1	Prawin Arya, GK Jha
AS 569	Planning of Surveys/Experiments	2	1	UC Sud, KK Tyagi, BN Mandal
AS 572	Statistical Quality Control	2	0	Wasi Alam, Kanchan Sinha
AS 600	Advanced Design of Experiments	1	1	Rajender Parsad, Cini Varghese
AS 601	Advanced Sampling Techniques	1	1	Hukum Chandra, Prachi Misra Sahoo
AS 602	Advanced Statistical Genetics	1	1	SD Wahi, AK Paul
AS 603	Regression Analysis	1	1	LM Bhar, RK Paul
AS 604	Linear Models	2	0	Rajender Parsad, VK Gupta
AS 606	Optimization Techniques	1	1	Amrender Kumar, RK Paul
AS 691	Seminar	1	0	Bishal Gurung
Trimester - II				
Code	Course Title	Credits		Instructors
		L	P	
PGS 504	Basic Statistical Methods in Agriculture	2	1	Amrit Kumar Paul, Eldho Varghese, Arpan Bhowmik
AS 502	Basic Design of Experiments	2	1	Susheel Kumar Sarkar, Sukanta Dash
AS 551	Mathematical Methods in Statistics	4	0	Cini Varghese, Sukanta Dash, Samrendra Das
AS 562	Advanced Statistical Methods	2	1	Seema Jaggi, RK Paul, Arpan Bhowmik
AS 565	Sampling Techniques	3	1	Tauqueer Ahmad, Prachi Misra Sahoo, Kaustav Aditya
AS 570	Statistical Modeling	2	1	RK Paul, Bishal Gurung
AS 571	Bioinformatics	3	1	AR Rao, Samrendra Das
AS 573	Demography	2	0	Bishal Gurung, AK Gupta
AS 605	Advanced Statistical Inference	1	1	KN Singh, LM Bhar
AS 607	Stochastic Process	3	0	Himadri Ghosh, Kanchan Sinha
AS 661	Advanced Designs for Single Factor Experiments	2	1	LM Bhar, VK Gupta
AS 663	Advanced Theory of Sample Surveys	2	1	Hukum Chandra, Tauqueer Ahmad
AS 691	Seminar	1	0	Sanjeev Panwar

Courses taught during the Academic Year 2013-14 in Computer Application

Trimester - III				
Code	Course Title	Credits		Instructors
		L	P	
CA 503	Statistical Computing in Agriculture	1	2	Rajender Parsad, RK Paul, Sukanta Dash
CA 563	Operating System	2	1	Yogesh Gautam, N Srinivasa Rao
CA 567	Computer Networks	2	1	SN Islam, Mukesh Kumar
CA 568	Software Engineering	2	0	AK Choubey
CA 571	Modeling and Simulation	2	1	PK Malhotra
CA 613	Artificial Neural Networks	2	1	Anshu Bhardwaj, GK Jha
CA 614	Knowledge Database Systems for Semantic Web	2	1	Sudeep
CA 691	Seminar	1	0	PK Malhotra

Courses taught during the Academic Year 2014-15 in Computer Application

Trimester - I				
Code	Course Title	Credits		Instructors
		L	P	
CA 502	Introduction to Computer Application	1	1	SN Islam, Samir Farooqi
CA 551	Mathematical Foundations in Computer Application	4	0	Sukanta Dash, Samrendra Das
CA 552	Computer Oriented Numerical Methods	2	1	Pal Singh, Upendra Pradhan
CA 560	Computer Organization and Architecture	3	0	N Srinivasa Rao
CA 561/ BI 505	Principles of Computer Programming	2	1	SB Lal, KK Chaturvedi
CA 565	Compiler Construction	2	1	Sangeeta Ahuja
CA 569	Web Technologies and Applications	2	1	Alka Arora, SB Lal
CA 575	Artificial Intelligence	2	1	Rajni Jain, Sudeep
CA 691	Seminar	1	0	SN Islam
Trimester - II				
Code	Course Title	Credits		Instructors
		L	P	
CA 501	Computer Fundamentals and Programming	3	1	Pal Singh, Sangeeta Ahuja
CA 562	Object Oriented Analysis and Design	2	1	Sudeep, N Srinivasa Rao
CA 564	Data Structures and Algorithms	2	1	AR Rao
CA 566 /BI 507	Data Base Management System	2	2	SB Lal, Mukesh Kumar
CA 572	GIS and Remote Sensing Techniques	2	1	Prachi Misra Sahoo, Anshu Bhardwaj
CA 573	Data Warehousing	2	1	Samir Farooqi, KK Chaturvedi
CA 577	Data Mining and Soft Computing	2	1	Alka Arora, Anshu Bhardwaj
CA 691	Seminar	1	0	Pal Singh

Courses taught during the Academic Year 2013-14 in Bioinformatics

Trimester - III				
Code	Course Title	Credits		Instructors
		L	P	
BI 510	Biological Databases and Data Analysis	2	1	Sanjeev Kumar, Samir Farooqi, MA Iquebal, MNV Parsad Gajula
BI 511	RNA/Protein Structure Prediction and Molecular Modeling	1	2	Sarika, Soma S Marla, Anil Rai
BI 512/ AS 608	Advanced Bioinformatics	2	1	AR Rao, M Grover, DC Mishra
BI 691	Seminar	1	0	Mir Asif Iquebal

Courses taught during the Academic Year 2014-15 in Bioinformatics

Trimester - I				
Code	Course Title	Credits		Instructors
		L	P	
BI 501/ MBB 509 /GP 540	Introduction to Bioinformatics	2	1	AR Rao, TR Sharma, K Gaiwad
BI 503	Mathematical Foundation in Computer Application	4	0	NK Sharma, Sukanta Dash
BI 505	Principles of Computer Programming	2	1	SB Lal, KK Chaturvedi
BI 510 – 2014	Principles of Biotechnology	4	0	Ramcharan Bhattacharya
BI 511 – 2014	Basic Biochemistry	4	1	Raj Deo Rai
BI 524	Tools and Techniques for Biological Data Mining	2	1	Sanjeev Kumar, MA Iquebal
BI 525	Advanced Programming in Bioinformatics	2	1	SB Lal, KK Chaturvedi
BI 601 - 2014	Genome Assembly and Annotation	1	2	Sanjeev Kumar, DC Mishra
BI 602	Bimolecular Modeling & Simulation	2	1	UB Angadi, Sudhir Srivastava
BI 691	Seminar	1	0	Sarika
Trimester - II				
Code	Course Title	Credits		Instructors
		L	P	
BI 506 – 2014	Computational Genomics	3	1	Mir Asif Iquebal, DC Mishra, Sarika
BI 507/ CA 566	Database Management System	2	2	SB Lal, Mukesh Kumar
BI 508	Computer Applications in Bioinformatics	2	1	SB Lal, KK Chaturvedi
BI 604 – 2014	Computational Techniques of Transcriptomics and Metabolomics	1	1	AR Rao, Md. Samir Farooqi
BI 642 – 2014	Genome Wide Association Study	2	1	KV Bhatt, Sunil Archak, T Napoleon
BI 691	Seminar	1	0	Md. Samir Farooqi

Board of Studies for Academic Year 2014-15

Agricultural Statistics

1.	Dr. Seema Jaggi, Professor (Agricultural Statistics)	Chairperson
2.	Dr. UC Sud, Director	Member (Ex-officio)
3.	Dr. KN Singh, Head (F&ASM)	Member
4.	Dr. Cini Varghese, Senior Scientist	Member
5.	Sh. Wasi Alam, Scientist	Member Secretary
6.	Sh. Pratyush Dasgupta, Student	Students' Representative

Computer Application

1.	Dr. P.K. Malhotra, Professor (Computer Application)	Chairman (till September 30, 2014)
2.	Dr. Seema Jaggi, Professor (Computer Application)	Chairperson (since October 1, 2014)
3.	Dr. UC Sud, Director	Member (Ex-officio)
4.	Dr. AK Choubey, Head, (CA)	Member
5.	Dr. Rajni Jain, Principal Scientist	Member
6.	Sh. KK Chaturvedi, Scientist	Member
7.	Dr. Alka Arora, Senior Scientist	Member Secretary
8.	Sh. Chandan Kumar Deb, Student	Students' Representative

Bioinformatics

1.	Dr. Anil Rai, Professor (Bioinformatics)	Chairman
2.	Dr. UC Sud, Director	Member (Ex-officio)
3.	Dr. AR Rao, Principal Scientist	Member
4.	Dr. SS Marla, Principal Scientist	Member
5.	Dr. UB Angadi, Senior Scientist	Member
6.	Dr. Kishore Gaikward, Principal Scientist	Member

7.	Dr. MA Iqbal, Scientist	Member Secretary
8.	Students' Representative	Md. Asif Khan, Student

Central Examination Committee for Academic Year 2014-15

Agricultural Statistics

1.	Dr. UC Sud, Director
2.	Dr. Seema Jaggi, Professor (Agricultural Statistics)
3.	Dr. Tauqueer Ahmad, Principal Scientist
4.	Dr. LM Bhar, Principal Scientist and Head (Statistical Genetics)
5.	Dr. AR Rao, Principal Scientist
6.	Dr. Himadri Ghosh, Principal Scientist

Computer Application

1.	Dr. UC Sud, Director
2.	Dr. P.K. Malhotra, Professor (Computer Application) Till September 30, 2014 Dr. Seema Jaggi, Professor (Computer Application) w.e.f. October 1, 2014
3.	Dr. Rajni Jain, Principal Scientist
4.	Dr. Sudeep, Senior Scientist
5.	Dr. Alka Arora, Senior Scientist
6.	Sh. KK Chaturvedi, Scientist
7.	Sh. SB Lal, Scientist
8.	Dr. Tauqueer Ahmad, Principal Scientist

Bioinformatics

1.	Dr. UC Sud, Director
2.	Dr. Anil Rai, Professor (Bioinformatics)
3.	Dr. AR Rao, Principal Scientist
4.	Dr. KV Bhatt, Principal Scientist
5.	Dr. Kishore Gaikwad, Senior Scientist
6.	Dr. UB Angadi, Senior Scientist

5

AWARDS AND RECOGNITIONS

AWARDS

Dr. Seema Jaggi

- Received the Bharat Ratna Dr. C. Subramaniam Award for Outstanding Teachers-2013 for excellent teaching in the field of Social Sciences during the 86th ICAR Foundation Day and Award Ceremony held at NASC Complex, New Delhi on July 29, 2014.



Dr. Hukum Chandra

- Awarded ICAR-National Fellow.



- Received Professor PV Sukhatme Gold Medal Award 2014 by the Indian Society of Agricultural Statistics (ISAS), New Delhi for outstanding contribution in the field of Agricultural Statistics.

Dr. Alka Arora

- Received the Best Paper Award during 68th Annual Conference of ISAS (January 29-31, 2015) for the following paper published in the Journal of ISAS in the Computer Science Section:
Jain, Rajni, Alam, AKM Samimul and Arora, Alka (2013). WBSTFP: Software for TFP Computation in Agriculture. *Journal of the Indian Society of Agricultural Statistics*, 67(3), 381-391.

Sh. KK Chaturvedi

- Received Fellowship Award of the Society of Scientific Development in Agriculture and Technology, Meerut for the outstanding contributions in the field of Computer Application.

Dr. Arpan Bhowmik

- Received Dr. GR Seth Memorial Young Scientist Appreciation Certificate-2013 from ISAS during its 68th Annual Conference organized from 29-31 January, 2015 at IASRI, New Delhi for the paper entitled 'Optimal Block Designs under a Non-Additive Mixed Effects Interference Model' by Arpan Bhowmik, Seema Jaggi, Eldho Varghese and Cini Varghese presented in the 67th Annual Conference of ISAS organized by Department of Farm engineering, Institute of Agricultural Sciences during 18-20 December, 2013 at Banaras Hindu University, Varanasi.

Best Paper/ Poster Awards

- Iquebal, MA, Sarika, Angadi, UB, Arora, Vasu, Sablok, Gaurav, Kumar, Sunil, Rai, Anil and Kumar, Dinesh. SBMDb: First whole genome based DNA microsatellite database of sugarbeet for bioenergy and industrial application. Awarded first in the 2nd National Conference on Converging Technologies Beyond 2020 (2CTB-2010) held during November 28-29, 2014 at University Institute of Engineering and Technology, Kurukshetra University, Kurukshetra, Haryana.
- Tandon, G, Jaiswal, S, Iquebal, MA, Singh, S, Kumar, S, Rai, A and Kumar D. In silico study of interaction of EDS1 and PAD4 proteins in tomato using molecular dynamics approach. Best paper award in Proteomics Session in International Symposium on New Perspectives in Modern Biotechnology organized during March 23-25, 2015 by Society for Applied Biotechnology at Puducherry.
- Kaur, S, Iquebal, MA, Jaiswal, S, Singh, S, Rai A and Kumar, D. In silico prediction and functional characterization of genes related to abiotic and biotic stresses in chickpea (*Cicer arietinum*). Best paper award in Genomics Session in International Symposium on New Perspectives in Modern Biotechnology organized during March 23-25, 2015 by Society for Applied Biotechnology at Puducherry.
- Joshi, Alka, Rudra, Shalini G, Sagar, VR, Varghese, Eldho, Singh, Brajesh, Raigond, Pinky and Singh, BP. Mineral fortification in potato chips by vacuum impregnation. Awarded second prize in poster presentation in National Seminar on Emerging Problems on Potato held in CPRI, Shimla organized during November 01-02, 2014 by IPA, Shimla in collaboration with CPRI, Shimla.
- Saxena, Raka, Kumar, Anil, Pavithra, S, Paul, Ranjit Kumar, Pal Kavita, Rana Simmi and Chauhan, Sonia. The intensity of market infrastructure for linking the smallholder farmers to markets: Evidences from selected markets of Uttarakhand. Best poster award in the XII Agricultural Science Congress at ICAR-NDRI Karnal during 3-6 February, 2015.

RECOGNITIONS

Dr. UC Sud

- Member of the Committee to examine methodological issues relating to fixing Minimum Support Prices (MSPs).
- Member, 17th meeting of Management and Systems Division Council (MSDC) on 10 May 2013 at Bureau of Indian Standards, Manak Bhawan, New Delhi.
- Chairman, 2nd Sub Committee of the Kerala State Strategic Statistical Plan (KSSSP) Implementation Expert Committee (Agricultural Statistics) at Thiruvanthapuram.
- Member of the Committee on Quinquennial Livestock Census Integrated Sample Survey Scheme.
- Chairman of the Technical Monitoring Committee for Central Sector Scheme on “Strengthening of Database and Geographical Information System for the Fisheries Sector”.
- Member, Empowered Committee meeting for Implementation of the Scheme “Awards & Fellowships and Outstanding and Meritorious Research Studies in Statistics”.

Dr. VK Gupta

- President, Society of Statistics and Applications and Patron, for 17th Annual Conference of the Society of Statistics, Computer and Applications held at Birla Institute of Management Technology, Bhubaneswar (February 23-25, 2015). Chaired the Meeting of the Executive Council and General Body Meeting of the Society. Chaired one of the plenary talks on Existence and Construction of Orthogonal Latin Hypercube Designs.
- Executive Council Nominee (Expert Member) on the Governing Body of Agricultural Economics Research Centre for a term of three years w.e.f. February 18, 2014 by Vice-Chancellor, University of Delhi.
- Chairman of the selection committee to fill up the two posts of Research Fellows by Chairperson, GB, Agricultural Economics Research Centre, University of Delhi, Delhi.

Dr. Anil Rai

- Nominated by the Council as Research Advisory Committee (RAC) member of National Institute



of Veterinary Epidemiology and Disease Informatics, Bangalore.

- Nominated as member of Technical Sub-Committee on Natural Rubber Statistic in India.

Dr. AR Rao

- Leading the 3-member team constituted by the Council to assist the ADG, National Agricultural Science Fund (NASF), ICAR in augmentation and analysis of resources generated in it since February 02, 2015.

Dr. Tauqueer Ahmad

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

Dr. Sudeep

- Received Appreciation Letter from Dean, PG School, IARI for excellent teaching in the discipline of Computer Application.

Offices in Professional Societies/ Research Journals

Agricultural Research

Dr. VK Gupta Associate Editor

Aloy Journal of Soft Computing and Applications

Sh. KK Chaturvedi Member, Reviewers Board

Annals of Agricultural Research

Sh. SN Islam Member, Editorial Board

Bureau of Indian Standards, New Delhi

Dr UC Sud Member, Management and Systems Division Council
Member, MSD 3: Statistical Methods for Quality and Reliability

Dr. Rajender Parsad Member, Management and Systems Division Council
Member, MSD 3: Statistical Methods for Quality and Reliability and Member, MSD3:3.4 Basic Statistical Methods

Computer Society of India, Delhi Chapter

Dr. Alka Arora Chairperson, Nomination Committee

Current Trends in Technology & Sciences

Sh. KK Chaturvedi Member, Editorial Board

Greener Journal of Agricultural Sciences

Dr. MA Iquebal Member, Editorial Board

Indian Journal of Agricultural Sciences

Dr. Anil Rai Member, Editorial Board

Indian Journal of Genetics and Plant Breeding

Dr. AR Rao Member, Editorial Board

Indian Society of Agricultural Statistics

Dr. VK Gupta Vice President
Chair Editor, JISAS

Dr. UC Sud Honorary
Associate Editor, JISAS

Dr. Hukum Chandra Joint Secretary

Dr. Lal Mohan Bhar Joint Secretary

Dr. Rajender Parsad Co-ordinating Editor

Dr. Sudeep Member, Executive Council

Dr. Alka Arora Member, Executive Council

Dr. AK Paul Member, Executive Council

Sh. SB Lal Member, Executive Council

Sh. KK Chaturvedi Member, Executive Council

Smt. Sangeeta Ahuja Member, Executive Council

Dr. Prawin Arya Member, Executive Council

Sh. SN Islam Member, Executive Council

Dr. BN Mandal Refree, JISAS

Indian Society of Agroforestry, Jhansi

Dr. Ajit Vice president
Member, Editorial Board, IJA

Indian Society of Pulses Research and Development

Dr. MA Iquebal Member, Editorial Board

Indra Gandhi National Open University, New Delhi

Dr. Rajender Parsad Member, School Board,
School of Science

Institute of Applied Statistics and Development Studies, Lucknow

Dr. VK Gupta President, Governing Body

Dr. UC Sud Member, Governing Body

Dr. Rajender Parsad Member, Governing Body

International Journal of Advanced Research in Computer and Communication Engineering

Sh. KK Chaturvedi Member, Editorial Board

International Journal of Advancements and Developments in Statistical Science

Dr. Hukum Chandra Member, Editorial Board

International Journal of Computational and Theoretical Statistics

Dr. VK Gupta Associate Editor

International Journal of Current Trends in Engineering & Technology (IJCTET)

Sh. KK Chaturvedi Member, Editorial Board

International Journal of Emerging Technology and Advanced Engineering

Sh. KK Chaturvedi Member, Editorial Board

International Journal of Genetics and Genomics

Dr. MA Iquebal Member, Editorial Board

International Statistical Institute, Netherlands

Dr. VK Gupta Elected Member

Dr. Rajender Parsad Elected Member

Dr. Hukum Chandra Elected Member

Journal of Computer Science and Engineering

Sh. KK Chaturvedi Member, Editorial Board

Journal of Farming Systems Research and Development Association

Dr. Prawin Arya Member, Editorial Board

Journal of Food Legumes

Dr. MA Iquebal Subject Editor

Journal of Model Assisted Statistics and Applications

Dr. Hukum Chandra Associate Editor

Dr. Eldho Varghese Associate Editor

Journal of Society for Advancement of Wheat Research

Dr. Rajender Parsad Member, Editorial Board

Journal of Statistical Theory and Practice

Dr. VK Gupta Associate Editor

Medicinal and Aromatic Plants Association of India

Dr. N Srinivasa Rao Vice President

Online Journal of Bioinformatics

Dr. MA Iquebal Member, Scientific Board

Open Access Journal for Medicinal and Aromatic Plants (OAJMAP)

Dr. N Srinivasa Rao Associate Editor

Pusa AgriScience, Journal of IARI, PG School

Dr. Rajender Parsad Member, Editorial Board

Rani Laxmi Bai Central Agriculture University, Jhansi

Dr. Ajit Faculty Member

School of Physical Sciences, North Eastern Hill University, Umshing, Shillong

Dr. VK Gupta Member, School Board of Physical Sciences

Society of Statistics, Computer and Applications

Dr. VK Gupta President

Dr. Rajender Parsad Vice President, Executive Editor, Statistics and Application

Dr. LM Bhar Joint Secretary Managing Editor, Statistics and Application

Dr. Seema Jaggi Member, Executive Council

Dr. Alka Arora Member, Executive Council

Dr. Hukum Chandra Member, Executive Council and Associate Editor, Statistics and Applications



Linkages and Collaborations in India and Abroad including Outside Funded Projects

S.No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
International Project				
1.	Mapping and cultural authority of science across Europe and India (MACAS-EU & India)	IHD, New Delhi LSE, London, UK	01 April 2012 (IASRI association w.e.f. 18 July 2013)	30 November 2015
ICAR Institutes/ SAUs				
2.	Bioprospecting of genes and allele mining for abiotic stress tolerance	NRCPB, New Delhi (NAIP Component-IV)	04 May 2009	30 June 2014
3.	Establishment of national agricultural bioinformatics grid for ICAR	ICAR-NBPGR, New Delhi ICAR-NBAGR, Karnal ICAR-NBFGR, Lucknow ICAR-NBAIM, Maunath Bhanjan ICAR-NBAII, Bangalore (NAIP Component-I)	01 April 2010	30 June 2014
4.	Refinement of livestock feed resources and development of dynamic database information system	ICAR-NIANP, Bangaluru	01 July 2010	31 December 2014
5.	Phenomics of moisture deficit and low temperature stress tolerance in rice	ICAR-NRCPB, New Delhi ICAR-IARI, New Delhi Delhi University, New Delhi ICAR-CRRI, Cuttack; ICAR-IGKV, Raipur CAU, Barapani ICAR-RC-NEHR, Barapani	15 February 2011	30 December 2015
6.	Development of web based mushroom expert system	ICAR-DMR, Solan	01 April 2011	31 March 2015
7.	Strengthening and refinement of Maize AgriDaksh	ICAR-DMR, New Delhi	01 April 2011	31 March 2016
8.	Planning, designing and analysis of experiments planned ON-STATION under PDFSR	ICAR-PDFSR, Modipuram	01 April 2012	31 March 2017

9.	Planning, designing and analysis of ON-FARM experiments under PDFSR	ICAR-PDFSR, Modipuram	01 April 2012	31 March 2017
10.	Planning, designing and analysis of data relating to experiments conducted under AICRP on LTFE	AICRP on LTFE ICAR-IISS, Bhopal	01 April 2012	31 March 2017
11.	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 2013	31 March 2017
12.	Engaging farmers, enriching knowledge: agropedia phase-II	IIT, Kanpur (NAIP)	01 April 2013	30 June 2014
13.	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 2016
14.	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	08 December 2016
15.	Network project on market intelligence	ICAR-NIAP, New Delhi (ICAR, DARE)	13 February 2014	31 March 2017
16.	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
17.	Bioinformatics approaches for data analysis and functional inferences in soil metagenome(s)	ICAR-NBAIM, Mau	01 July 2014	30 June 2017
18.	Development and application of electronic learning and diagnostic modules for health management of dogs	ICAR-IVRI, Izatnagar	01 July 2014	31 December 2015
19.	Tobacco Agridaksh: An online expert system	ICAR-CTRI, Rajahmundry	20 October 2014	20 October 2017
20.	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
21.	ICAR network project on transgenics in crops	ICAR-NRCPB (ICAR)	27 January 2015	31 March 2017
Government of India				
22.	Whole genome association (WGA) analysis in common complex diseases: An Indian initiative	UDSC, NII, Delhi University, AIIMS, DMC (DBT)	29 September 2008	31 July 2014
23.	Experimental designs in the presence of indirect effects of treatments	DST	01 October 2011	30 September 2015
24.	Assessment of quantitative harvest and post harvest losses of major crops/ commodities in India	ICAR-CIPHET, Ludhiana (Ministry of Food Processing Industries, Government of India)	01 February 2012 (IASRI association w.e.f. 01 June 2012)	31 March 2015
25.	A new distributed computing framework for data mining	BITS, Pilani (Department of Electronics & Information Technology, Government of India)	15 October 2012 (IASRI association w.e.f. 01 November 2012)	14 October 2015

26.	Pilot study for estimation of seed, feed and wastage ratios of major food grains	National Accounts Division, Central Statistics Office, MOS&PI, Government of India	01 July 2013	30 June 2015
27.	Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals	ICAR-NDRI, Karnal (DBT)	01 February 2013	31 January 2016
28.	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 2016
29.	Study to test the developed alternative methodology for estimation of area and production of horticultural crops. (CHAMAN program under MIDH)	Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MoA), Government of India.	16 September 2014	15 June 2017
30.	Pilot study for developing state level estimates of crop area and production on the basis of sample sizes recommended by Professor Vaidyanthan Committee Report	Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.	16 February 2015	15 February 2017
31.	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
Consultancy Studies				
32.	Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping	FAO	18 December 2014	17 June 2016

ICAR-IASRI

Volume 18 No. 4 NEWS January-March, 2015

- Research Achievements
- Human Resource Development
- Awards and Recognitions
- Forecast of Activities
- Publications
- Authors' Feedback
- Participation
- Conferences/Seminars
- Symposium



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.

A quantitative assessment of harvest and post-harvest losses for 45 major agricultural crops/commodities in 120 districts of the country was made using stratified multistage random sampling design. A comparison of losses between 2013-14 vis-à-vis 2005-2007 was made for various food grains, oilseeds, fruits and vegetables.

Development of resistance to chemical antibiotics in cattle is an unsolved ill date. Anti-Microbial Peptides (AMPs) are considered as alternative to chemical antibiotics. Different machine learning techniques such as Artificial Neural Networks (ANNs) and Support Vector Machines (SVMs) have been applied to predict AMPs in cattle. SVMs with different kernels have exhibited high accuracy of prediction and this were implemented on a web server for classification/prediction of novel AMPs of cattle. The developed server is made available in public domain for ready use by the application scientists.

Phenomics is another emerging area where the institute scientists in collaboration with ICAR-IARI and IIT-Delhi have developed a phenome data management system with several analysis modules meant for estimation of physical and biochemical traits of rice under moisture deficit and low temperature stress tolerance. A non-destructive approach involving regression methodology has been developed for estimation of leaf area and chlorophyll content of rice seedlings under pot culture conditions through image analysis. An online software 'Leaf Area Estimator' has been developed and deployed on the production server for ready use by the experimental biologists.

Two international trainings, one for officials of Ministry for Agriculture, Irrigation and Livestock, Afghanistan and the other for officials of African-Arable Rural Development Organization (AARDO), two CAPT trainings and two trainings for technical personnel of ICAR were organized at the Institute. Besides, four national workshops have also been organized.

Scientists of the institute have received various awards and recognitions. During the period, four new projects were initiated. The staff of the institute has participated in the Swachh Mission organized by ICAR as a part of Swachh Bharat Abhiyan, a national campaign by the Government of India.

Scientists of the institute have published 30 research papers in National/International Journals of repute, published 4 book chapters and delivered 18 invited lectures in various training programmes organized outside the institute. Scientists have participated in different conferences/symposia/workshops, etc. and presented several invited talks, oral/poster papers and organized different sessions in various capacities.

It is hoped that the contents of this document would be informative and useful to scientists in NARS. Any suggestions for improving the contents of the newsletter further would be highly appreciated.

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अंक 10

सांख्यिकी-विमर्श



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लाइब्रेरी एवेन्यू, पुसा, नई दिल्ली - 110012





List of Publications

Research Papers

1. Ahammed, Shabeer TP, Saha, Ajoy, Gajbhiye, VT, Gupta, Suman, Manjaiah, KM and Varghese, Eldho (2014). Simultaneous removal of multiple pesticides from water: Effect of organically modified clays as coagulant aid and adsorbent in coagulation flocculation process. *Environ. Tech.*, DOI:10.1080/09593330.2014.914573.
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3. Ahammed, Shabeer TP, Saha, Ajoy, Gajbhiye, VT, Gupta, Suman, Manjaiah, KM and Varghese, Eldho (2015). Exploitation of nano-Bentonite, nano-Halloysite and organically modified nano-Montmorillonite as an adsorbent and coagulation aid for the removal of multi-pesticides from Water: A sorption modelling approach. *Water Air Soil Pollution*, **226(3)**, DOI:10.1007/s11270-015-2331-8.
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- अशोक कुमार गुप्ता एवं विजय बिन्दल। संस्थान के कीर्तिस्तम्भ: प्रोफेसर बाल बी.पी.एस. गोयल, 1-4
- अंजनी कुमार चौबे, अलका अरोड़ा, सुदीप मरवाह, एन. एस. राव, मुकेश कुमार, राकेश सैनी, सुभाष चन्द एवं ऊषा जैन। भा.कृ.अनु.प. में एकीकृत संचार एवं वेब होस्टिंग – एक अवलोकन, 20-24
- अशोक कुमार गुप्ता, अंकुर बिस्वास एवं विजय बिन्दल। सहसंबंध एवं समाश्रयण, 25-33
- अमृत कुमार पाल, नाओरेम ओकेन्द्रो सिंह, रंजीत कुमार पॉल, बिशाल गुरुंग, वसी आलम एवं सत्यपाल सिंह। मछलियों के मौसमी विकास के लिए साइन वेब फंक्शन के साथ संशोधित गोम्पर्टज मॉडल, 34-38
- हिमाद्री घोष, सविता वधवा एवं प्रज्ञेष्णु। विषम चक्रीय आँकड़ों के पूर्वानुमान के लिए फूरियर स्वसमाश्रयी (एफ-एआर) गुणांक अरैखिक काल-श्रृंखला प्रतिमान-एक व्यष्टि अध्ययन, 39-42
- अलका अरोड़ा, सुदीप मरवाह, कुसुमाकर शर्मा, प्रदीप कुमार मल्होत्रा, ए.के.एम. सामिमुल आलम, पुष्पांजलि रावत एवं ऊषा जैन। सी.बी.पी. वोटल: भा.कृ.अनु.प. द्वारा प्रायोजित प्रशिक्षण कार्यक्रम के ऑनलाइन प्रबन्धन हेतु सूचना तंत्र, 43-45
- प्रवीण आर्य, धर्मराज सिंह, अनिल कुमार, कमलेश नारायण सिंह, रंजीत कुमार पॉल एवं ऊषा जैन। भारत में सरसों की वस्तुओं में बाजार समाकलन, 46-51
- प्राची मिश्रा साहू, तौकीर अहमद, कमलेश नारायण सिंह, अशोक कुमार गुप्ता एवं नीलम चन्द्रा। उपग्रह छाया चित्र में बादल आवरण के अन्तर्गत फसल क्षेत्र आकलन की कार्यप्रणाली विकसित करने के लिये अध्ययन, 52-57
- सुकान्त दाश, सुशील कुमार सरकार, वैद्यनाथ मण्डल एवं देवेन्द्र कुमार। एस.पी.एस.एस. का उपयोग कर मिश्रित मॉडल का विश्लेषण, 58-64
- उपेन्द्र कुमार प्रधान, कृष्ण लाल, विनोद कुमार गुप्ता, प्रबिण कुमार मेहेर एवं विजय पाल सिंह। अपेक्षित उत्पादन के लिए प्रक्रिया चर के साथ मिश्रण प्रयोगों में अनुकूलतम स्थितियाँ, 65-70

- बिशाल गुरुंग, अमृत कुमार पॉल, रंजीत कुमार पॉल एवं कमलेश नारायण सिंह। भारत में स्टिक-लाख के पूर्व अनुमान के लिये स्टोकास्टिक मॉडल, 71–74
- सारिका, मीर आसिफ इकबाल, ऊषा जैन, अनिल राय एवं दिनेश कुमार। भैंस में नए गुण-बिन्दुओं की खोज, 75–77
- रंजीत कुमार पॉल, बिशाल गुरुंग, अमृत कुमार पॉल, वसी आलम एवं कंचन सिन्हा। अरहर दाल के खुदरा मूल्य का पूर्वानुमान, 78–79
- वसी आलम, अमृत कुमार पॉल, रंजीत कुमार पॉल, कंचन सिन्हा एवं राम नरेश। एफिड सरसों के प्रबंधन के लिये श्रेणीबद्ध परीक्षण प्रक्रियाएँ, 80–82
- अमृत कुमार पॉल, नाओरेम ओकेन्द्रो सिंह, रंजीत पॉल, बिशाल गुरुंग एवं ऊषा जैन। प्रत्याशित मान प्राचलों का उपयोग करते हुए आर्डर वन के स्वसमाश्रयी में फॉक्स मॉडल का संयोजन, 83–88
- अर्पण भौमिक, एल्दो वरगीस, सीमा जग्गी, सिनी वरगीस, कादर अली सरकार एवं विजय बिन्दल। रन अनुक्रमों में न्यूनतम स्तर परिवर्तन सहित द्विस्तरीय बहु-उपादानी परीक्षण, 89–93
- सुकान्त दाश, सुशील कुमार सरकार, देवेन्द्र कुमार एवं ज्ञान सिंह। कृत्रिम तंत्रिका नेटवर्क एवं पारंपरिक वर्गीकरण पद्धतियों का तुलनात्मक अध्ययन, 94–96
- बिशाल गुरुंग, कमलेश नारायण सिंह, रंजीत कुमार पॉल एवं लॉरेस लेपचा। भारत के समुद्रीय और पशुधन के निर्यात उत्पादन में वाष्पशीलता और मुद्रीता, 97–101
- वसी आलम, रंजीत कुमार पॉल, अमृत कुमार पॉल, बिशाल गुरुंग, कंचन सिन्हा, कमलेश नारायण सिंह, ऊषा जैन एवं राम नरेश। भारत में पशुधन एवं डेरी उत्पादन की स्थिति, 102–105
- उदय प्रताप सिंह, आत्माकुरी रामाकृष्णा राव, सन्त दास वाही, प्रबिण मेहेर एवं रूपम कुमार सरकार। गुणात्मक और मात्रात्मक आंकड़ों के मिश्रण पर आधारित जर्मप्लाज़म का एक कोर सेट के विकसित करने की विधि, 106–116
- हुकुम चन्द्र एवं विजय बिन्दल। अर्द्ध-सतत डाटा हेतु लघु क्षेत्र आकलन, 117–125
- ऊषा जैन। संस्थान की राजभाषा यात्रा : 2014–15, 126–128

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 - ICT Infrastructure and Unified Messaging & Web Hosting Solution in ICAR, User Manual – Email configuration, Version: 1.0
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- Short documents in different functional areas of MIS & FMS in ICAR have been prepared and made available at <http://www.iasri.res.in/misfms/>. Resources have been created in the areas of Finance(19), HRMS(1), Projects(3), SCM(3) and Others(3) (2014, Choubey, AK, Arora, Alka, Marwaha, Sudeep, Islam, SN, Bhardwaj, Anshu, Kumar, Mukesh, Rao, NS, Singh, Pal, and Ahuja, Sangeeta).
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Consultancy and Advisory Services

Advisory services for researchers in NARS 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

This consultancy was awarded to IASRI by Food and Agriculture Organization (FAO) of United Nations under the “Global Strategy to Improve Agricultural and Rural Statistics” of FAO. The study involves development of an appropriate methodology for estimation of area, production and productivity under mixed, repeated and continuous cropping and subsequent field testing in three countries one each in Asia-Pacific, Latin America/Caribbean and Africa region. The countries identified by the FAO, Rome for field testing of developed methodology are Indonesia, Jamaica and Rwanda in the Asia-Pacific, Caribbean and Africa regions respectively. The first Technical Report of the project entitled “Synthesis of Literature and Framework” was prepared and submitted to the FAO. The comments on the report was received from FAO. The comments were incorporated and the revised first Technical Report was submitted to the funding agency. Gap analysis for crop area and yield estimation in general and crop area and yield estimation under mixed and continuous cropping in particular has been carried out. The methodology for estimating crop area, yield and production under mixed, repeated and continuous cropping has been developed. The schedules for primary data collection as per the developed methodologies were designed. The second Technical Report of the project entitled

“Gap analysis and proposed methodologies for estimation of crop area and crop yield under mixed and continuous cropping” was prepared and submitted to the FAO. Country schedule for obtaining information about the Agricultural Statistics System of the field testing countries and Work Plan for the field testing countries have been prepared and sent to Indonesia and Rwanda.

Advisory Services

Following advisory services were provided to the scientists/students of National Agricultural Research System and other organizations:

- Sh. Cousin Musvosvi, Ph.D. Student, Department of Genetics & Plant Breeding, University of Agricultural Sciences, Dharwad on the analysis of alpha lattice designs to evaluate 72 maize hybrids in one experiment, and 28 maize hybrids in another experiment. The advice was given regarding the SAS Code to be used for the analysis and how to use Indian NARS Statistical computing Portal.
- Shri R Balaji Naik, Ph.D. (Agronomy), S.V. Agricultural College, Tirupati, ANGRAU, Hyderabad on the analysis of data generated using a Strip -Split Plot Design. and Dr. CM Parihar, Scientist (Agronomy), DMR, New Delhi on how to compute percentage increase or decrease in yield over the years using data from an experiment conducted using a split plot design with three main plot treatments (Zero tillage, Permanent Bed and Conventional tillage) and four sub treatments (Maize-wheat-mungbean, Maize-chickpea-sesbania, Maize-mustard-mungbean and Maize-maize-sesbania) cropping systems and three replications.

- Dr. Sujit Sarkar, Scientist, Division of Agricultural Extension, IARI, New Delhi on the use of logistic regression analysis to study the adaptive behavior of farmers in the state of Himachal Pradesh and Rajasthan respectively by taking into account different structural, socio-cultural, psychological and personality variables. A stepwise logistic regression analysis has been performed to identify the most significant variables affecting the adaptive behavior of farmer. A high percentage of correct classification have been observed in both the states respectively.
- Ms. Mayanka, a Research Scholar from Lady Irwin College, Delhi University on the use of Kendall's tau correlation coefficient for measuring the relationship between several socio-economic variables like sex, family type, education, age, marital status, employment, income length of stay in the village.
- Developed maps for the total population of cattle, buffaloes, yak, mithuns, bovines, sheep, goats, horses & ponies, mules, donkeys, camel, pigs etc for Department of Animal Husbandry, Govt. of India.
- Ms. Meenu Gupta, student M.Sc. (Floriculture) on the use of Repeated Measurement ANOVA for data on different bio-chemical parameters observed over a period of time.
- Dr. TV Prasad, Senior Scientist, NBPGR on the use of Probit analysis to obtain LD50 and LD99 value of electron beam on pulse beetle. The probit analysis was performed separately for five different insect stages of pulse beetle viz. egg stage, early larva stage, middle larva stage, late larva stage and pupa stage. The experiment consists of seven different doses of electron beam.
- Dr. KH Singh, Principal Scientist, Directorate of rapeseed and Mustard Research, Bharatpur on analysis of data generated through an alpha design with $v=28$, $b=12$, $r=3$, $k=7$ at four locations.
- Dr. NK Lenka, Principal Scientist, IISS Bhopal on the analysis of data generated from an experiment conducted to study the runoff values from 5 different crop cover treatments in two replications.
- Dr. Vikender Kaur, Scientist, NBPGR, New Delhi on the procedure of analysis of factorial CRD using SAS.
- Dr. Sujay Rakshit and Dr. Harvinder Talwar from Directorate of Sorghum Research, Hyderabad on the analysis of data pertaining to an experiment conducted using an alpha design in three replications in blocks of size 8 to study the performance of 48 genotypes in two artificially created environments (stress: rainfed and no stress) across two locations for two years (2010 and 2011). They were also advised on the SAS code to be used.
- Mr. Sandip Mandal, Scientist, Agricultural Engineering Division, ICAR Research Complex for NEH Region on the use of contrast analysis for studying the impact of 24 treatment combinations (12 doses of bio-char + 2 doses of fertilizer) along with two control on soil biomass, pH, CEC etc.
- Miss Fatima Siddiqui, a Ph.D. student of Department of Statistics and Operations Research, Aligarh Muslim University (AMU), Aligarh in the area of Remote Sensing and Statistics.
- Dr. Neeta Singh, NBPGR, IARI, New Delhi in asymmetrical factorial experiments of responses on germination percentage of various crops like till, mustard, wheat etc. in 14 period, 3 moisture level and 3 temperature condition.
- Dr. Jitendra Kumar, Director, Directorate of Medicinal and Aromatic Plants, Anand on fitting of Ritger and Peppas' equation for determination of diffusion components of 11 different formulations of each of carbofuran and imazethapyr for their release in soil and water.
- Dr. KP Singh, Senior Scientist, Agricultural Mechanization Division, CIAE, Bhopal was advised on the analysis of data generated using a Split Plot Design on Maize-Soybean sequence.
- Scientist at DWR Karnal on the layout of alpha design for an experiment to be conducted to test and compare the 250 genotypes of wheat. Two different layouts: (i) $v=250$, $b=30$, $r=3$, $k=25$ and (ii) $v=250$, $b=75$, $r=3$ and $k=10$ were suggested.
- Dr. Neeta Singh and Dr. Kalyani of NBPGR, IARI, in factorial CRD of two factor at level 11 and 8 for response variable MTS and LEH percentage.
- Mr. Debasish Chakraborty, Scientist, Division of Agricultural Engineering, ICAR research complex for NEH region, Umiam, Meghalaya on the use of split plot design with Agro advisory

- and without Agro advisory as the two main plot treatments and farmer's practice along with modern agronomic practice as the two sub plot treatments.
- Dr. MH Wani, Professor, Rajiv Gandhi Chair, SKUAST-K, Srinagar in cointegration analysis and causality testing for the data of Apple price in different markets of India.
 - Ms. Prativa Sahu, Scientist, NRC on Pomegranate, Solapur. The pollen germination data on male and bisexual flowers, collected from two different position of plant (Nodal and Axile) and kept under 4 different durations in cryopreservation for 5 different cultivars as well as 5 wild germplasms were analysed as Factorial CRD. To get the optimal combinations of flower type, flower position and cryopreservation temperature, the data were analysed using Response surface methodology.
 - Dr. NB Singh, Scientist, NRC on Pomegranate, Solapur on different growth traits to study the performance of pomegranate hardwood cuttings after 90 and 180 days of four different AMF (arbuscular-mycorrhizal fungi) inoculation were analyzed using ANOVA, correlation and regression methodologies.
 - Dr. (Ms) Aarti Bairwa, Scientist, Central Potato Research Station, Muthorai, Udagamandalam (Tamil Nadu) to study the population dynamics of nematode in different crops and for different seasons. This experiment has been conducted for eight different crops such as potato, carrot, radish, beat root, cauliflower, cabbage garlic and French bean.
 - Ms. Shilpa HB, Scientist NRC on Pomegranate, on Genotype-Phenotype association.
 - Mr. Roshan Kumar, Technical Assistant, Central University of Punjab, Bhatinda who is currently doing his Ph.D. with Dr. Elumalai at Presidency College, Madras on the use of clustered analysis for grouping different microbial strain based on various physiochemical characters.
 - Department of Animal Husbandry, Govt. of India regarding development of maps for the total population of cattle, buffaloes, yak, mithuns, bovines, sheep, goats, horses & ponies, mules, donkeys, camel, pigs etc.
 - Ms. Savita, Ph.D. Scholar, Soil Science Department, GB Pant University of Agriculture and Tech., Pantnagar - 263145, Uttarakhand, India.
 - Mrs. Geeta Kalucha, Sr. Asst. Professor, Department of Mathematics, University of Delhi on SAS programming in a sample survey related problem.
 - Ms. Sukanya Barua, Ph.D. scholar of the Division of Agricultural Extension, IARI on regression analysis using indicator variables to determine the factors influencing the knowledge level of the respondents about scientific practices of vegetable cultivation.
 - Dr. Anita Malhotra, Associate Professor, Lakshmibai College, University of Delhi, Delhi on suitable statistical techniques for analysis of data.

Launch Workshop of Research Projects

- Pilot Study for Developing State Level Estimates of Crop Area and Production on the basis of Sample Sizes Recommended by Professor Vaidyanathan Committee Report
- Research on Improving Methods for Estimating Crop Area, Yield and Production under Mixed, Repeated and Continuous Cropping
- Study to Test the Developed Alternative Methodology for Estimation of Area and Production of Horticultural Crops: IASRI Component of CHAMAN Programme under MOH

March 22- 24, 2015
Computer Building, IASRI, Pusa, New Delhi

Division of Sample Survey
ICAR-Indian Agricultural Statistics Research Institute
Library Avenue, Pusa, New Delhi 110012
<http://www.iasri.res.in>





RAC, Management Committee and IRC

Research Advisory Committee (RAC)

The Research Advisory Committee (RAC) of the Institute constituted for a period of three years w.e.f. June 12, 2013 consists of following members:

1. **Dr. Bimal K Roy** Chairman
Director, Indian Statistical Institute,
203 Barrackpore Trunk Road,
Kolkata - 700 108 (West Bengal)
2. **Dr. Rajeeva Karandikar** Member
Director, Chennai Mathematical Institute,
H 1, SIPCOT IT Park, Siruseri,
Kelambakkam - 603 103 (Tamil Nadu)
3. **Dr. Saumyadipta Pyne** Member
PC Mahalanobis Chair Professor,
CR Rao Advanced Institute of Mathematics,
Statistics and Computer Science,
University of Hyderabad Campus,
Prof. CR Rao Road, Hyderabad - 500 046
4. **Dr. Bal BPS Goel** Member
Former Director, IASRI,
B-77, Naraina Vihar,
New Delhi - 110 028
5. **Dr. SD Sharma** Member
Former Director, IASRI,
Former Vice-Chancellor,
Dev Sanskriti Vishwavidyalaya, Haridwar
D-15/02 Second Floor
Ardee City
Gurgaon - 122 011, Haryana
6. **Shri GC Manna** Member
Deputy Director General (ESD),
Central Statistical Office,
MOS & PI, Sardar Patel Bhawan,
Sansad Marg, New Delhi - 110 001
7. **Dr. UC Sud** Member
Director, IASRI, Library Avenue,
New Delhi - 110 012
7. **Assistant Director General (Edn.)** Member
Indian Council of Agricultural Research,
Krishi Anusandhan Bhavan - II, Pusa,
New Delhi – 110 012
9. **Dr. Seema Jaggi** Member-Secretary
Principal Scientist and
Incharge, PME Cell, IASRI,
Library Avenue,
New Delhi - 110 012

The 16th meeting of the RAC of IASRI was organized on January 21, 2015 under the Chairmanship of Professor Bimal K. Roy. The meeting was attended by Dr. SD Sharma, Dr. Bal BPS Goel, Dr. G Venkateshwarlu, ADG (Education Division), ICAR, New Delhi; Dr. UC Sud, Director, IASRI, as members of RAC of the Institute and Dr. Seema Jaggi, Principal Scientist and Incharge, PME Cell, IASRI as Member Secretary RAC. Dr. VK Gupta, National Professor, ICAR, Dr. Prajneshu, Emeritus Scientist and Former Head, Statistical Genetics, IASRI, Dr. Anil Rai, Head, Centre for Agricultural Bioinformatics, Dr. KN Singh, Head, Division of Forecasting and Agricultural Systems Modelling, Dr. AK Chaubey, Head, Division of Computer Applications, Dr. Lal Mohan Bhar, Head, Division of Statistical Genetics, Dr. Rajender Parsad, Former Head, Division of Design of Experiments and Shri SD Wahi, Principal Scientist also attended the meeting as special invitees.

Dr. UC Sud welcomed the Chairman and other members and made the introductory remarks and briefed about the major achievements of the Institute including the establishment of the first



supercomputing hub for Indian Agriculture, ASHOKA (Advanced Supercomputing Hub for OMICS Knowledge in Agriculture) in the institute and its strengthening by adding modules on computational aspects. Further, development and implementation of ICAR-ERP system consisting of a robust and flexible Management Information System (MIS) including Financial Management System (FMS) in ICAR and creation of healthy statistical computing environment in the National Agricultural Research System with the efforts of IASRI was informed. Dr. Sud also informed the house about the newly created Statistical Genetics division in the institute and that Dr. Lal Mohan Bhar has recently joined as Head of this division. He also presented the broad research programmes, significant research achievements, future research programmes and other related activities of the Institute during 2014. He presented the 71 research projects in which scientists of the Institute were involved during the year out of which 25 were externally funded, 1 consultancy project and 1 National Professor Scheme of ICAR. He apprised the members regarding 23 completed research projects and 16 new projects undertaken during the period. Besides, one project under consultancy mode was also undertaken. The institute has published its Annual Report 2013-14, Agriculture Data Book, Quarterly News Letters and Sankhyiki Vimarsh. 79 research papers were published in national/ international refereed journals. A number of popular articles, reference manuals, book chapters,

leaflets/ brochures and e-manuals/e-resources were also published. The scientists of the institute have participated in different conferences/ workshops and a total of 39 papers have been presented in these conferences. The Institute has received the copyright from the Registrar, office of Copyrights, New Delhi for Statistical Package for Factorial Experiments (SPFE 1.0), Statistical Package for Augmented Designs (SPAD), Statistical Package for Animal Breeding (SPAB2.0), Statistical Package for Agricultural Research (SPAR 2.0) and Software for Survey Data Analysis (SSDA 1.0) developed by the institute. Dr. Sud highlighted the awards and recognitions won by the scientists of the Institute. One scientist received the ICAR's Bharat Ratna Dr. C Subramaniam Award for Outstanding Teachers-2013 for excellent teaching in the field of Social Sciences during the 86th ICAR Foundation Day, one scientist awarded ICAR-National Fellow, one scientist received the IARI Merit Medal for his Ph.D. research work during 52nd Convocation of PG School IARI, one scientist received Team Award from Indian Society of Agricultural Engineering for significant contribution in "Assessment of Harvest and Post-Harvest Losses of Major Crops and Livestock Produce in India". Some scientists have received best paper awards and are nominated on Editorial Boards of national and international journals. One scientist has served as an FAO consultant to Bangladesh on harmonization and dissemination of Unified

Agricultural Production Statistics in Bangladesh. The thrust areas for XII plan were also presented under the broad six programmes of the institute and the futuristic approach of the institute as per the Vision 2050 document was also presented. Thereafter, Chairman and Members gave their opening remarks and appreciated the efforts and achievements of the Institute.

Dr. Seema Jaggi, Incharge, Training Administration Cell presented the details of the training and teaching activities of IASRI. It was informed that during the 52nd Convocation of Post Graduate School IARI held on 21st February 2014, 2 Ph.D. (Agricultural Statistics), 8 M.Sc. (Agricultural Statistics), 5 M.Sc. (Computer Application) and 1 M.Sc. (Bioinformatics) students have received their respective degrees. Further, she informed that one Ph.D. (Agricultural Statistics) student received the IARI Merit Medal for his Ph.D. research work and one M.Sc. (Agricultural Statistics) student received the IARI Best Student award. Two students, One M.Sc. (Agricultural Statistics) and one M.Sc. (Computer Application) received the Nehru Memorial Gold Medal of IASRI. It was also informed that some of the students are getting DST Inspire and UGC Fellowships. A land mark event is that the Ph.D. programme in Bioinformatics has been started from academic session 2014-15. It was also informed that during the year, 664 researchers have been trained through various training programmes. A Senior Certificate Course in Agricultural Statistics and Computing was also conducted.

Dr. VK Gupta, ICAR National Professor apprised the RAC about the research activities of the National Professor Scheme. He informed that the monograph entitled "Weighting and Calibration in Sample Survey Estimation" (VK Gupta, UC Sud and Chandra Bhanu Chauhan) has been revised after a review by a referee and has since been sent for publication. Similarly 20 Chapters and three Appendices have been written on the proposed book entitled "Statistical Analysis of Agricultural Experiments." The manuscript is being reviewed by the referees. After review and revision as per the suggestions received the manuscript would be revised and sent for publication. An article on "Significance of Statistical Sciences in Agricultural Research" (Prem Narain, VK Gupta and Rajender Parsad) was submitted to NAAS. For comparing several test preparations with more than one standard preparation, incomplete block designs have been obtained for multiple asymmetric parallel line assays. Use of integer linear programming has been made for generation of incomplete block

designs with a given concurrence matrix and for a derived concurrence matrix using the parameters of the design (v, b, k). The concurrence matrix has nearly balanced concurrences. This has also been extended to generate balanced treatments incomplete block design. Calibration approach has been used in successive sampling for getting the estimate of the mean for the second occasion when the auxiliary information is available and when it is not available. Then two more situations are considered, (i) when the auxiliary information is related with the study variable and (ii) when the auxiliary variable is related with the inverse of the study variable. An article entitled "Predicting soil organic carbon stock in Upper Gangetic Plains of India- A geostatistical model approach" (Vinod K Singh, Meenu Rani, Brahma S Dwivedi, Susheel K Singh, Vinod K Gupta and Rajendra P Mishra) has been submitted for publication. Web resources like Sample Survey Resources Server and Design Resources Server have been further strengthened. These are being widely used by the scientists in NARES that help in improved experimentation, both by way of planning the experiments and analysis of data and drawing more appropriate and valid inferences and converting this information into knowledge.

The members appreciated the efforts made and were satisfied with the co-ordination between ICAR National Professor Research Unit and the Institute. The Chairman and members gave their best wishes for continued outstanding work.

Thereafter all the Heads of the Divisions presented the research achievements of their respective Divisions.

During the presentations, there were academic, healthy and constructive discussions and interactions on the research, teaching and training activities of the Institute. All the members unanimously complimented the Director and Heads of Divisions for an excellent research output, teaching and training activities of the Institute and for doing an excellent work for NARES. They also expressed that the Institute is progressing very well and must continue to play an important role in NARES

After discussions, the following action points emerged:

1. Collaborative research studies may be undertaken with other institutes in India and elsewhere specializing in diverse upcoming fields of study.

2. Efforts should be made to take up projects that will address the estimation of loss due to natural resource depletion and degradation, environmental hazards, climate change etc. The institute must initiate research programmes to study the impact of climate change and environment on agriculture economy, ground water contamination affecting the agriculture productivity and health of farming community.
3. For implementation of the techniques/ methodologies developed, the institute should concentrate its efforts on dissemination of these newly developed techniques/ methodologies to the users.
4. Spatio-temporal models may be developed for predictive and integrative analyses of geo-referenced multi-sectoral data.
5. Methodological and applied research may be conducted to address the challenges of data which has high volume, variety and velocity.
6. The online services and web resources developed may be strengthened. Efforts may be made to develop more such facilities.
7. Attempts should be made to relook into the past methodologies, specifically in the context of crop cutting experiments, so that improvements can be made and techniques developed which are more economical and acceptable.
8. The institute should work on need based and current problems that includes the refined methodology for forecasting in agriculture and intelligent decision making processes.
9. The requirement of "Master's degree in Statistics with Specialization in Agriculture" for recruitment of scientists in the discipline of Statistics and Informatics is not a viable and good option. Council may be approached to remove the "Specialization in Agriculture" requirement.
10. The scientists of the institute may be sent for training in the core areas of Statistics and Informatics to national/ international organizations of repute for enhancing their capabilities and providing an international exposure.
11. The trainees coming to the institute from different institutes as part of their course requirement work for the Institute Projects and contribute significantly. In other institutes, like

ISI, the trainees are given stipend for the work done during their training period. The Council may be requested to waive the fees of trainees.

12. Vacant scientific positions at IASRI should be filled on priority basis and for this the concerned authorities may be approached. Further, for maintaining data centre and providing 24 hours web/IT services, technical manpower is must. Efforts may be made to fill the vacant positions of technical personnel.

Institute Management Committee (IMC)

The Director of the Institute, who is In-charge of the overall management of the Institute, is assisted in the discharge of his functions by the Institute Management Committee (IMC) constituted by the Council. IMC provides a broad-based platform for decision making process by periodically examining the progress of the Institute activities and by recommending suitable remedial measures for bottlenecks, if any. IMC was reconstituted for a period of three years w.e.f. August 27, 2013 vide office order no. 7(1)/2013-Admn.II dated 17.09.2013 with the following members:

- | | |
|--|-----------------------|
| 1. Dr. UC Sud | Chairman (Ex-Officio) |
| Director, IASRI,
Pusa, New Delhi-110 012 | |
| 2. Director of Agriculture | Member |
| Government of Delhi, ITO, New
Delhi-110001 | |
| 3. Director of Agricultural Insurance Statistics & Crop | Member |
| Government of Uttar Pradesh,
Lucknow, UP | |
| 4. Joint Director (Research) | Member |
| IARI, Pusa, New Delhi-110 012 | |
| 5. Dr. (Smt.) Ravinder Kaur | Member |
| Director(A), IARI and
Project Director,
Water Technology Centre,
IARI, Pusa, New Delhi -110 012 | |
| 6. Dr. Suresh Pal | Member |
| Head, Division of
Agricultural Economics,
IARI, Pusa, New Delhi -110 012 | |
| 7. Dr. Niranjan Prasad | Member |
| Division of Processing and
Product Development,
IINRG, Ranchi | |

- 8. Dr. (Smt.) Rajni Jain** Member
Principal Scientist, (till 03.07.2014)
NIAP, Pusa, New Delhi-110 012
- 9. Finance & Accounts Officer** Member
IARI,
Pusa, New Delhi-110 012
- 10. Head of Office** Member Secretary
IASRI,
(Ex-Officio)
Pusa, New Delhi-110 012

63rd meeting of IMC was organized at IASRI on June 13, 2014. At the outset, Dr. UC Sud, Director, IASRI, New Delhi and the Chairman of the Management Committee welcomed all the distinguished members and special invitees present in the meeting. Dr. Seema Jaggi, Incharge PME Cell made presentation on research and other related activities of the institute. She also presented the achievements of completed as well as ongoing research projects of the institute. Dr. PK Malhotra, Professor (Computer Application) and In-charge, Training Administration Cell made presentation on Teaching and Training Activities of the Institute. Further, Members expressed their concern about the vacant positions of both Scientists and Technical Personnel and suggested that this may be pursued with the ICAR urgently. In this regard, it was brought to the knowledge of members that efforts have been initiated to fill up the vacant posts of Scientists and Technical personnel. Actual expenditure incurred up to March 31, 2014 in respect of Plan/ Non-Plan of the Institute was presented before the committee. Purchase of necessary equipments/items under XII plan EFC in the year 2014-15 was put up before the committee with justification for kind consideration and approval was taken.

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, 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 106 on-going research projects was reviewed and 22 research projects were declared complete.

Two meetings (81st and 82nd) of the IRC were held during September 25-26, 2014 and March 19-20, 2015 respectively.

- In the 81st meeting, 11 new research projects (06 Institute funded, 03 in collaboration with other Institutes and 02 outside funded) were approved and progress of 53 on-going research projects (22 Institute funded, 08 in collaboration with other Institutes and 23 outside funded) were discussed and 19 research projects were declared as complete.
- In the 82nd meeting, 05 new research projects (01 Institute funded, 01 in collaboration with other Institutes and 03 outside funded) were approved and progress of 45 on-going research projects (24 Institute funded, 06 in collaboration with other Institute and 15 outside funded) was reviewed and 05 research projects were declared as complete.



Papers Presented and Participation of the Institute at the Conferences/Workshops etc.

- Brainstorming National Workshop on Crop Insurance organized by the Department of Agriculture and Cooperation at Mahalanobis National Crop Forecast Centre, Pusa Campus, New Delhi on May 15, 2014.
 - Sud, UC. Relevance of small area estimation techniques in the context of crop insurance.
- XXXII Group Meeting of the All India Coordinated Research Project on Vegetable Crops, Varanasi, June 24-27, 2014
 - Prasad, Rajender*, Dhandapani, A., Singh, B. and Dash, Sukanta. Information System for Planning and Analysis of Experiments of AICRP on VC.
- Department of Economics and Management, University of Pisa, Pisa, Italy, July 23, 2014.
 - Chandra, H. Estimation of Poverty and Social Exclusion Indicators at the Small Area Level (Invited speaker).
- Department of Statistics, Computer Applications, University of Florence, Florence, Italy on 24 July 2014.
 - Chandra, H. A spatially nonstationary Fay-Herriot model for small area estimation (Invited speaker).
- International Conference on Agriculture, Forestry, Horticulture, Aquaculture, Animal Sciences, Food Technology, Biodiversity and Climate Change Sustainable Approaches (AFHAFBC-2014), at Jawaharlal Nehru University, New Delhi during 30-31 August, 2014.
 - Sarika, Iquebal, MA, Arora, V, Rai, A and Kumar, Dinesh (2014) Development of antimicrobial peptide prediction tool using Support Vector Machine based approach.
- Sixth Workshop on Forging Partnerships in Statistical Training in Asia and the Pacific: Networking for Agricultural and Rural Statistics, 02-04 September 2014, Tsukuba, Ibaraki, Japan.
 - Chandra, H. A curriculum for training on agricultural and rural statistics (Invited speaker).
- International Conference on Innovative Approach in Applied Physical, Mathematical / Statistical, Chemical Sciences and Emerging Energy Technology for Sustainable Development (APMSCSET-2014) at Jawaharlal Nehru University, New Delhi, during September, 27-28, 2014.
 - Alam, Wasi. Sequential testing procedures in a family of lifetime distributions with applications.
- National Workshop on Improvement of Agricultural Statistics organized by Directorate of Economics and Statistics, Ministry of Agriculture, Government of India at NASC Complex, New Delhi on September 30-October 01, 2014.
 - Ahmad, T*, Sud, UC, Rai, A, Sahoo, PM and Bhatia, VK. Study to develop an alternative methodology for estimation of cotton production.
 - Tyagi KK. Estimation of area and production of food grain crops on the basis of small sample sizes.
- National Conference on Recent Advances in Statistical and Mathematical Sciences and their Applications (RASMSA-2014) at Kumaon University, Nainital during October 04-06, 2014.
 - Bhar, LM. Incomplete block designs for multiple slope ratio assays.

- Bharadwaj, Anshu. Geostatistics in forestry: An overview. (Invited talk)
- Chandra, H. Small area estimation under transformation. (Invited talk)
- Dash, Sukanta*, Parsad, Rajender and Gupta, VK. Row column designs for factorial experiments in two rows with orthogonal parameterization.
- Lal, SB*, Sharma, Anu, Chandra, Hukum and Rai, Anil. Software for Survey Data Analysis SSDA Ver 2.0. (Invited talk)
- Paul, Ranjit Kumar. M-estimation and LMS estimation techniques for designed experiments. (Invited talk)
- Pradhan, UK* and Lal, K. Efficient designs for mixture experiments with process variable in smaller number of runs. (Invited talk)
- Varghese, Eldho* and Varghese, Cini. MERC designs involving diallel crosses incorporating specific combining abilities for test lines versus control line comparisons. (Invited talk)
- Workshop on Next Generation Sequencing (NGS) Techniques of DNA at Institute of Advanced Study in Science and Technology (IAAST), Guwahati, Assam during October 20-22, 2014.
 - Kumar, Dinesh. How NGS technology can be used for genetic improvement and management of germplasm. (Invited talk)
- 12th Asian Maize Conference, Bangkok, Thailand during October 30 – November 1, 2014.
 - Kumar, Bhupender*, Guleria, SK, Dubey, RB, Khanorkar, SM, Patel, J, Varghese, Eldho, Kumar, Vinod, Abhishek, Alok, Das, Abhijit Kumar, Mukri, Ganapati, Kumar, Ramesh, Singh, Vishal, Yathish KR, Hooda, KS, Singh, SB, Sekhar, JC, Yadav, OP. AMMI analysis for yield stability of elite maize hybrids under rainfed and irrigated conditions.
 - Kumar, Bhupender *, Chaudhary, Dharam Paul, Parihar, CM, Jat, SL, Sapna, Pradeep, T, Puttaramanaik, Kumar, Vinod, Varghese, Eldho, Abhishek, Alok, Das, Abhijit Kumar, Mukri, Ganapati, Kumar, Ramesh, Singh, Vishal, Yathish KR, Singh, SB, Sekhar, JC, Kaul, Jyoti, Yadav, OP. Study of GEI for quality traits in maize using AMMI and Eberhart and Russell model.
- International Conference on Stem Cell Research, Cancer Biology, Biomedical Sciences, Bioinformatics and Applied Biotechnology which was held at Jawaharlal Nehru University, New Delhi, on November 01-02, 2014.
 - Meher, PK. Eukaryotic donor splice site prediction: A machine learning approach.
- International Conference on Emerging Trends in Biotechnology (ICETB 2014) at Jawaharlal Nehru University, New Delhi during November 6-9, 2014.
 - Iquebal, MA*, Sarika, Anil Rai and Dinesh Kumar (2014). Computational approach for prediction of cattle antimicrobial peptides using Artificial Neural Network methodology (Invited Lecture).
- 2nd Conference on Converging Technologies Beyond 2020 (2CTB-2020) at Institute of Engineering and Technology, Kurukshetra University, Kurukshetra during November 28-29, 2014.
 - Kumar, Dinesh. Genomics approach to enhance Indian agricultural productivity and role of super computer. (Invited talk)
 - Iquebal, MA*, Sarika, Angadi, UB, Arora, Vasu, Sablok, Gaurav, Kumar, Sunil, Rai, Anil and Kumar, Dinesh (2014). SBMDb: First whole genome based DNA microsatellite database of sugarbeet for bioenergy and industrial application.
- ISPRS Technical Commission VIII Symposium on Operational Remote Sensing Applications: Opportunities, Progress and Challenges and Annual Conventions of ISRS and ISG and Joint Sessions with ISPRS TC IV & VI during December 09-12, 2014 at Hyderabad.
 - Sahoo, PM*, Ahmad, T, Singh, KN and Gupta, AK. Spatial Imputation techniques for predicting missing information in satellite images.
- International Conference on Innovative Research in Applied Physical, Mathematical/Statistical, Chemical Sciences, Environmental Dynamics, Integration of Life Sciences and Engineering held at Jawaharlal Nehru University, New Delhi, during December 27 – 28, 2014.
 - Alam, Wasi. Sequential probability ratio test for the parameters of limiting form of discrete distributions.
- 102nd Indian Science Congress organized at University of Mumbai, Mumbai during January 03-07, 2015.
 - Sud, UC. Calibration approach based estimator of population total for successive sampling in presence of auxiliary.

- Chandra, H and Sud, UC (2015). Disaggregate Level Crop Yield Estimation using Small Area Estimation Techniques (Invited speaker).

Session in Agriculture and Forestry Sciences

- Rao, AR*, Sarkar, Rupam Kumar, Meher, Prabina Kumar and Wahi, SD. An approach to the development of a core set of germ plasm using mixture of qualitative and quantitative data. (Invited talk)
- Islam, SN. ICT in agriculture: Foundation for a new revolution. (Invited talk)
- Varghese, Cini*, Varghese, Eldho, Jaggi, Seema and Bhowmik, Arpan. Experimental designs for open-pollination in polycross trials. (Poster presentation)

Session on Mathematical Sciences (including Statistics)

- Rao, AR*, Sarkar, Rupam Kumar, Varghese, Cini, and Meher Prabina Kumar. Incomplete block designs for next generation sequencing experiments.
- Symposium on Accelerating Biology 2015: Catalyzing Evolution” at C-DAC, Pune during January 20-22, 2015.
 - Kumar, Dinesh. NGS data and its applications in agriculture. (Invited talk)
- International Consultation Meeting of Fish Genomics for Development of Roadmap for Fish Molecular Breeding Programme in India, at ICAR-CIFA, Bhubaneshwar on January 23, 2015.
 - Kumar, Dinesh. Bioinformatics in genomic analysis. (Invited talk).
- 68th Annual Conference of the Indian Society of Agricultural Statistics organized at ICAR-IASRI, New Delhi during January 29-31, 2015.

a. Invited Papers

Session on Mountain/ Hill Agriculture

- Ahmad, Tauqueer*, Sud, UC and Sahoo, Prachi Misra. Methodological issues relating to estimation of area and production of horticultural crops.
- Ajit*, Dhyani, SK, Newaj, Ram and Handa, AK. Simulation of carbon sequestered under tree based systems in hilly district of Himachal Pradesh.
- Sahoo, Prachi Misra*, Rai, Anil, Ahmad, Tauqueer. Generation of agricultural statistics in North Eastern hilly regions using remote sensing and GIS.

Session on Women Empowerment in Agriculture

- Arora, Alka*, Sudeep, Choubey, AK, Alam, AKM Samimul, Dahia, Rama. Women participation scenario in agricultural education and research.

Session on Emerging Issues in Design and Analysis of Experiments

- Bhar, Lalmohan* and Ojha, Sankalpa. Influence measures in blocked designs of experiments with correlated errors.
- Varghese, Cini*, Varghese, Eldho, Jaggi, Seema and Bhowmik, Arpan. WebPD: An online software for the generation of polycross designs.
- Susheel Kumar Sarkar and Sukanta Dash*. Repeated measurements for ordinal data.

Session on New Challenges in Survey Sampling

- Lal, SB*, Sharma, Anu, Chandra, Hukum and Rai, Anil. Sample selection software for survey data.

Session on Advances in Agricultural Informatics

- Choubey, AK*, Arora, Alka, Sudeep, Dahiya, Shashi, Islam, SN, Bhardwaj, Anshu. E-governance through Enterprise Resource Planning System in ICAR.
- Rao, AR. Agricultural Bioinformatics - A potential avenue for research and development in Indian Agriculture.

Session on Statistical Modelling for Biological and Economic Phenomena

- Ghosh, Himadri*. Some fuzzy time-series models and their application to agriculture.
- Gurung, Bishal*. Stochastic volatility models and their application.

b. Workshop on Methodology for Estimating Crop Area and Yield under Mixed and Continuous Cropping

- Aditya, Kaustav* and Singh, Man. Methods for estimation of crop area in different countries.
- Ahmad, Tauqueer* and Sahoo, Prachi, Misra. Methods for estimation of crop yield in different countries.
- Biswas, Ankur* and Chandra, Hukum. Use of global positioning system in crop area estimation.

- Sud, UC* and Gupta, VK. Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping – An overview.

c. Contributed Papers

Session on Design of Experiments

- Bhowmik, Arpan*, Varghese, Eldho, Jaggi Seema and Varghese Cini. 2^k factorial experiment with minimum level changes.
- Dash, Sukanta*, Parsad, Rajender and Gupta, VK. Efficient row-column designs for mixed level factorial experiments based on baseline parameterization.
- Pradhan, Upendra Kumar* and Lal, Krishan. Analysis of mixture experiments for optimum response.
- Varghese, Eldho* and Varghese, Cini. Type III complete diallel cross experiments under row-column setup with specific combining abilities.

Session on Sampling Techniques

- Aditya, Kaustav*. Higher order calibration estimators under two stage sampling design.
- Biswas, Ankur*, Rai, Anil and Ahmad, Tauqueer. Spatial bootstrap variance estimation technique in presence of missing observations.
- Chandra, H, Maheshwar, Shikha*, Aditya, Kaustav and Panna, Nupur. Micro level crop yield estimation - An application of small area estimation technique.
- Gupta, AK*, Sud, UC, Tyagi, KK, Chandra, H, Ahmad, T, Sahoo, PM, Aditya, Kaustav, Biswas, Ankur and Singh, Man. Seed, feed and wastage ratios of major food crops in Uttar Pradesh.
- Yadav, Satish Kumar, Wahi, SD* and Sud, UC. Calibration estimator in presence of quadratic relationship between study and auxiliary variable.

Session on Statistical Modelling

- Gurung, Bishal*, Singh, KN and Paul, Ranjit Kumar. An alternative approach to capture cyclical and volatile phenomena in time-series data.
- Kumar, Anil*, Chaturvedi, Ajit, Chaudhary, Alka, Panwar, Sanjeev and Arya, Prawin.

Development of class of 'Accelerated' sequential procedures and associated second-order approximations under reliability model.

- Panwar, Sanjeev*, Singh, KN, Kumar, Anil and Rathore, Abhishek. Performance evaluation of different crop yield forecasting approaches using weather indices.

Session on Informatics

- Ahuja, Sangeeta*. Kernel density based Bayesian cluster ensemble.
- Arora, Alka*, Sudeep and Alam, AKM Samimul. Decision support system for effective management of ICAR sponsored training programs.
- Islam, SN*. Expert system shell for agricultural crops (ShellAg).
- Kumar, Mukesh*, Choubey, AK, Arora, Alka, Dahiya, Shashi, Bhardwaj, Anshu, Rao, N Srinivasa, Sudeep, Islam, SN and Ahuja, Sangeeta. e-Human resources management system: purposes and uses.
- Kumar, Sumit*, Nath, Kamalika and Gupta, AK. Data entry software in MS Access 2007.
- Rao, N Srinivasa*, Kumar, Mukesh and Choubey, AK (2015). Designing of results framework document management system in ICAR: An initiative.
- Singh, KN*, Bhardwaj, SP, Panotra, Narinder and Sahoo, Prachi Misra. Use of Geographic Information System (GIS) and Remote Sensing (RS) technology to get economic benefit by optimization of resource use in agriculture.

Session on Statistical Application

- Bhardwaj, SP*. Study of price volatility in pulse crops – A case study of masoor grain.
- Pal, Soumen* and Mazumdar, Debasis. Long term trend analysis of temperature over India.
- Paul, Ranjit Kumar*, Gurung, Bishal and Paul, Amrit Kumar. Dual long memory in agricultural commodity prices.
- Alam, Wasi* and Sinha, Kanchan. Comparative study on recent versions of exponential distributions.
- Sahoo, Prachi Misra*, Rai, Anil, Ahmad, T, Raju, BMK and Osman, M. Development

of Rainfed Areas Prioritization Index (RAPI) for characterization of rainfed areas in India.

- Arya, Prawin*, Singh, DR, Kumar, Anil and Singh, KN. An econometric study for emergence of ground water markets and its determinants in Hanumangarh district of Rajasthan.

Session on Statistical Genetics/Bioinformatics

- Das, Samarendra*, Meher, Prabina Kumar and Rao, AR. Reverse engineering and analysis of gene regulatory networks for salinity stress response in rice.
- Farooqi, Samir*, Sanjukta, RK, Mishra, DC, Singh, DP, Rai, Anil, Chaturvedi, KK Sharma, Naveen and Prabha, Ratna. Comparative genome analysis of halophilic and non-halophilic bacteria using codon usage bias based tools.
- Grover, Monendra*, Mishra, DC and Srivastava, Sudhir. Quantum computation and biological stress.
- Kaur, Sukhdeep, Iquebal, MA, Sarika, Tandon, Gitanjali, Rai, Anil and Kumar, Dinesh. Salinity stress responsive candidate gene selection for introgression: A meta-analysis.
- Meher, Prabina Kumar* and Rao, AR. Evaluating the performance of machine learning classifiers for the prediction of donor splice sites in rice genomes.
- Mishra, DC*, Rajan, Veena, Srivastava, Sudhir, Kumar, Sanjeev and Rai, Anil. Support Vector Machine (SVM) based prediction model for protein-protein interaction using protein 3D structure and physicochemical properties.
- Paul, AK*, Paul, Ranjit Kumar, Prabhakaran, VT, Singh, Inder and Dhandapani, A. Comparison of different parametric and non-parametric stability measures for non-normal data.
- Shukla, Shantanu Iquebal, MA, Sarika, Angadi, UB, Rai, Anil and Kumar, Dinesh. The onion genomic resource: A genomics and bioinformatics driven resources for extemporizing onion functional analysis and breeding.
- Srivastava, Sudhir, Mishra, DC, Lal, SB and Angadi, UB. A tool for protein structure comparison using elastic shape analysis.

d. Contributed Papers (Students)

Session on Design of Experiments

- Chetan*, Laxmi, Ratna Raj and Parsad, Rajender. Construction of design for mixture-of-mixture experiments under restricted region using central composite designs.
- Dasgupta, Pratyush*, Bhar, Lalmohan and Gupta, VK. Robustness of BIB designs for multi-response experiments against the loss of observations as per efficiency criterion.
- Datta, Anindita*, Jaggi, Seema, Varghese, Cini and Varghese, Eldho. Generalized row-column designs with factorial treatment structure.
- Gopinath, Pratheesh P*, Parsad, Rajender, Gupta, VK and Mandal, BN. Two dimensional balanced sampling plan excluding adjacent units.
- Harun, Mohd.*, Varghese, Cini, Varghese, Eldho and Jaggi, Seema. Designs for breeding trials involving three-way crosses. (Mohd. Harun was awarded an appreciation letter from the society for best presentation)
- Roy, Himadri Shekhar*, Bhar, LM and Gupta, VK. A study on outliers in factorial experiments.

Session on Sampling Techniques

- Guha, Saurav*, Chandra, H, Sud, UC, Aditya, Kaustav and Lal, SB. Estimation of finite population total for outlier contaminated survey data. (Saurav Guha was awarded an appreciation letter from the society for best presentation)
- Islam, Sadikul*, Sud, UC, Ahmad, T, Wahi, SD and Sudeep. An application of calibration approach for estimation of finite population ratio under two-phase sampling design.
- Kumar, Pankaj*, Kumar, Anil and Tikkiwal, GC. Measures of poverty using small area estimation in India.
- Moury, Pramod Kumar*, Ahmad, Tauqueer, Sud, UC, Sahoo, Prachi Misra and Lal, SB. Estimation of crop yield at tehsil level using double sampling regression approach under stratified two stage sampling design framework. (Pramod Kumar Moury was awarded an appreciation letter from the society for best presentation)

- Basak Pradip*, Chandra H and Sud UC. Estimation of finite population total for skewed data using model calibration approach. (Pradip Basak was awarded an appreciation letter from the society for best presentation)

Session on Statistical Modelling and Applications

- Banerjee, Rahul*, Gurung, Bishal, Singh, KN and Panwar, Sanjeev. Dynamics of area substitution of edible oilseeds in India.
- Lall, Shwetank*, Ghosh, Himadri and Prajneshu. Comparison of compound tweedie distribution and modified gamma distribution for rainfall modelling. (Shwetank Lall was awarded an appreciation letter from the society for best presentation)
- Lama, Achal*, Jha, Girish K and Paul, Ranjit, Kumar. Forecasting agricultural commodity price volatility using GARCH model with structural break. (Achal Lama was awarded an appreciation letter from the society for best presentation)

Session on Statistical Genetics/ Bioinformatics

- Supriya, P* and Bhat, KV. Assembly, annotation, functional classification of transcriptomes and identification of key genes for moisture stress tolerance in Cucumis melo. (P Supriya was awarded an appreciation letter from the society for best presentation)
 - Choudhary, Ram Kumar*, Rao, AR and Wahi, SD. Detection and testing of biennial rhythm in Mango.
 - Deb, Chandan Kumar* and Sudeep. Classification tree based problem identification: Module for Agridaksh. (Chandan Kumar Deb was awarded an appreciation letter from the society for best presentation)
 - Naha, Sanchita*, Sudeep, Malhotra, PK, Arora, Alka and Wahi, SD. Agent based crop variety selection recommender system. (Sanchita Naha was awarded an appreciation letter from the society for best presentation)
- Workshop on Application of Bioinformatics in Life Sciences during February 18-20, 2015 at

- a) School of Biotechnology, Faculty of Science, BHU, Varanasi
 - Kumar, Dinesh. Digital biology and its applications in agriculture. (Invited talk on February 20, 2015)
- b) Department of Microbiology, Institute of Medical Sciences, BHU, Varanasi.
 - Kumar, Dinesh. Prediction of antimicrobial peptides by machine learning approach. (Invited talk)
- 17th Annual Conference on Statistics and Informatics for Smart Decisions in Managing Resources: Issues and Challenges held at BIMTECH, Bhubaneswar, Odisha during February 23-25, 2015.
 - Ahuja, Sangeeta. Robust performance ensemble in agroforestry research.
 - Arora, Alka. Rough set based approach for cluster analysis. (Invited talk in the session of Data Mining)
 - Bhar, LM. Cook-statistic in blocked design of experiments with correlated errors. (Invited talk in the session of Experimental Designs)
 - Chandra, H (2015). Estimation of Poverty and Social Exclusion Indicators at the Small area Level.
 - Das, Samarendra. Gene selection using support vector machines and MRMR filter for time-series gene expression data.
 - Dash, Sukanta. Efficient row column designs for factorial experiments in two rows with orthogonal parameterization.
 - Gurung, Bishal. Combining models to improve forecasting of price volatility.
 - Gurung, Bishal. State space models for forecasting price volatility. (Invited talk in the session of Challenges in Socio Economic Analysis)
 - Mandal, BN. An integer linear programming approach to construction of balanced treatment incomplete block designs.
 - Paul, RK. Application of long memory time series models in agriculture. (Invited talk In the session of Statistical Modeling)
 - Sarkar, Ananta*, Sarkar, Susheel Kumar and Bhar, LM. Design of experiments: Need of the day. (Invited talk in the session of Experimental Designs)
- 9th INDIACOM; 2nd 2015 international conference on Computing for Sustainable Global Development at Bharti Vidyapeeth's Institute

of Computer Applications and Management (BVICAM), New Delhi during March 11-13, 2015.

- Sarkar, Susheel Kumar* and Khanduri, Om Prakash. Information system of agricultural field experimentation in India.
- Deb, CK, Marwaha, S, Malhotra, PK, Wahi, SD* and Pandey, RN. Strengthening soil taxonomy ontology software for description and classification of USDA soil taxonomy up to soil series.
- International Symposium on New Perspectives in Modern Biotechnology organized by Society for Applied Biotechnology, at Puducherry from 23 - 25 March 2015.
 - Tandon, G*, Jaiswal, S, Iquebal, MA, Singh, S, Kumar, S, Rai, A and Kumar, D (2015). In silico study of interaction of EDS1 and PAD4 proteins in tomato using molecular dynamics approach.
 - Kaur, S*, Iquebal, MA, Jaiswal, S, Singh, S, Rai, ., Kumar, D (2015). In silico prediction and functional characterization of genes related to abiotic and biotic stresses in chickpea (*Cicer arietinum*).
- Workshop on Harnessing and Enhancing Quality of Agricultural Research organized by National Professor Unit at IASRI, New Delhi on March 25, 2015.
 - Bhar, Lalmohan. Outliers in designed experiments
 - Chandra, H. Probability sampling, sample size determination and sample survey resources server.
 - Gupta, VK. Fundamentals of design of experiments.
 - Jaggi, Seema. Experimental designs for indirect effects of treatments and online software.
 - Parsad, Rajender. Applications of designs for factorial experiments in NARES and design resources server.
 - Varghese, Cini. Experimental designs for polycross trials.

INVITED LECTURES DELIVERED

Dr UC Sud

- A lecture on System for Collection of Agricultural Statistics in India on August 8, 2014 at National Statistical Systems Training Academy (NSSTA), Noida.

Dr. Anil Rai

- Lecture on Bioinformatics in Agriculture in one week capacity building program for scientists of NARES at National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi.
- Lecture on Bioinformatics and its Applications in Agriculture in CAFT training on Functional Genomics and Proteomics - Techniques and Tools for Crop Improvements on November 24, 2014 at IARI New Delhi.
- Two lectures on Statistical Data Mining Tools for Strategic Analysis and Spatial Analysis through GIS and Geo-statistics in CAFT training program on Strategies to Enhance Oilseed Brassica Production under Climate and Resource Constraints Scenario on November 28, 2014 at DRMR, Bharatpur, Rajasthan.

Dr. Seema Jaggi

- Two lectures on Testing of Hypothesis and Analysis of Variance in a training workshop on Research Methodology from September 16-27, 2014 at Council for Social Development, New Delhi.
- A lecture on Functions and Activities of IASRI along with Teaching Programmes in Agricultural Statistics during a one day visit of students of Lady Shri Ram (LSR) College, University of Delhi at IASRI on September 29, 2014.
- A lecture on Functions and Activities of IASRI during a one day visit (December 5, 2014) at IASRI of the participants of six weeks training programme on Official Statistics and Related Methodology of International Statistical Education Centre (ISEC) Kolkata conducted by NASA.

Dr. Rajender Parsad

- Two lectures using Webinar on Web Resources for Designed Experiments and Indian NARS Statistical Computing Portal in Training programme on Advances in Pest Forecast Models and Decision Support System for Crop Protection in Changing Climate Scenario organized at CRIDA, Hyderabad for plant protection scientists and agro-meteorologist during October 29-November 18, 2014.

- Two lectures using Webinar on Advanced Designs and Pooled Analysis and Response Surface Designs in Training programme on Analysis of Experimental Data organized at NAARM, Hyderabad during November 10-15, 2014.
- Four Lectures on Basic Statistical Concepts and Tests of Significance, Design of experiments (single factor, multiple factor, multi-location, on-station and on-farm), Combined Analysis of Data across Sites, Years, On-station vs On-farm Experiment, Unequal Replication etc. and Site Regression Biplot in Training Workshop on Experimental Techniques and Data Analysis in Agriculture organized by CIMMYT, India at NASC complex, Pusa, New Delhi during February 12-14, 2015.

Dr. KK Tyagi

- Lecture on Sampling Techniques to a batch of 21 Afghanistan nationals sent by Agronomy Division, IARI on April, 01, 2014.
- One lecture on An Overview of Different Methods of Sampling Used in Sample Surveys and Small Area Estimation Techniques to the participants of a Training Programme on Official Statistics for 19 ISS Probationers at National Statistical Systems Training Academy (NSSTA), MOSPI on July 18, 2014.

Dr. Dinesh Kumar

- Taught Fish Bioinformatics Courses to M.F.Sc and Ph.D. students during April 29-30, 2014 at Central Institute of Fisheries Education (CIFE).
- Five lectures on i) Global Status of Domestic Animal Bioinformatics: Where do we stand?, ii) DNA Signature based SNP and STR Marker Analysis, iii) Next Generation Sequencing Data and Genome Assembly, iv) RNA Seq/ Differential Gene expression/Transcriptome Analysis and v) IPR issues related to Indigenous Domestic Animal Germplasm in DBT funded training programme on Molecular Tools and Bioinformatics Approaches for Livestock Genome Analysis held during September 10-30, 2014 at Central Institute for Research on Cattle (ICAR-CIRC), Meerut.
- A lecture on Global Status of Agricultural Bioinformatics and Challenges for India in National Training Programme on Recent

Trends on Bioinformatics and its Application in Agriculture held at ICAR-NAARM, Hyderabad during January 02-13, 2015.

- Two lectures on i) Global Status of Domestic Animal Bioinformatics: Where do we stand? and ii) IPR Issues Related to Indigenous Domestic Animal Germplasm in National Training Programme on Advanced Tools for Analysis of Phenomic and Genomic Data organized by Dairy Cattle Breeding Division at ICAR-National Dairy Research Institute, Karnal - 132 001 (Haryana) during March 05-25, 2015.
- Lecture on Applications of Bioinformatics in Increasing Agri-Productivity to 101st batch of FOCARS of 239 ARS probationers at ICAR-NAARM, Hyderabad on February 05, 2015.

Dr. Tauqueer Ahmad

- Lecture on Resampling Techniques for Complex Survey Data at Department of Statistics and Operations Research, Aligarh Muslim University (AMU), Aligarh on June 28, 2014.
- A lecture on Collection of Agricultural Statistics using Remote Sensing and GIS in the National Statistical Systems Training Academy (NSSTA), Noida on July 18, 2014.

Dr. Hukum Chandra

- A lecture on Statistical Computing using R in Faculty Development Programme 2014 at Ramanujan College, University of Delhi, on November 01, 2014.
- As Resource Person 'Faculty Development Programme 2014' at Ramanujan College, University of Delhi, on November 01, 2014.
- As Resource Person, sessions on 'Statistical Tools and their Applications', Lakshmibai College, University of Delhi, Delhi, January 10, 2015 and February 14, 2015.
- As Resource person, workshop on R and SPSS Software, Department of Statistics, University of Delhi, Delhi, India, February 20, 2015.
- As Resource person, workshop on R, Banasthali University, Banasthali, Rajasthan, January 19-20, 2015.

Dr Prachi Misra Sahoo

- Lecture on Geostatistics and its Applications using GIS in short course on Remote Sensing

and GIS for Natural Resource Management for M.A./M.Sc. Students of Jamia Millia Islamia, New Delhi held during March 19-21, 2015 at IARI, New Delhi.

Dr. Sudeep

- A lecture on IPv6 and Migration from Ipv4 to Ipv6 in DARE/ICAR during a Workshop on IPv6 at CSSRI, Karnal on May 16, 2014.

Dr. MA Iquebal

- Two lectures on Genome Assembly (Theory and Practical) and Genome Annotation (Theory) in National Training Programme on Advanced Tools for Analysis of Phenomic and Genomic Data organized by Dairy Cattle Breeding Division at ICAR-National Dairy Research Institute, Karnal during March 05-25, 2015.
- Three lectures on i) DNA Signature based SNP and STR Marker Analysis (P), ii) Genome Annotation (P) and iii) Metagenomics of Rumen microbes (T+P) in DBT funded training programme on Molecular Tools and Bioinformatics Approaches for Livestock Genome Analysis held during September 10-30, 2014 at Central Institute for Research on Cattle (ICAR-CIRC), Meerut.

Dr. Sarika

- Three lectures on i) DNA Signature based SNP and STR marker analysis (Theory and Practical), ii) Genome Annotation (Practical) and iii) Metagenomics of Rumen Microbes (Theory and Practical) in National Training Programme on Advanced Tools for Analysis of Phenomic and Genomic Data organized by Dairy Cattle Breeding Division at ICAR-National Dairy Research Institute, Karnal during March 05-25, 2015.
- Three lectures on i) Genome annotation (T), ii) Genome Assembly (P) and iii) RNA Seq/ Differential Gene expression/ Transcriptome Analysis (P) in DBT funded training programme on Molecular Tools and Bioinformatics Approaches for Livestock Genome Analysis held during September 10-30, 2014 at Central Institute for Research on Cattle (ICAR-CIRC), Meerut.

Dr. Susheel Kumar Sarkar

- Two lectures on Testing of Hypothesis and Non-Parametric Methods in 2nd ICSSR Training

Program on Research Methodology Course in Social Sciences for Ph.D. Students during March 13-24, 2015 at Department of Geography, Jamia Millia Islamia University, New Delhi.

- Three lectures on i) Discriminant Analysis, ii) Factor Analysis and iii) Cluster Analysis in 4th one week Research Methodology Course on Applied Research Techniques using SPSS in Social Sciences during December 8-13, 2014 at Centre for Jawaharlal Nehru Studies, Jamia Millia Islamia University, New Delhi.

Dr. PK Meher

- A lecture on Biological Sequence Analysis using R-software in a workshop on Recent Trends in Bioinformatics and Its Application in Modern Biotechnology organized by Uttarakhand Council for Biotechnology during February 17-19, 2015 at Camp Office of UCB, Dehradun.

Participation

Conferences / Workshops / Trainings / Seminars / Symposia etc.

- Workshop on National Crop Insurance Programme: Challenges and Opportunities on April 01, 2014 at New Delhi. (Dr. UC Sud)
- Workshop on 'Ipv6 Road Show cum Hands-on-Workshop' organized by ERNET India at India Habitat Centre, Lodhi Road, New Delhi on April 15, 2014. (Dr. Mukesh Kumar)
- Workshop on PME in NARS: Status, Experiences and Way Forward organized jointly by NAIP, ICAR and IFPRI on May 27, 2014 at National Agricultural Science Centre (NASC) Complex, New Delhi. (Dr. UC Sud and Dr. Seema Jaggi)
- Workshop on All India Coordinated Research Project on Long Term Fertilizer Experiments held at CSK Himachal Pradesh Krishi Viswa Vidyalaya, Palampur during June 02-03, 2014. (Dr. LM Bhar)
- International Workshop sponsored by DST India and National Commission for Scientific and Technological Research CHILE on Big Data Handling from June 04-06, 2014 at BITS Pilani, Goa Campus. (Dr. Anil Rai)
- Workshop on Impact of Capacity Building Programme under NAIP at NASC, New Delhi during June 06-07, 2014. (Dr. UC Sud, Sh. SD Wahi and Dr. AK Paul)

- Refresher Course on Agricultural Research Management at NAARM, Hyderabad during July 14-26, 2014. (Dr. Monendra Grover)
- Workshop on Statistical Computing using R software jointly organized by NIRT (ICMR) and Presidency College, Chennai under the aegis of International Biometric Society (Indian Region) during July 17-19, 2014. (Sh. SD Wahi and Dr. AR Rao)
- 86th ICAR Foundation Day and Award Ceremony and Directors/ Vice Chancellors Conference organized by ICAR at NASC during July 29-30, 2014. Sh. Narendra Modi, Hon'ble Prime Minister of India delivered the Foundation Day lecture and Honoured the awardees. (Dr. UC Sud)
- One day workshop on Hindi organized by Krishi Parbandhan Nideshalya on September 26, 2014 at NASC complex, New Delhi. (Dr. SP Bhardwaj, Dr. Cini Varghese, Dr. AK Gupta, Dr. Prawin Arya and Dr. Sanjeev Panwar)
- National Workshop for Launching of CHAMAN Project at NASC Complex, New Delhi on September 16, 2014. (Dr. UC Sud, Dr. AK Gupta, Dr. Tauqueer Ahmad and Dr. Prachi Misra Sahoo)
- 7th Agriculture Leadership Summit 2014 organized by Agriculture Today Group at hotel Taj Palace, New Delhi on September 27, 2014. (Dr. KK Tyagi and Dr. Tauqueer Ahmad)
- National Workshop on Improvement on Agricultural Statistics organized by Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India at NASC, New Delhi during September 30 - October 01, 2014. (Dr. UC Sud, Dr. KK Tyagi, Dr. AK Gupta, Dr. Tauqueer Ahmad, Dr. Hukum Chandra and Dr. Prachi Misra Sahoo)
- Aurovet Knowledge Symposium held at AP Shinde Symposium Hall, NASC Complex, New Delhi during October 08-09, 2014. (Sh. Pal Singh)
- National Seminar on Maximizing Systems for Improving Food and Nutrition Security at AP Shinde Symposium Hall, NASC Complex, New Delhi on October 16, 2014. (Sh. Pal Singh)
- RFD Workshop organized by Engineering Division, ICAR to review the progress of April-September, 2014 related to RFD 2014-15 on October 21, 2014. The Mid-term achievements of the Institute presented in the workshop. (Dr UC Sud and Dr AK Mogha)
- National Workshop on Appraisal cum Data Validation of NISAGENET and Awareness Seminar on e-learning portal on Agricultural Education organized at CS Azad University of Agriculture and Technology, Kanpur, UP from November 11-12, 2014. (Dr. Sudeep and Sh. Pal Singh)
- 8th International Conference on Mushroom Biology and Mushroom Products held at NASC Complex, New Delhi during November 19-22, 2014. (Dr. Sudeep Marwah and Sh. Pal Singh)
- Workshop on Smart Infrastructure held at Sanchar Bhawan, New Delhi on November 24, 2014. (Dr. UC Sud)
- International Conference on Innovation in Indian Agriculture: Ways Forward organised at India International Centre, New Delhi during December 04-05, 2014. (Dr. Ranjit Kumar Paul, Dr. Wasi Alam and Dr. Sanjeev Panwar)
- Third Annual Workshop of National Knowledge Network NKN: (Encourage, Empower, Enable, Enrich) NGN during December 15-17, 2014 at IIT, Guwahati. (Dr. AK Choubey and Sh. Rakesh Kumar Saini)
- 31st Biennial Workshop of AICRP_IFS organized at TNAU, Coimbatore during December 22-24, 2014. (Dr. Cini Varghese and Dr. Susheel Kumar Sarkar)
- Annual Workshop of AICRP-PHT during Session on Harvest and Post-Harvest Losses held at UAS Bangalore on January 08, 2015. (Dr. Anil Rai)
- Roundtable Technical Session with Dr. Stephan Brobst, CTO, Teradata Inc. on January 08, 2015. (Sh. KK Chaturvedi)
- 7th Agricultural Summit AGRI@8% - Challenges and Way out on January 15, 2015 at Hotel Sanghrilla, New Delhi. (Dr Sanjeev Panwar and Sh. Bishal Gurung).
- Workshop on Assessment of Harvest and Post-Harvest Losses of Major Crops and Commodities on January 23, 2015 at IIT, Chennai. (Dr. UC Sud)

- 12th Agricultural Science Congress held on February 03-06, 2015 at National Dairy Research Institute, Karnal Commemorating the Silver Jubilee of National Academy of Agricultural Sciences. (Dr. UC Sud, Sh. SD Wahi, Dr. AR Rao and Dr. Sangeeta Ahuja)
- Workshop on IPv6 implementation in Departments of GOI at DoT on February 11, 2015. (Dr. Mukesh Kumar and Dr. Sudeep)
- Workshop on PME Indicators and Implementation Strategy organized by NAAS, NAARM and IFPRI at NASC Complex, New Delhi on February 23, 2015. (Dr. Seema Jaggi)
- Workshop on Training Needs Assessment for HRD Nodal Officers of ICAR held at NAARM, Hyderabad on February 26, 2015. (Dr. Seema Jaggi)
- Workshop on Impact Assessment of Agricultural Research and Development on March 17, 2015 at National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi. (Dr. RK Paul)
- Workshop on Synthesizing Statistical and Agricultural Sciences for Harnessing and Enhancing Quality of Agricultural Research organized by National Professor Unit at IASRI, New Delhi on March 25, 2015. (Dr. Seema Jaggi, Dr. Rajender Parsad, Dr. LM Bhar, Dr. Cini Varghese, Dr. Susheel Kumar Sarkar, Dr. BN Mandal, Dr. Eldho Varghese, Dr. Sukanta Dash, Dr. Arpan Bhowmik, Dr. UK Pradhan and Mr. Kader Ali Sarkar)

Krishi Vigyan Mela

- The institute participated in the PUSA Krishi Vigyan Mela 2015 organized by IARI, New Delhi



from March 10-12, 2015 and elevated a stall to exhibit its significant research findings and software. The stall attracted a huge number of visitors including farmers, students and entrepreneurs. Through live demonstrations and posters, the developed technologies were explained to the visitors. The Institute received “Best Stall Award” in the mela.

Trainings Attended

- 21 days CAFT on Agricultural Web Application Development using Content Management Tools from September 24, 2014 to October 14, 2014 at ICAR- IASRI. (Dr. Susheel Kumar Sarkar)
- One month Orientation Training at ICAR-IASRI, New Delhi from October 14 to November 13, 2014 as a part of 100th FOCARS. (Mr. Kader Ali Sarkar)
- Three months Professional Attachment Training under Prof. Mausumi Bose at Indian Statistical Institute, Kolkata as a part of 100th FOCARS from December 15, 2014 to March 16, 2015. Carried out a short-term research project on “Robustness of Crossover Designs under Correlated Errors”. (Mr. Kader Ali Sarkar)

Visit Abroad

Dr. UC Sud

- Visited Bangladesh to participate in the Workshop on Harmonization and Dissemination Unified Agricultural Production Statistics in Bangladesh during June 23-29, 2014.

Dr. Hukum Chandra

- Visited Italy to attend the Collaborative Training Programme on Small Area Estimation under Generalised Linear Mixed Model from Dr. Nicola Salvati, researcher of Statistical Methodology, Department of Economics and Management, University of Pisa, Italy during June 09 to August 01, 2014.
- Visited Tsukuba, Ibaraki, Japan to participate in Sixth Workshop on Forging Partnerships in Statistical Training in Asia and the Pacific: Networking for Agricultural and Rural Statistics, during September 02-04 2014 and attended Experts Meeting on Skills Framework and

Training Needs Assessment Tools for Agricultural and Rural Statistics on 05 September 2014. Also made a presentation on A curriculum for training on agricultural and rural statistics.

- Visited Chiba, Japan during December 15-18, 2014 to attend the training programme at United Nations Statistical Institute for Asia and the Pacific on Assessing Training Needs of the Statistical Workforce in Agricultural Statistics.

Sh. KK Chaturvedi

- Attended a training on Bioinformatics at Cornell University, Ithaca, USA during January 28 – April 05, 2014 sponsored by NAIP (ICAR).

Dr. Sanjeev Panwar

- Visited Addis Ababa, Ethiopia as a resource person in the training course on “Advanced Experimental Designs, Data Analysis and Management for Breeding Trials” during November 03-08, 2014.

Dr. Susheel Kumar Sarkar

- Visited Spain to attend training on Integrated Breeding Multi-Year Course (IB-MYC) Year 3 under Generation Challenge Programme - Integrated Breeding Platform (GCP-IBP) during 09-30 May 2014 at Mediterranean Agronomic Institute of Zaragoza (IAMZ) in Zaragoza, Spain.

11

Conference/Workshops/ Seminars etc. Organized

Conference

- 68th Annual Conference of the Indian Society of Agricultural Statistics was organized at ICAR-IASRI, New Delhi during January 29-31, 2015.

The objective of the Conference was to provide a platform for exchange of ideas among the researchers on Advances in Statistics and Informatics for Agricultural Research and to provide a platform for interactions among the researchers. The scientists and Technical Officers were involved in organizing the Conference. The conference was inaugurated



by Dr. TCA Anant, Chief Statistician of India and Professor JK Ghosh, Former Director, Indian Statistical Institute, Kolkata was the Sessional President.

- Various sessions were organized on the following sub-themes:
 1. Mountain/Hill Agriculture
 2. Women Empowerment in Agriculture
 3. Emerging Issues in Design and Analysis of Experiments
 4. New Challenges in Survey Sampling
 5. Advances in Agricultural Informatics
 6. Statistical Modelling for Biological and Economic Phenomenon
- Two memorial lectures were organized viz. Dr. Rajendra Prasad Memorial Lecture delivered by Professor Manoj Panda of Institute of Economic Growth and Dr. VG Panse Memorial Lecture delivered by Dr. S. Pyne of CR Rao AIMSCS, Hyderabad. Besides this, sessions on Professor PV Sukhatme Gold Medal Award presentation, Dr. GR Seth Memorial Young Scientist Award presentation and Sessions on Contributed Papers Presentation were also organized.
- Dr. Jayanta K Ghosh, ISI, Kolkata and Purdue University, USA and Sessional President, of the Conference delivered Presidential Address on Big Data and Analytics and Some Cautionary Remarks on the History of Statistics. Professor Prem Narain, Executive President of the Society delivered a special lecture during the Conference.
- Sessions for students and managed by students were also organized. 9 students (6 Agricultural Statistics, 2 Computer Application,

1 Bioinformatics) received Appreciation Certificates for the excellent presentation of their papers in the respective sessions during this Conference.

The following scientists of the Institute were involved in the Conference in various capacities:

Name of Scientist	Organized/Acted as	Name of Session
Dr. UC Sud	Organizing Secretary	68 th Annual Conference of ISAS
Dr. Anil Rai	Convener	Advances in Agricultural Informatics
	Member, Organizing Committee	68 th Annual Conference of ISAS
Dr. Seema Jaggi	Convener	Women Empowerment in Agriculture
	Member, Organizing Committee	68 th Annual Conference of ISAS
Dr. Rajender Parsad	Convener and Chairman	Mountain/Hill Agriculture
	Member, Organizing Committee	68 th Annual Conference of ISAS
Dr. KN Singh	Member, Organizing Committee	68 th Annual Conference of ISAS
Dr. AK Choubey	Member, Organizing Committee	68 th Annual Conference of ISAS
	Chairman	Technical session of contributed papers on Informatics
Sh. SD Wahi	Chairman	Technical session of contributed papers on Statistical Genetics/ Bioinformatics
Dr. LM Bhar	Convener	Emerging Issues in Design and Analysis of Experiments
	Co-Organizing Secretary	68 th Annual Conference of ISAS
Dr. Hukum Chandra	Convener	New Challenges in Survey Sampling
	Co-Organizing Secretary	68 th Annual Conference of ISAS
Sh. KK Chaturvedi	Rapporteur	Advances in Agricultural Informatics
	Evaluator	Session for students on Statistical Modelling and Applications
Dr. Sarika	Rapporteur	Women Empowerment in Agriculture
Dr. DC Mishra	Rapporteur	Mountain/Hill Agriculture
	Evaluator	Session for students on Design of Experiments/ Statistical Genetics/ Informatics
Dr. Eldho Varghese	Rapporteur	Emerging Issues in Design and Analysis of Experiments
Dr. Kaustav Aditya	Rapporteur	New Challenges in Survey Sampling
	Evaluator	Session for students on Sampling Techniques
Dr. Ranjit Kumar Paul	Rapporteur	Statistical Modelling for Biological and Economic Phenomenon
	Evaluator	Session for students on Statistical Modelling and Applications
Dr. Prawin Arya	Rapporteur	Technical session of contributed papers on Statistical Modelling
Dr. Anshu Bharadwaj	Rapporteur	Technical session of contributed papers on Informatics
Dr. Sanjeev Panwar	Rapporteur	Technical session of contributed papers on Statistical Applications
Dr. MA Iquebal	Rapporteur	Technical session of contributed papers on Statistical Genetics/ Bioinformatics
Dr. SK Sarkar	Rapporteur	Technical session of contributed papers on Design of Experiments
Dr. Bishal Gurung	Rapporteur	Technical session of contributed papers on Statistical Applications
Dr. Prachi Misra Sahoo	Evaluator	Session for students on Sampling Techniques
	Chairperson	Applied Statistics in Agriculture
Dr. N Srinivasa Rao	Evaluator	Session for students on Statistical Modeling and Application
Dr. Arpan Bhowmik	Evaluator	Session for students on Design of Experiments/ Statistical Genetics/ Informatics
Dr. Ankur Biswas	Rapporteur	Technical session of contributed papers on Sampling Techniques

- During the Conference a Workshop on “Methodology for Estimating Crop Area and Yield under Mixed and Continuous Cropping” was organized on January 29, 2015.



Other Conference Sessions

Dr. Seema Jaggi

- Co-chaired the session organized for the scientific and technical personnel of IASRI during the Sensitization Workshop on ICAR Unified Communication Solutions on November 19, 2014.

Dr. Dinesh Kumar

- Chaired a Session at University Institute of Engineering and Technology, Kurukshetra University, Kurukshetra in 2nd Conference on Converging Technologies Beyond 2020 (2CTB-2020) during November 28-29, 2014 and also delivered an invited talk entitled Genomics approach to enhance Indian agricultural productivity and role of super computer.

Dr. Hukum Chandra

- Convener and Co-chairman of the invited session on Recent Advances in Sample Survey Techniques in the National Conference on Statistical and Mathematical Sciences and their Applications, Nainital, Uttarakhand during October 04-06, 2014.
- Convener of the session on Advances in Survey Estimation in the 17th Annual Conference of the Society of Statistics, Computer and Applications held at Bhubaneswar during February 23-25, 2015.
- Chairman, session on Recommendations on Guiding Principles for Developing Training Needs Assessment tools, Experts Meeting on Skills Framework and Training Needs Assessment Tools for Agricultural and Rural Statistics held on September 05, 2014 at Tsukuba, Japan.

Dr. Prachi Misra Sahoo

- Rapporteur in the Technical Session II: “Study to Test the Developed Alternative Methodology

for Estimation of Area and Production of Horticultural Crops in the Launch Workshop of three Externally Funded Projects held during March 23-24, 2015 at IASRI, New Delhi.

Dr. Ankur Biswas

- Rapporteur in the Technical Session III: 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 Launch Workshop of three Externally Funded Projects held during March 23-24, 2015 at IASRI, New Delhi.

Sh. SB Lal

- Chaired a session on “Demography and Medical Sciences” in National conference on ‘Recent Advances in Statistical and Mathematical Sciences and their Applications’ (RASMSA 2014) organized by the Department of Statistics, Kumaun University, Nainital, Uttarakhand held during October 4-6, 2014.

Dr. Sarika

- Chaired a Session on Biotech Chapter II in 2nd National Conference on Converging Technologies Beyond 2020 (2CTB-2010) held during November 28-29, 2014 at University Institute of Engineering and Technology, Kurukshetra University, Kurukshetra, Haryana.

Dr. MA Iquebal

- Co-Chaired a Session on Biotech Chapter II in 2nd National Conference on Converging Technologies Beyond 2020 (2CTB-2010) held during November 28-29, 2014 at University Institute of Engineering and Technology, Kurukshetra University, Kurukshetra, Haryana.

Annual Day

- The 55th Annual Day of the Institute was celebrated on July 2, 2014. Dr. Arvind Kumar,





DDG (Education) presided over the function and Dr. Alope Kumar Sikka, DDG (NRM) ICAR, New Delhi delivered the Nehru Memorial Lecture on “Hydrological Modeling for Climate Change Impact on Water Resources”.

- The Annual Report of the Institute for the year 2013-14 was released on this occasion. The project reports of three NAIP funded projects Strengthening Statistical Computing for NARS (NAIP Component I: Consortium Leader), Establishment of National Agricultural Bioinformatics Grid in ICAR and Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR were also released.



- Nehru Memorial Gold Medal for the year 2011-13 was awarded to Sh. Pradip Basak, M.Sc.



(Agricultural Statistics) student and Sh. Tanuj Mishra, M.Sc. (Computer Application) student.

Teacher’s Day

The institute celebrated Teacher’s Day on September 5, 2014. On this occasion Dr. SD Sharma, Former Director IASRI was honoured. Dr. VK Gupta, National Professor ICAR presided over the function.



ICAR Foundation Day

ICAR Foundation Day was celebrated on July 16, 2014 at IASRI, New Delhi. Scientists, technical, administrative, students and other staff attended the function. Former Directors of the Institute and IASRI Alumni were invited to participate. All the distinguished invitees Dr. SK Raheja, Dr. SD Sharma, Dr. VK Bhatia, Dr. Alope Dey, Dr. AC Kulshreshtha, Dr. Randhir Singh, Dr. HVL Bathla shared their experiences in ICAR.

हिन्दी सप्ताह का आयोजन

संस्थान में 09 से 15 सितम्बर 2014 के दौरान हिन्दी सप्ताह का आयोजन किया गया। दिनांक 09 सितम्बर 2014 को हिन्दी सप्ताह का उद्घाटन संस्थान के निदेशक, डॉ. उमेश चन्दर सूद जी द्वारा किया गया। हिन्दी सप्ताह के उद्घाटन के तत्पश्चात प्रश्न-मंच का आयोजन किया गया। हिन्दी सप्ताह के दौरान 'डॉ. दरोगा सिंह स्मृति व्याख्यान' के साथ-साथ वैज्ञानिक प्रभागों में हिन्दी में सर्वाधिक वैज्ञानिक कार्य करने के लिए प्रभागीय चल-शील्ड, काव्य-पाठ, प्रश्न-मंच, अन्ताक्षरी, हिन्दीतर कर्मियों के लिए हिन्दी श्रुतलेख एवं शब्दार्थ लेखन प्रतियोगिता आयोजित की गयी। अन्ताक्षरी प्रतियोगिता के संचालकों द्वारा इस प्रतियोगिता को ऑडियो विजुअल रूप में प्रस्तुत किया गया जिससे यह प्रतियोगिता अत्यन्त ही रोचक रही। सभी प्रतियोगिताओं में छात्रों सहित संस्थान के विभिन्न वर्गों के कर्मियों ने बढ़-चढ़कर सहभागिता की। संस्थान में प्रत्येक वर्ष हिन्दी दिवस के अवसर पर डॉ. दरोगा सिंह स्मृति व्याख्यान का आयोजन किया जाता है जिसमें किसी सुप्रसिद्ध वैज्ञानिक द्वारा किसी भी वैज्ञानिक विषय पर हिन्दी में व्याख्यान दिया जाता है। इस वर्ष इस कड़ी का तेइसवाँ व्याख्यान भारतीय कृषि सांख्यिकी अनुसंधान संस्थान की पूर्व प्रमुख वैज्ञानिक, डॉ. रंजना अग्रवाल जी द्वारा "फसलों के उपज के कटाई-पूर्व



अनुमान हेतु मौसम आधारित मॉडल" विषय पर दिया गया और इस कार्यक्रम की अध्यक्षता परिषद् के पूर्व सहायक महानिदेशक (एच.आर.डी.), डॉ. सुखदेव शर्मा जी द्वारा की गयी। दिनांक 15 सितम्बर, 2014 को हिन्दी सप्ताह के समापन समारोह के अवसर पर इस दौरान आयोजित प्रतियोगिताओं के सफल प्रतियोगियों को पुरस्कृत करने के साथ-साथ वर्ष 2013-14 के दौरान "सरकारी कामकाज मूल रूप से हिन्दी में करने के लिए प्रोत्साहन योजना" के अन्तर्गत भी नकद पुरस्कार प्रदान किये गये। इसके अतिरिक्त, जुलाई 2013 से जून, 2014 तक की अवधि के दौरान संस्थान में आयोजित कार्यशालाओं के वक्ताओं/प्रशिक्षकों को भी सम्मानित किया गया।

Seminars

Salient outcomes from the completed research projects undertaken on different aspects of Agricultural Statistics, Computer Application and Bioinformatics were presented in the seminars organized regularly at the Institute. Open seminars were also organized for new research project proposals. Outline of Research Work (ORW) seminars, Course seminars and Thesis seminars were delivered by the students of M.Sc. and Ph.D. (Agricultural Statistics), M.Sc. and Ph.D. (Computer Application) and M.Sc. (Bioinformatics). During the period under report, a total of 108 seminar talks were delivered. Out of these, 96 were student seminars, 11 by scientists of the Institute and 01 by Guest Speaker Dr. Surya Saha, Cornell University, USA on June 13, 2014.

Details of Seminars Delivered

Category	Type of seminar	Number
Guest		01
Scientists	Project Completion	04
	New Project Proposal	04
	Foreign Training	05
	Foreign Training	01
	General (RFD)	01
Students	ORW	23
	Thesis	15
	Course	55
	Open	03
TOTAL		108

Workshops under various Projects

S. No.	Title	Venue	Date	Sponsored by	Participants
1.	Workshop under NISAGENET Workshop on NISAGENET for Appraisal cum Validation of Data	CSAUA&T, Kanpur, UP	11-12 November 2014	Education Division, ICAR	22
		Rajasthan University of Veterinary & Animal Sciences	16-17 December 2014	Education Division, ICAR	22
		AC&RI Madurai, TNAU, Tamil Nadu	08-09 January 2015	Education Division, ICAR	23
		Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra	09-10 March 2015	Education Division, ICAR	25
2.	Workshop under MIS/FMS Sensitization Workshop on ICAR Unified Communication Services Cordinator : Dr. Alka Arora Co-Cordinator : Dr. N Srinivasa Rao	IASRI, New Delhi	19 November 2014	IASRI, New Delhi	125
3.	Workshop under ITMU Workshop on Software Licensing for the Scientists of the Institute under the aegis of Institute Technology Management Unit Cordinators : Dr. Rajender Parsad Dr. Tauqueer Ahmad	IASRI, New Delhi	01 November, 2014	IASRI, New Delhi	60
4.	Launch Workshop of Research Projects i. Pilot study for Developing State Level Estimates of Crop Area and Production on the basis of Sample Sizes Recommended by Professor Vaidyanathan Committee Report ii. Study on Improving Methods for Estimating Crop Area, yield and Production under Mixed, Repeated and Continuous Cropping iii. Study to Test the Developed Alternative Methodology for Estimation of Area and Production of Horticultural Crops	IASRI, New Delhi	23-24 March 2015	FAO, DES DAC	95
5.	Workshop under National Professor Project Workshop on Synthesizing Statistical and Agricultural Sciences for Harnessing and Enhancing Quality of Agricultural Research	IASRI, New Delhi	25 March 2015	National Professor Project	27
Hindi Workshop					
6.	एस.पी.एस.एस. द्वारा आंकड़ों का विश्लेषण (Data analysis using SPSS) Coordinators : Dr. Cini Varghese Dr. Arpan Bhowmik	IASRI, New Delhi	24 May 2014	IASRI, New Delhi	20



Distinguished Visitors

INDIAN

Dr. S Ayyappan

Secretary, DARE & Director General
Indian Council of Agricultural Research (ICAR),
New Delhi

Prof. RB Singh

Chancellor, Central Agricultural University, Imphal

Dr. Alagusundaram

Deputy Director General (Engg.), ICAR, New
Delhi

Dr. Arvind Kumar

Deputy Director General (Edu.), ICAR, New Delhi

Dr. AK Sikka

Deputy Director General (NRM), ICAR, New
Delhi

Dr. Krishna Kumar

Deputy Director General (Hort), ICAR, New Delhi

Dr. DS Yadav

Vice-Chancellor, UP Technical University,
Lucknow

Dr. Anupam Verma

Former ICAR-National Professor and IARI
Adjunct Professor

Dr. AK Vasisth

ADG(PIM/ESM), ICAR, New Delhi

Dr. Kanchan K Singh

ADG(AE), ICAR, New Delhi

Dr. PS Pandey

ADG(EP&HS), ICAR, New Delhi

Dr. MB Chetti

ADG(HRD), ICAR, New Delhi

Dr. Venkateshwarlu

ADG (EQA&R), ICAR, New Delhi

Dr. Mamta Saxena

Advisor (hort), Krishi Bhawan, New Delhi

Dr. Prem Narain

Former Director, IASRI, New Delhi

Dr. Bal BPS Goel

Former Director, IASRI, New Delhi

Dr. SD Sharma

Former Director, IASRI, New Delhi

Dr. VK Bhatia

Former Director, IASRI, New Delhi

Dr. SK Raheja

Former Director, IASRI, New Delhi

Dr. AK Srivastava

Former Joint Director, IASRI, New Delhi

Dr. Manoj Nardeosingh

Assistant Secretary General, ICAR, New Delhi

Sh. AK Srivastava

Former DDG (FOD), NSSO, MNCFC

Dr. (Smt.) Ravinder Kaur

Director (A), IARI, New Delhi

Dr. Ramesh Chand

Director, NIAP, New Delhi

Dr. KC Bansal

Director, NBPGR, New Delhi

Dr. C Chattopadhyay

Director, NCIPM, New Delhi

Dr. RK Jain

Joint Director (Edn.) & Dean, IARI

Dr. Bimal K Roy

Director, Indian Statistical Institute, Kolkata

Dr. Padam Singh

Former Member, National Statistical Commission & Head Research & Evaluation EPOS, Health Consultants (India) Pvt. Ltd., Gurgaon

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Principal Adviser, Directorate of Economics and Statistics
Ministry of Agriculture, Government of India

Mrs. Sangeeta Verma

ESA, Directorate of Economics and Statistics
Ministry of Agriculture, Government of India

Smt. Rugmini Parmar

Adviser, Directorate of Economics and Statistics,
Department of Agriculture & Cooperation
Ministry of Agriculture, Government of India

Sh. Rajeev Lochan

Adviser, Directorate of Economics and Statistics,
Department of Agriculture & Cooperation
Ministry of Agriculture, Government of India

Sh. Debasish Guha

Adviser, Directorate of Economics and Statistics,
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Dr. SK Mukherjee

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Ministry of Agriculture, Government of India

Ms. Malti Devi Negi

Adviser, Directorate of Economics and Statistics,
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Ministry of Agriculture, Government of India

Sh. Amar Singh

Adviser, Directorate of Economics and Statistics,
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Ministry of Agriculture, Government of India

Dr. S Chandra Sekar

Adviser, Directorate of Economics and Statistics,
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Sh. PC Bodh

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Sh. TK Dutta

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Sh. Chander Kant

Add. Statistical Adviser, Directorate of Economics and Statistics,
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DDG and Agriculture Census Commissioner
Directorate of Economics and Statistics,
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Ministry of Agriculture, Government of India

Sh. DK Sahoo

DDG, NSSO (FOD), Faridabad

Dr. AC Kulshreshtha

Former Additional Director General (Training)
Ministry of Statistics and Programme Implementation
Government of India

**Sh. TV Raman**

Additional Director General (Training)
Ministry of Statistics and Programme
Implementation
Government of India

Dr. GSN Murthy

Deputy Director General (Training)
National Academy of Statistical Administration

Prof. Bikas Sinha

Former Member, National Statistical Commission

Dr. Alope Dey

INSA Senior Scientist
Indian Statistical Institute, New Delhi

Dr. Kumar Sundaram

Deputy Director, CSO, New Delhi

Sh. Ashish Kumar

Additional Director General
CSO, Ministry of Statistics and Programme
Implementation,
Government of India

Sh. SC Malik

Director, CSO, Ministry of Statistics and
Programme Implementation,
Government of India

Sh. Yogender Singh

Deputy Director General, NASA

Dr. PL Gautum

Former VC, CPU Hamirpur

Dr. B Mishra

Former VC, SKUAST Jammu

Dr. CL Acharya

Former Director (Extn.), CSKHPKV Palampur

Dr Suresh S. Honnappagol

Animal Husbandry Commissioner
Department of Animal Husbandry, Dairying and
Fisheries
Ministry of Agriculture, Government of India

Ms. Neelima Johri

Chairman, Board of Revenue Rajasthan, Ajmer

Sh. Bhanwar Lal

Director (Statistics), Board of Revenue
Rajasthan, Ajmer

Prof. DRM Samudraiah

Former Deputy Director (Sensors)
Indian Space Research Organization
Govt. of India, Ahmedabad

Sh. Kumar Sundaram

Deputy Director, National Accounts Division
CSO, M/o Statistics & Programme
Implementation

Dr. Goutam Roy

Asstt. Director (Statistics), Raipur

Dr. Priyanka Aggrawal

Asstt. Professor, Deptt. of Statistics
Hindu College, University of Delhi

Dr. CB Tripathi

Deptt. of Bio-Statistics
Institute of Human Behaviour and Allied
Sciences, Delhi

Dr. PK Joshi

TFRI, New Delhi

Dr. Suresh Kumar

IIRS, Dehradun

Mrs. Mamta Kumari

IIRS, Dehradun

Dr. SK Saha

IIRS, Dehradun

Dr. M. Mohanty

IISS, Bhopal

Dr. SS Ray

MNCFC, New Delhi

Dr. Neetu

MNCFC, New Delhi

Dr. C Patnaik

SAC, Ahemdabad

Sh. VK Singh

Director (Agriculture), Lucknow, UP

Sh. BH Narayanswami

Joint Director (Agriculture), Karnataka

Sh. Basant Kumar

Technical Architect
Mphasis: An HP Company, Pune

Dr. Suresh Pal

Head, Division of Agricultural Economics,
IARI, Pusa, New Delhi

FOREIGN

Dr. Raj S Chikara

Prof. of Mathematics & Statistics
University of Houston, USA

Dr. Surya Saha

Cornell University, USA

Dr. Murari Singh

Senior Biometrician
ICARDA, Amman, Jordan

Dr. Shyam Singh Yadav

Advisor, Ministry of Agriculture, Irrigation and
Livestock
International Republic of Afghanistan

Prof. I Ngalinda

Rector, Eastern African Statistical Training
Centre (EASTC)
Chuo cha Takwimu Mashariki mwa Africa

Sh. Michael Lokshin

Manager, DECSM – Surveys and Methods Team
The World Bank, Washington DC, United States

Sh. Sergiy Radyakin

Economist, Development Research Group
The World Bank, Washington, DC United States

Annexure-I

LIST OF RESEARCH PROJECTS

DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEMS RESEARCH

On-going

ICAR National Professor Scheme

1. Designs for single factor and multi-factor experiments and their applications in agricultural systems research. VK Gupta: 05.04.2006-16.03.2016

Institute Funded

2. 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
3. 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
4. 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 (w.e.f. 01.10.2012) and Shashi Dahiya (on study leave from 03.07.2014): 01.04.2012–31.03.2017
5. Planning, designing and analysis of experiments planned 'On Stations' under the AICRP on IFS. (SIX1209)
Anil Kumar and Eldho Varghese (w.e.f. 01.10.2012): 01.04.2012–31.03.2017
6. Factorial experiments with minimum level changes in run sequences. (AGENIASRISIL201301200013)
Arpan Bhowmik, Eldho Varghese, Cini Varghese and Seema Jaggi: 16.08.2013-15.02.2016

Outside Funded

7. Experimental designs in the presence of indirect effects of treatments. Funded by DST (SOX1115)
Seema Jaggi, Cini Varghese, Anu Sharma (till 04.09.2013) and Eldho Varghese: 01.10.2011–30.09.2015
8. Bioacoustics tool: A novel non-invasive approach for different monitoring of health and productivity in dairy animals. Funded by DBT (AGENIASRICOP201300400005)
NDRI, Karnal: Surender Singh Lathwal, Shiv Prasad, TK Mohanty, Archana Verma, AP Ruhil and SV Singh, IASRI: Anil Kumar: 01.02.2013-31.01.2016
9. 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 (since January 2015), Satyandra Singh (since October 2014), T Choubey: 05.02.2014-31.03.2017

Completed

Institute Funded

10. Experimental designs for polycross trials. (AGENIASRISIL201300200003)
Cini Varghese, Seema Jaggi and Eldho Varghese: 04.02.2013–31.07.2014

New Initiated**Institute Funded**

11. Minimal responses surface designs for resource optimization in agricultural experiments. (AGENIASRISIL201401500034)
Eldho Varghese, Arpan Bhowmik, Seema Jaggi and Cini Varghese: 04.09.2014-03.09.2017
12. A optimal block designs for comparing test treatments with control treatment(s)-an algorithmic approach. (AGENIASRISIL201500200039)
BN Mandal, Rajender Parsad, VK Gupta and Sukanta Dash: 18.02.2015-17.02.2018

FORECASTING, MODELLING AND SIMULATION TECHNIQUES IN BIOLOGICAL AND ECONOMIC PHENOMENA**On-going****Institute Funded**

13. A study on modelling and forecasting of time-series with long memory processes. (AGENIASRISIL201300700008)
Ranjit Kumar Paul, Himadri Ghosh and Bishal Gurung: 01.05.2013-30.04.2015
14. A study on STAR and SV families of nonlinear time-series models for describing cyclicity and volatility in Agriculture. (AGENIASRISIL201300800009)
Bishal Gurung, Himadri Ghosh and Ranjit Kumar Paul: 21.05.2013-30.04.2015
15. Development of statistical approach for prediction of eukaryotic splice sites. (AGENIASRISIL201301300014)
Prabina Kumar Meher, SD Wahli and AR Rao: 03.09.2013-02.09.2015
16. Estimation of heritability under correlated errors. (AGENIASRISIL201400100020)
Amrit Kumar Paul and SD Wahli: 04.01.2014-03.01.2016

Outside Funded

17. 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

Completed**Institute Funded**

18. Study of commodity price forecast based on time series data. (AGENIASRISIL201300300004)
SP Bhardwaj, DR Singh (till 31.07.2013), KN Singh, Ranjit Kumar Paul and Sanjeev Panwar (w.e.f. 01.03.2014): 18.02.2013-28.02.2015

Outside Funded

19. Mapping and cultural authority of science across Europe and India (MACAS-EU & India)[†]. Funded by ICSSR, New Delhi. (AGENIASRISOL201301600017) (Association of IASRI w.e.f. 18.07.2013)
IHD: Rajesh Shukla, IASRI: KN Singh: 01.04.2012 -30.09.2015

New Initiated**Institute Funded**

20. 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

21. Network project on impact assessment of agricultural research and development. Funded by ICAR. (AGENIASRICOP201500100038)
NIAP, New Delhi: PS BIRTHAL, Jaya Jumrani, Kingsly IT, SK Srivastava
IASRI: Ranjit Kumar Paul: 01.01.2015-31.03.2017 (Association of IASRI w.e.f. 12.01.2015)

DEVELOPMENT OF TECHNIQUES FOR PLANNING AND EXECUTION OF SURVEYS AND STATISTICAL APPLICATIONS OF GIS AND REMOTE SENSING IN AGRICULTURAL SYSTEMS

On-going

Outside Funded

22. Pilot study for estimation of seed, feed and wastage ratios of major food grains. Funded by National Accounts Division, Central Statistical Office, MOS&PI, Government of India. (AGENIASRISOL201300900010)
AK Gupta, UC Sud, KK Tyagi (till 30.09.2014), Hukum Chandra, Tauqueer Ahmad, VK Jain (till 31.10.2013), Kaustav Aditya, Prachi Misra Sahoo and Ankur Biswas: 01.07.2013-30.06.2015
23. Development of innovative approaches 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: 09.12.2013-08.12.2016
24. Assessment of quantitative harvest and post harvest losses of major crops/commodities in India (Collaboration with CIPHET, Ludhiana association w.e.f. 01.06.2012) (COP1220)
CIPHET, Ludhiana: SK Nanda, (till 30.11.2013), RK Gupta (from 14.11.2013 to May 2014), SN Jha (since June 2014) and RK Vishwakarma IASRI: Tauqueer Ahmad, Anil Rai and Prachi Mishra Sahoo: 01.02.2012-31.03.2015

Completed

Institute Funded

25. Small area estimation for skewed data. (AGENIASRISIL201300100002)
Hukum Chandra, UC Sud and Kaustav Aditya: 19.01.2013-31.12.2014

New Initiated

Institute Funded

26. Calibration estimators under two stage sampling design when study variable is inversely related to auxiliary variable. (AGENIASRISIL201400800027)
Ankur Biswas, Kaustav Aditya and UC Sud: 01.05.2014-30.04.2016

Outside Funded

27. 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 and Ankur Biswas: 16.09.2014-15.06.2017
28. 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, Ankur Biswas, Vandita Kumari, Raju Kumar, Anshu Bhardwaj and Anil Kumar: 16.02.2015- 15.02.2017

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

On-going

Institute Funded

29. Methodology for protein structure comparison and its web implementation. (AGENIASRISIL201300600007)
Sudhir Srivastava, MNV Prasad Gajula (till 31.03.2014), DC Mishra and SB Lal (since 04.04.2014): 18.04.13-17.04.15

30. Development of a tool for comparison of protein 3D structure using graph theoretic approach. (AGENIASRISIL201400500024)
UB Angadi, KK Chaturvedi, Monendra Grover and Sudhir Srivastava: 18.03.2014- 31.01.2017
31. Multilevel functional classification of abiotic stress related proteins in poaceae. (AGENIASRISIL201400600025)
Monendra Grover, UB Angadi and Sudhir Srivastava: 20.03.2014-14.08.2016

Outside Funded

32. Phenomics of moisture deficit and low temperature stress tolerance in rice (Funded by NRCPB, New Delhi). (COP1106)
NRCPB: P Ananda Kumar, IARI: Viswanathan Chinnusamy, IASRI: Sudeep, SD Wahi, Alka Arora and AR Rao (w.e.f. 01.10.2013), IIT: S Chaudhury, University of Delhi: JP Khurana, CRRI, Cuttack: ON Singh, IGKV, Raipur: G Chandel, CAU, Barapani: Wricha Tyagi, ICAR RC-NEHR, Barapani: A Pattanaik: 15.02.2011–30.12.2015
33. 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 Singh and Vandana Rai, DRR: D Subramanyam, P Senguttuvel, DKMA: Himanshu, CDAC: Rajendra Joshi: 01.04.2013-31.03.2016
34. Whole genome sequencing and development of allied genomic research in two commercially important Fish-Labeo rohita and Clarias batrachus. Funded by DBT (AGENIASRISOL201301400015)
IASRI: Dinesh Kumar, Sarika (w.e.f. 28.01.2014) and Mir Asif Iquebal (w.e.f. 28.01.2014), NBFGR: NS Nagpure, Basdeo Kushwaha and Ravindra Kuamr, CIFA: Paramananda Das, P Jayasankar and L Sahoo, Anand Agricultural University: Chaitanya G Joshi, PG Koringa: 10.09.2013-09.09.2016

Completed

Institute Funded

35. Parallelized workflows for gene prediction, phylogenetic analysis and primer designing. (SIX1219)
SB Lal, Anu Sharma (till 05.09.2013) and Sarika: 28.08.2012–03.02.2015

Outside Funded

36. Whole Genome Association (WGA) analysis in common complex diseases: An Indian initiative (Centre of Excellence in Genome Science and Predictive Medicine) Funded by DBT (COP0807)
UDSC: BK Thelma, NII: Ramesh C Juyal, DU: Sanjay Jain, IASRI: AR Rao and SD Wahi (w.e.f. 22.06.2010), AIIMS: Ashok Kumar, DMC: Ajit Sood: 29.09.2008–31.07.2014
37. Bio-prospecting and allele mining for abiotic stress tolerance (NAIP Component IV: Consortium Partner). (COP0910)
NRCPB: NK Singh, IASRI: AR Rao, Sudeep and SD Wahi: 04.05.2009–30.06.2014

New Initiated

Institute Funded

38. Estimation of breeding value using longitudinal data. (AGENIASRISIL201400700026)
Upendra Kumar Pradhan, Prabina Kumar Meher, AR Rao and AK Paul: 23.04.2014-22.10.2016
39. Modelling and construction of transcriptional regulatory network using time-series gene expression data. (AGENIASRISIL201401100030)
Samrendra Das, Bishal Gurung, Sanjeev Kumar and SD Wahi: 22.05.2014 – 21.11.2016
40. Bioinformatics approaches for data analysis and functional inferences in soil metagenome(s). (Collaboration with NBAIM, Mau). (AGENIASRICIP201401200031)
NBAIM, Mau: DP Singh, Renu, Sunil Kumar, IASRI: Anil Rai, Sanjeev Kumar and Samir Farooqi: 01.07.2014-30.06.2017

Outside Funded

41. 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

42. A new distributed computing frame work for data mining. Funded by Department of Information Technology. Association of IASRI w.e.f. 01.11.2012. (COP1222)
BITS, Pilani: Navneet Goyal, Poonam Goyal and Sundar Balasubramaniam, IASRI: Sanjeev Kumar and Sudhir Srivastava (w.e.f. 02.05.2013): 15.10.2012–14.10.2015

DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH

On-going

Institute Funded

43. Project information and management system of ICAR (PIMS-ICAR). (SIX0901)
RC Goyal (till 30.06.2013), Pal Singh, PK Malhotra (till 30.09.2014), Sudeep and Alka Arora: 01.01.2009–30.04.2014
44. Management system for post graduate education - II. (SIX1218)
Sudeep, PK Malhotra (30.09.2014), RC Goyal (till 30.06.2013), Yogesh Gautam (till 15.08.2014) and Pal Singh (w.e.f. 01.10.2013): 01.04.2012– 31.03.2017
45. 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): 01.04.2012–31.03.2017
46. Development of web based mushroom expert system. (CIP1110)
DMR, Solan: Mahantesh Shirur (till 30.09.2012), K Manikandan (from 01.10.2012 to July 2014), B Vijay, RC Upadhyay, VP Sharma, OP Ahlawat, Satish Kumar, Shwet Kamal and Goraksha C Wokchaure, IASRI: Sudeep (w.e.f. 01.10.2013), Yogesh Gautam (w.e.f. 01.10.2011), Pal Singh, Hari Om Agarwal (till 29.02.2012) and Harnam Singh (till 01.02.2012): 01.04.2011–31.03.2015
47. Strengthening and refinement of maize AgriDaksh. (CIP1113)
DMR: Virendra Kumar Yadav (till June 2014), KP Singh (from July 2014), P Kumar, Vinay Mahajan, KS Hooda, Jyoti Kaul, Ashok Kumar, Aditya Kumar Singh, Ishwar Singh, Meena Shekhar, DP Choudhary, Avinash Singode, CM Parihar, Chikkappa G Karjagi, and Ambika Rajendran; IASRI: Sudeep (w.e.f. 01.03.2012), Yogesh Gautam (w.e.f. 01.10.2011), Pal Singh, Hari Om Agarwal (till 29.02.2012) and Harnam Singh Sikarwar (till 01.02.2012), NS Rao (from 01.10.2014): 01.04.2011–31.03.2016

Completed

Institute Funded

48. Refinement of livestock feed resources and development of dynamic database information system. (Collaboration with NIANP, Adugodi, Bangalore) (AGENIASRICIP201400400023) (Association of IASRI w.e.f. 22.08.2013)
NIANP, Bangalore: S Jash and S Anandan, IASRI: UB Angadi: 01.07.2010–31.12.2014

Outside Funded

49. Establishment of National Agricultural Bioinformatics Grid in ICAR. Funded by NAIP (COL1002)
Director (IASRI), Anil Rai, PK Malhotra (till 31.03.2011), KK Chaturvedi (till 31.08.2010 and again from 01.10.2013), Dinesh Kumar, SB Lal, Anu Sharma, Samir Farooqi, Sudeep (till 31.03.2011), AR Rao, Seema Jaggi, Sanjeev Kumar (w.e.f. 01.09.2011), Sarika (w.e.f. 03.09.2012), Hukum Chandra, MA Iquebal (w.e.f. 01.04.2013) and Monendra Grover (w.e.f. 01.10.2013): 01.04.2010–30.06.2014
50. Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR. Funded by NAIP (COL1203)
Director (IASRI), AK Choubey (w.e.f. 15.02.2013), Alka Arora, Sudeep, Shashi Dahiya, Soumen Pal (till 30.09.2012), SN Islam (w.e.f. 11.06.2012), Anshu Bharadwaj (w.e.f. 15.03.2013), Mukesh Kumar (w.e.f. 01.10.2013), Pal Singh (w.e.f. 01.10.2013), N Srinivasa Rao (w.e.f. 01.10.2013) and Sangeeta Ahuja (w.e.f. 01.10.2013): 19.01.2012–30.06.2014
51. Engaging farmers, enriching knowledge: agropedia phase-II. Funded by NAIP (AGENIASRISOL201301000011)
IIT, Kanpur: TV Prabhakar, IASRI: Shashi Dahiya, Yogesh Gautam and AK Choubey: 01.04.2013-30.06.2014

New Initiated**Institute Funded**

52. Results framework document management system in ICAR (RFD-MS). (AGENIASRISIL201400900028)
N Srinivas Rao, Mukesh Kumar and AK Choubey: 09.05.2014-30.04.2017
53. Development of 16s rDNA rumen specific microbes database. (Collaboration with NIANP, Bangalore) (AGENIASRICIP201401400033) (Association of IASRI w.e.f. 23.07.2014)
NIANP, Bangalore: M Baghat, AP Kolte, IASRI: UB Angadi, Monendra Grover: 01.04.2014 -31.03.2017
54. Development and application of electronic learning and diagnostic modules for health management of dogs. (Collaboration with IVRI, Izatnagar) (AGENIASRICIP201401300032)
IVRI, Izatnagar: Rupasi Tiwari, IASRI: Mukesh Kumar: 01.07.2014-31.12.2015
55. Tobacco Agridaksh: An online expert system. (AGENIASRICIP201401800037)
CTRI, Rajahmundry: H Ravisankar, D Damodar Reddy, U Sreedhar, K Sivaraju, K Sarala, S Kasturi Krishna, M Anuradha, IASRI: N Srinivasa Rao, Sudeep: 20.10.2014-20.10.2017

Outside Funded

56. ICAR Network Project on Transgenics in Crops (NPTC). (AGENIASRICOP201500400041)
NRCPB: NK Singh, IASRI: MA Iquebal, Sarika, Dinesh Kumar, Anil Rai: 27.01.2015-31.03.2017

CONSULTANCY PROJECT

57. Study on improving methods for estimating crop area, yield and production under mixed, repeated and continuous cropping. Funded by FAO, Rome.
UC Sud, Tauqueer Ahmad, Prachi Misra Sahoo, Ankur Biswas, Kaustav Aditya, Vandita Kumari, Raju Kumar, Anil Rai and Man Singh: 18.12.2014-17.06.2016

Annexure-II

IASRI PERSONNEL

Director

Dr. UC Sud (officiating till 18.11.2014 and regular w.e.f. 19.11.2014)

National Professor (on Strength of ICAR)

Dr. VK Gupta

Head, Division of Design of Experiments

Dr. Rajender Parsad (till 29.04.2014)
Dr. UC Sud (A) (30.04.2014 to 29.03.2015)
Dr. Seema Jaggi (A) (w.e.f. 30.03.2015)

Head, Division of Sample Surveys

Dr. UC Sud

Head, Division of Statistical Genetics

Sh. SD Wahi (A) (till 21.10.2014)
Dr. Lalmohan Bhar (w.e.f. 22.10.2014)

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. Rajender Parsad (till 22.07.2014)
Dr. Seema Jaggi (w.e.f. 23.07.2014)

Professor (Computer Application)

Dr. PK Malhotra (till 30.09.2014)
Dr. Seema Jaggi (w.e.f. 01.10.2014)

Professor (Bioinformatics)

Dr. Anil Rai

Warden, Sukhatme Hostel

Dr. UC Sud (till 23.05.2014)
Dr. AK Chaubey (w.e.f. 24.05.2014)

Incharge, Prioritization, Monitoring & Evaluation (PME) Cell

Dr. Seema Jaggi

Vigilance Officer

Dr. UC Sud

Transparency Officer & Nodal Officer, RTI

Sh. SD Wahi

Welfare Officer

Dr. UC Sud (till 01.12.2014)
Dr. SP Bhardwaj (w.e.f. 02.12.2014)

Incharge, National Agricultural Science Museum

Sh. Pal Singh (w.e.f. 15.05.2014)

Senior Administrative Officer

Sh. Suresh Kumar Gajmoti (w.e.f. 11.09.2014)

Sr. Finance and Accounts Officer

Sh. AP Sharma

Library

Dr. Anil Rai, Incharge
Sh. Praveen Kumar Saxena, Librarian (till 31.07.2014)
Sh. SPS Hans, Librarian (w.e.f. 27.10.2014)

Public Information Officer

Smt. Poonam Singh

Annexure-III

VARIOUS COMMITTEES

Consultancy Processing Cell (CPC)

1. Dr. Rajender Parsad, Principal Scientist	Chairman
2. Dr. PK Malhotra, Principal Scientist & Professor (Computer Application)	Member (till 30.09.2014)
3. Dr. Seema Jaggi, Principal Scientist and Incharge, PME Cell	Member
4. Dr. Tauqueer Ahmad, Principal Scientist	Member
5. Head of Office (Ex-Officio)	Member
6. Finance and Accounts Officer (Ex-Officio)	Member
7. Sh. PP Singh, Chief Technical Officer	Member-Secretary

Institute Technology Management Committee (ITMC)

1. Dr. UC Sud, Director	Chairman
2. Dr. PK Malhotra, Principal Scientist & Professor (Computer Application)	Member (till 30.09.2014)
3. Dr. Anil Rai, HD (CABin) (Technical Expert – A Scientist of the Institute)	Member
4. Dr. Seema Jaggi, Principal Scientist (Technical Expert – A Scientist of the Institute)	Member
5. Dr. Madhuban Gopal, Principal Scientist and National Fellow, IARI (IPR Expert – A Scientist from ICAR Institute in the Zone)	Member (till 01.01.2015)
6. Dr. KS Rana, Professor and Head of Division of Agronomy (IPR Expert – A Scientist from ICAR Institute in the Zone)	Member (w.e.f. 02.01.2015)
7. Dr. Rajender Parsad, Incharge, ITMU	Member–Secretary

Institute Technology Management Unit (ITMU)

1. Dr. Rajender Parsad, Principal Scientist Member-Secretary, ITMC	Officer Incharge
2. Dr. Tauqueer Ahmad, Principal Scientist	Member
3. Sh. PP Singh, Chief Technical Officer	Member

Institute Results-Framework Document (RFD) Committee

1. Director	Chairman
2. Dr. UC Sud, Head (Division of Sample Surveys)	RFD Nodal Officer & Member Secretary (till 02.01.2015)
3. Dr. Anil Rai	RFD Nodal Officer & Member Secretary (w.e.f. 03.01.2015)
4. Dr. KK Tyagi, Principal Scientist	RFD Co-Nodal Officer (till 06.08.2014)
5. Dr. AK Mogha	RFD Co-Nodal Officer (w.e.f. 07.08.2014)
6. All Heads of Divisions	Member
7. Incharge, PME Cell	Member
8. Professor (Agricultural Statistics)	Member



9. Professor (Computer Application)	Member
10. Professor (Bioinformatics)	Member
11. Chief Administrative Officer	Member
12. Senior Finance & Accounts Officer	Member
RFD Cell of the Institute	
1. Dr. UC Sud, Director HD (Sample Surveys) & RFD Nodal Officer	Chairman
2. Dr. AK Mogha	Member
3. Sh. Bikram Singh	Member
Institute Deputation Committee	
1. Director	Chairman
2. All Heads of Divisions	Member
3. Chief Administrative Officer	Member
4. Sr. Finance & Accounts 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. UC Sud, Director	Chairman
2. Dr. AK Chaubey, Head (CA)	Member
3. Dr. KK Tyagi, Principal Scientist	Member (till September 2014)
4. Sh. SD Wahi, Principal Scientist	Member
5. Dr. Seema Jaggi, Incharge, PME Cell	Member
6. Sh. AP Sharma, Sr. F&AO	Member
7. Sh. SK Gajmoti, Head of Office	Member Secretary
Staff Side Members	
1. Sh. KB Sharma, Assistant	Secretary
2. Sh. Virender Kumar, Technical Officer	Member
3. Sh. Krishan Kumar, UDC	Member
4. Sh. Hari Lal, Driver	Member
5. Sh. Ashok Kumar, SSS	Member
6. Sh. Janak Kumar, SSS	Member
Grievance Committee	
Official Side Members	
1. Dr. UC Sud, Director	Chairman
2. Dr. AK Chaubey, Head (CA)	Member
3. Sh. AP Sharma, Sr. F&AO	Member
4. Smt. Poonam Singh, AO	Member
5. Sh. Chander Vallabh, AAO	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, UDC | Member, Administrative Group |
| 4. Sh. Viveka Nand, SSS | Member, Skilled Supporting Staff Group |

ICAR Staff Welfare Fund Scheme

- | | |
|---|------------------------------|
| 1. Dr. UC Sud, Director, Welfare Officer | Chairman (till 01.12.2014) |
| 2. Dr. SP Bharadwaj, Principal Scientist, Welfare Officer | Chairman (w.e.f. 02.12.2014) |
| 3. Dr. Seema Jaggi, Principal Scientist | Female Member |
| 4. Dr. KK Tyagi, Principal Scientist | Member (till 30.09.2014) |
| 5. Sh. AP Sharma, Sr. F&AO | Member |
| 6. Head of Office | Member |
| 7. Sh. KB Sharma, Secretary, IJSC(SS) | Member |
| 8. Sh. Mahender Pandit, Member IGC | Member |
| 9. AAO, Admn-II | Member Secretary |

Women Cell

- | | |
|--|-------------|
| 1. Dr. Seema Jaggi, Principal Scientist | Chairperson |
| 2. Ms. Vijay Bindal, Chief Technical Officer | Member |
| 3. Smt. Poonam Singh, AO | Member |
| 4. Smt. Suman Khanna, Stenographer | Member |
| 5. Smt. Sushma Gupta, AAO | Convener |

Canteen Committee

- | | |
|--|-----------------|
| 1. Dr. UC Sud, Director | Chairman |
| 2. Head of Office | Hony. Secretary |
| 3. Sh. AP Sharma, Sr. F&AO | Member |
| 4. Chander Vallabh, AAO (Admn. II) | Member |
| 5. Dr. Cini Varghese, Senior Scientist | Lady Member |
| 6. Sh. KB Sharma, Assistant and Secretary IJSC | Member |
| 7. Sh. Diwan Singh, Coupon Clerk | Member |

International Training Hostel (ITH)/Panse Guest House

Dr. Anil Kumar, Principal Scientist is the Incharge and Sh. Diwan Singh is the Caretaker of the Guest Houses. A total of 1177 Trainees/Guests from ICAR Institutes, SAU's/Officials from Central/State Governments/Private Organizations and Foreign Trainees from various institutes stayed at ITH and about 1187 guests stayed at Panse Guest House during the period under report.

Hostel Executive Committee

- | | |
|---|-----------------------|
| 1. Warden | Dr. AK Chaubey |
| 2. Prefect | Achal Lama |
| 3. Mess Secretary Cum Assistant Prefect | Pramod Kumar Moury |
| 4. Cashier | Pratheesh P. Gopinath |
| 5. Maintenance Secretary | Shyam Sundar Parui |
| | Gopal Saha |
| 6. Sports Secretary | Nitin Varshney |
| | Md. Asif |

7. Cultural Secretary	Rahul Banerjee PN Somanna
8. Gym Secretary	Sumit Saurabh Animesh Kumar
9. Health Secretary	Amit Kairi
10. Magazine Secretary	Sushil Kumar
11. Commom Room Secretary	Prakash Lakra Nalin Kant Chaudhari
12. Computer Lab Secretary	Parvez Mallick Anubhav Roy
13. Communication Secretary	Subhrajit Satpathy Kuldeep Aswal
14. Auditors	Chiranjib Sarkar Neeraj Budhlakoti Pradip Basak Rajeev Kumar Saurav Guha
15. Dining Hall Committee	Chandan Kumar Deb Mohd. Harun Rajeev Ranjan Chiranjib Sarkar
16. Warden's Nominee	Arvind Kumar
Institute Recreation Club	
1. Dr. UC Sud, Director	President
2. Sh. OP Khanduri, Scientist	Vice President (till November 2014)
3. Sh. Mayank Pundeey, Assistant	Secretary
4. Sh. Dharmendra Tanwar, LDC	Treasurer
5. Sh. Pramod Kumar, Assistant Chief Technical Officer	Member
5. Sh. Raj Kumar Verma, UDC	Member
7. Sh. Sunil Kumar-I, LDC	Member
8. Smt. Kanta Bahl, Assistant	Lady Member
Institute Sports Committee	
1. Dr. UC Sud, Director	President
2. Dr. KN Singh, HD, Forecasting and Agricultural Systems Modelling	Vice President
3. Sh. OP Khanduri, Scientist	Vice President (till November 2014)
4. Sh. AP Sharma, Sr. F&AO	Member
5. Smt. Poonam Singh, AO	Member
6. Sh. Susheel Kumar Sarkar, Scientist	Member
7. Sh. RS Tomar, Assistant Chief Technical Officer	Member
8. Sh. Chander Vallabh, AAO	Member
9. Sh. KB Sharma, Assistant & Secretary, IJSC	Member
10. Smt. Vijay Laxmi Murthy, PA	Lady Member



IASRI Employees Co-operative Thrift and Credit Society Limited

1. Dr. UC Sud, Director	Patron
2. Sh. UC Bandooni	President
3. Ms. Vijay Bindal	Vice-President
4. Sh. Pratap Singh	Secretary
5. Sh. Pradeep Kumar	Treasurer
6. Sh. Naresh Chand	Internal Auditor
7. Mrs. Vijay Laxmi Murthy	Member
8. Mrs. Savita Wadhwa	Member
9. Sh. Manoj Kumar	Member
10. Sh. Ram Bhool	Member
11. Sh. Gyan Singh	Member
12. Sh. Prabhu Dayal	Member
13. Sh. Rajnath	Member (till February 2015)

Annexure-IV

NATIONAL AGRICULTURAL SCIENCE MUSEUM (NASM)

National Agricultural Science Museum (NASM) was conceived by the ICAR and executed by the National Council of Science Museums (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. NASM is situated at NASC Complex, DPS Marg, Opposite Dasghara Village, Pusa Campus, New Delhi.

A Central Management Committee was constituted with following Chairman/ Members to finalize the content of the manuscript to be given to NCSM for Modernization/ Strengthening of National Agricultural Science Museum:

Dr. K Alagusundaram, DDG (Engg.)	Chairman
Dr. KK Singh, ADG (Engg.)	Member
Dr. Jankiram, ADG (Hort.)	Member
Dr. Venkateshwarlu, ADG (EQR)	Member
Dr. Adhiguru, Principal Scientist (Extension)	Member
Dr. SK Choudhary, ADG (SWM)	Member
Dr. BS Prakash, ADG (AN&P) (Animal Science)	Member
Dr. PK Chakrabarty, ADG (PP&B) (Crop Science)	Member
Dr. Madan Mohan, ADG (MF)	Member
Dr. Rameshwar Singh, Project Directorate, DKMA	Member
Dr. UC Sud, Director, IASRI	Member
Dr. VP Kothiyal, Director (Works)	Member Secretary

The Management Committee with following Chairman/Members is looking after day-to-day activities of the Museum:

Dr. UC Sud, Director, IASRI	Chairman
Dr. AK Choubey, Head (CA), IASRI	Member
Sh. AP Sharma, Sr. F&AO, IASRI	Member
Sh. SK Gajmoti, Head of Office, IASRI	Member
Sh. Pal Singh, Scientist & Incharge, NASM	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 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 schools/colleges are exempted from entrance fee. NASM is listed at the website of Delhi Government and can be accessed through http://www.delhitourism.gov.in/delhitourism/entertainment/museum_in_delhi.jsp.

Distinguished VVIP(s)/Visitors

- **Hon'ble Prime Minister Shri Narendra Modiji** along with **Shri Radha Mohan Singhji**, Union Minister of Agriculture, **Dr. Sanjeev Kumar Balyanji**, Union Minister of State for Agriculture and Food Processing Industries & **Dr. S. Ayyappan**, Secretary, DARE and Director General, ICAR visited National Agricultural Science Museum showcasing ICAR technologies and products on the occasion of 86th Foundation Day and ICAR Award Ceremony held on July 29, 2014. The visit was for 10 minutes and it was live telecasted on Doordarshan.



- **Dr. Jose Graziano Da Silva**, Director General, FAO also visited National Agricultural Science Museum NASM on September 8, 2014.
- During the year 2014-15, 21204 visitors visited NASM and 2640 tickets were sold. Students from 44 schools of Delhi/NCR, Students from Universities of 15 States and farmers from 18 States of India visited NASM. Trainees of different training programmes conducted by ICAR Institutes and many important delegations visited NASM.

National Agricultural Science Museum participated in the Pusa Krishi Vigyan Mela 2015 held at IARI, New Delhi during March 10-12, 2015. Films based on Agriculture festival of India, Green Revolution & Indigo Cultivation shown through plasma and posters of NASM were demonstrated to the general visitors, researchers and farmers to give them adequate knowledge about NASM. More than 1000 visitors including Students, farmers, Govt. and Non-Govt. agencies visited NASM Stall. Certificate was received from the Organizing Committee for successfully participating in this Mela and providing valuable information to farmers.





Results-Framework Document (RFD)

for

Indian Agricultural Statistics Research Institute

(2013-2014)

Address

Library Avenue, Pusa, New Delhi- 110 012

Website

<http://www.iasri.res.in>

SECTION 1: Vision, Mission, Objectives and Functions

Vision

Statistics and Informatics for enriching the quality of Agricultural Research.

Mission

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

Objectives

1. To develop statistical methodologies for improving the quality of agricultural research
2. To develop informatics for enhancing efficiency of the system
3. To develop globally competitive human resources

Functions

1. Undertaking basic, applied, adaptive, strategic and anticipatory research in Agricultural Statistics
2. Developing Agricultural Knowledge Management and Information System for National Agricultural Research System
3. Conducting PG teaching and in-service, customized and sponsored training courses in Agricultural Statistics, Computer Applications and Bioinformatics at National and International level
4. Providing advisory and consultancy services for strengthening the National Agricultural Research System
5. Providing methodological support in strengthening National Agricultural Statistical System

SECTION 2: Inter se Priorities among key Objectives, Success Indicators and Targets

Sl. No.	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target/Criteria Value				
							Excellent	Very Good	Good	Fair	Poor
1.	To develop statistical methodologies for improving the quality of agricultural research	50	Development of efficient statistical techniques Statistical and computational support for agricultural research	Methodologies developed for design of experiments/ forecasting/sample surveys/statistical genetics/ bio-informatics Tools and techniques provided/AICRP/Network project supported	Number	40	9	8	6	4	2
2.	To develop informatics for enhancing efficiency of the system	10	Development of Information System/Decision Support System/Expert System/ Software	Information System/ Decision Support System/ Software deployed	Number	10	2	1	0	0	0
3.	To develop globally competitive human resources	29	Conducting M.Sc. and Ph.D. programmes Organization of ICAR and customized sponsored national/ international training programmes	Students obtaining degrees Training programmes conducted	Number	15	17	16	14	12	10
	Efficient functioning of the RFD system	03	Timely submission of Draft RFD (2013-14) for approval Timely submission of results for RFD (2012-13)	On-time submission On-time submission	Date	02	15/05/13	16/05/13	17/05/13	20/05/13	21/05/13
	Administrative reforms	04	Implement ISO 9001 as per the approved action plan Prepare an action plan for Innovation	% Implementation On-time submission	%	02	100	95	90	85	80
	Improving internal efficiency / responsiveness / service delivery of Ministry / Department	04	Implementation of Sevottam	Independent Audit of implementation of Citizen's Charter Independent Audit of implementation of public grievance redressal system	Date	02	30/07/13	10/08/13	20/08/13	30/08/13	10/09/13
					%	02	100	95	90	85	80

SECTION 3: Trend Values of the Success Indicators

Sl. No.	Objectives	Actions	Success Indicators	Unit	Actual value for FY 11/12	Actual value for FY 12/13	Target value for FY 13/14	Projected value for FY 14/15	Projected value for FY 15/16
1.	To develop statistical methodologies for improving the quality of agricultural research	Development of efficient statistical techniques	Methodologies developed for design of experiments/ forecasting/sample surveys/statistical genetics/ bio-informatics	Number	9	8	8	9	9
		Statistical and computational support for agricultural research	Tools and techniques provided/AICRP/ Network project supported	Number	2	5	4	4	4
2.	To develop informatics for enhancing efficiency of the system	Development of Information System/Decision Support System/Expert System/ Software	Information System/ Decision Support System/ Software deployed	Number	1	2	1	1	1
3.	To develop globally competitive human resources	Conducting M.Sc. and Ph.D. programmes	Students obtaining degrees	Number	17	15	16	17	17
		Organization of ICAR and customized sponsored national/ international training programmes	Training programmes conducted	Number	10	13	11	11	11
	Efficient functioning of the RFD system	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	-	-	16/05/13	-	-
		Timely submission of results for RFD (2012-13)	On-time submission	Date	-	-	02/05/13	-	-
	Administrative reforms	Implement ISO 9001 as per the approved action plan	% Implementation	%	-	-	95	-	-
		Prepare an action plan for Innovation	On-time submission	Date	-	-	10/08/13	-	-
	Improving internal efficiency / responsiveness / service delivery of Ministry / Department	Implementation of Sevottam	Independent Audit of implementation of Citizen's Charter	%	-	-	95	-	-
			Independent Audit of implementation of public grievance redressal system	%	-	-	95	-	-

SECTION 4: Acronym

SI. No.	Acronym	Description
	PG	Post Graduate
	AICRP	All India Coordinated Research Project
	AICRPs	All India Coordinated Research Projects
	M. Sc.	Master of Science
	Ph. D.	Doctor of Philosophy
	ICAR	Indian Council of Agricultural Research
	SAUs	State Agricultural Universities
	MoSPI	Ministry of Statistics and Programme Implementation
	DoAC	Department of Agriculture and Cooperation
	DADF	Department of Animal Husbandry, Dairying and Fisheries

SECTION 5: Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl. No.	Success indicator	Description	Definition	Measurement	General Comments
	Methodologies developed for design of experiments/ forecasting/sample surveys/statistical genetics/bio-informatics	Development of methodologies for design of experiments/ forecasting/sample surveys/statistical genetics/bio-informatics	Research work for development of methodologies	Number of methodologies developed	Nil
	Tools and techniques provided/AICRP/ Network project supported	Development of tools and techniques in statistical and computational support for agricultural research	Research and development of tools and techniques	Number of tools and techniques developed	Nil
	Information System/ Decision Support System/ Software deployed	Development of Information System/ Decision Support System/ Software deployed	Research and development of Information System/ Decision Support System/ Software	Number of Information System/ Decision Support System/ Software deployed	Nil
	Students obtaining degrees	Teaching of various courses and research guidance to M.Sc./Ph.D. students in Agricultural Statistics/Computer Applications/Bioinformatics disciplines	Human resources development by teaching of various courses and research guidance.	Number of students obtaining degrees	Nil
	Training programmes conducted	Conducting of training programmes	Human resources development by conducting training programmes	Number of training programmes conducted	Nil

SECTION 6: Specific Performance Requirements from other Departments

Location Type	State	Organization Type	Organization Name	Relevant Success Indicator	What is your requirement from this Organization	Justification for this requirement	Please quantify your requirement from this Organization	What happens if your requirement is not met
State/Central	Concerned States	Others	Others	Methodologies developed for design of experiments/ forecasting/sample surveys/ statistical genetics/bio-informatics	Financial Support	For completion of various activities of projects	May not be quantified	Progress of various research projects will be affected

SECTION 7: Outcome / Impact of Activities of Organization Ministry

Sl. No.	Outcome / Impact of Organization	Jointly responsible for influencing this outcome / impact with the following department(s)/ ministry(ies)	Success Indicator(s)	Unit	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
1.	Enhancing efficiency through statistical/ computational tools and informatics	SAUs/AICRPs/MoSPI/DoAC/DADF	Increase in usage of methodologies/tools and accessibility of information	%	5	5	5	5	5
2.	Enhancing availability of quality human resource	SAUs, Central and State Govt. Officials	Research papers published Successful completion of degree programme and employability of the students	Number % passed out	90 94	85 80	90 87	92 88	95 90

Annual (April 1, 2013 to March 31, 2014) Performance Evaluation Report in respect of RFD 2013-2014 of RSCs i.e. Institutes

Annexure-VI

Name of the Division: Agricultural Engineering
Name of the Institution: ICAR-Indian Agricultural Statistics Research Institute, New Delhi
RFD Nodal Officer: Dr UC Sud



S. No.	Objectives	Actions	Success Indicators	Unit	Weight (%)	Target/Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable	
						Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score			
1.	To develop statistical methodologies for improving the quality of agricultural research	Development of efficient statistical techniques	Methodologies developed for design of experiments/ forecasting/ sample surveys/ statistical genetics/bio-informatics	Number	40	9	8	6	4	2	9	100	40	111.3	Excellent Target achieved	
2.	To develop informatics for enhancing efficiency of the system	Statistical and computational support for agricultural research	Tools and techniques provided/AICRP/Network project supported	Number	10	5	4	3	2	1	5	100	10	125	Excellent Target achieved	
3.	To develop globally competitive human resources	Development of Information System/Decision Support System/Expert System/Software	Information System/Decision Support System/Software deployed	Number	10	2	1	0	0	0	3	100	10	300	Excellent Target achieved	
		Conducting M.Sc. and Ph.D. programmes	Students obtaining degrees	Number	15	17	16	14	12	10	16	90	13.5	100	-	
		Organization of ICAR and customized sponsored national/international training programmes	Training programmes conducted	Number	14	12	11	9	7	5	12	100	14	109.1	Excellent Target achieved	

S. No.	Objectives	Weight (%)	Actions	Success Indicators	Unit	Weight (%)	Target/Criteria Value				Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable	
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%		Poor 60%	Raw Score			Weighted Score
4.	Efficient functioning of the RFD system	3	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	02	15/05/13	16/05/13	17/05/13	20/05/13	21/05/13	14/05/13	100	02		
			Timely submission of results for RFD (2012-13)	On-time submission	Date	01	01/05/13	02/05/13	05/05/13	06/05/13	07/05/13	30/04/13	100	01		
5.	Administrative reforms	4	Implement ISO 9001 as per the approval action plan	% Implementation	%	02	100	95	90	85	80	100	100	02		
			Prepare an action plan for Innovation	On-time submission	Date	02	30/07/13	10/08/13	20/08/13	30/08/13	10/09/13	30/07/13	100	02		
6.	Improving Internal Efficiency/responsiveness/service delivery of Ministry/Department	4	Implementation of Sevottam	Independent Audit of implementation of Citizen's Charter	%	02	100	95	90	85	80	100	100	02		
				Independent Audit of implementation of public grievance redressal system	%	02	100	95	90	85	80	100	100	02		
													98.5			

Total Composite Score: 98.5

Rating: Excellent



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भारतीय कृषि अनुसंधान परिषद

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